ABSTRACT


Transparency and traceability are widely discussed issues in the textile and apparel industry (TAI). Although more and more companies are adopting transparency and traceability in their supply chains, many facets of them are still unknown. More research is needed to facilitate the application of transparency and traceability in the TAI and develop theories in this domain. In this context, this study aimed to explore supply chain transparency and traceability in the TAI. Specifically, this study was conducted to investigate the following: (a) how companies differentiate between transparency and traceability and perceive their relationship with sustainability, (b) the motivation of companies to adopt transparency and traceability, (c) how companies evaluate and communicate their transparency and traceability efforts, and (d) the importance of transparency and traceability efforts to companies’ supply chain strategies.

A qualitative research method was employed to achieve the aforementioned goals. The data were collected from 11 in-depth one-on-one semi-structured interviews with the representatives and executives of eight US-based companies between February 2022 and April 2022. Various companies (e.g., large, small, etc.) were sampled to ensure a broad range of views and perspectives on the research questions. All interviews were conducted over Zoom due to travel constraints enforced as a result of the COVID-19 pandemic. The data were first transcribed and then analyzed using NVivo 12 software.

In response to research question 1, it was found that most companies adopted sustainability as their core corporate initiative. Most companies used Elkington’s three dimensions of sustainability, but few companies did not use the term economic; instead, they
used the more practical term “product” to represent economic aspects. The companies’ sustainable practices regarding environmental and product/materials dimensions were more diversified than the social ones. Furthermore, the responses indicated that companies identified transparency and traceability as two separate topics. Transparency depends on traceability, and both are prerequisites of sustainability.

Regarding research question 2, it was ascertained that the factors influencing companies to adopt transparency and traceability were different. Concerning transparency, external factors (e.g., consumers, various associations, and regulations) had a higher impact than internal factors (e.g., self-motivation). Among the external factors, consumers influenced companies to adopt transparency in various ways such as forcing brands and retailers directly and manufacturers indirectly to implement transparency. Various associations (e.g., Fair Labor Association) motivated companies to adopt transparency by establishing membership requirements and rating companies. On the other hand, regulatory forces had minimum impact on companies in adopting transparency. Only a few companies were motivated to adopt transparency due to internal factors. Conversely, concerning traceability, internal factors had a higher impact than external factors. Companies mostly adopted traceability due to internal factors; for example, companies adopted traceability to authenticate the sustainability product claims they made and identify their supply chain risks. Compared to the case of transparency, consumers had minimum influence. External factors such as regulations (e.g., withhold release order, and modern slavery acts) further accelerated the adoption of traceability.

Regarding research question 3, it was found that companies used soft and inexpensive tools such as websites, interactive maps, and QR codes to communicate their transparency efforts. Concerning traceability, companies used advanced technology and standards; in this...
regard, companies used Oritain technology to trace fibers. However, only manufacturers employed technology to trace social and environmental aspects. Notably, there is a significant lack of evaluation systems for transparency and traceability.

Regarding research question 4, it was found that most companies—except for a few—considered transparency their top strategic priority and an important part of supplier selection. Almost all companies placed high importance on traceability efforts in their supply chain strategies and adopted some short-term and long-term plans for it. Some companies also considered it a key deciding factor for product sourcing. The current study’s findings make several contributions to the literature and industry by uncovering complex issues of transparency and traceability.

by
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A dissertation submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Textile Technology Management

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DEDICATION

I want to dedicate my research to all family members, especially my mother, father, my beloved wife, brothers, and sisters, for their unconditional love, encouragement, and sacrifices. Without my family members' tremendous support, unconditional love, and sacrifices, I would not reach today's position. Thanks all for always believing in me!
BIOGRAPHY

Md Sadaqul Bari was born and grew up in a rural area of Bogura city, the entrance city of the North part of Bangladesh, where education is still inaccessible to most people. The path toward his education journey was not easy. He had to overcome many hardships to reach today’s position. Bari completed his B.S. in Textile Engineering from Primeasia University, Dhaka, Bangladesh securing the 1st position among 200 students. After that, he worked as a Textile Engineer in two reputed textile and apparel manufacturing companies in Bangladesh (Epyllion and IDS Group). After working for nearly three years in the textile industry, he obtained an offer to join as a Lecturer in the Department of Textile Engineering at Primeasia University. After serving another four years in academia, Bari got admission to the Ohio University of MS program in Apparel, Textiles, and Merchandising with a full funding opportunity. He earned his MS degree in Apparel, Textiles, and Merchandising from Ohio University in 2019. During his master’s study at Ohio University, Bari was awarded the Outstanding Graduate Student Award and obtained many grants from the Patton College of Education.

After earning his master’s degree from Ohio University, Bari started his Ph.D. in Textile Technology Management at Wilson College of Textile in NC State University with a prestigious Provost’s Fellowship in Fall 2019. At NC State University, Bari obtained an external research grant from Cotton Incorporated. His research focuses on supply chain transparency and traceability in the textile and apparel industry, a hot and emerging research area. He published his research in various prestigious journals and disseminated it to many national and international conferences.
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# TABLE OF CONTENTS

LIST OF TABLES ........................................................................................................ viii
LIST OF FIGURES ....................................................................................................... ix

**Chapter 1: Introduction** .......................................................................................... 1

1.1 Introduction and Research Background .......................................................... 1
1.2 Problem Statements ......................................................................................... 3
1.3 Research Purpose ............................................................................................ 7
1.4 Contribution of this Study ............................................................................. 9
1.5 Limitations of the Study ............................................................................... 10
1.6 Definition of Terms ....................................................................................... 10
1.7 Organization of Dissertation ........................................................................ 11

**Chapter 2: Literature Review** .............................................................................. 12

2.1 Concepts and Benefits of Transparency and Traceability ............................ 12
   2.1.1 Definition of Traceability ...................................................................... 12
   2.1.2 Definition of Transparency .................................................................. 14
   2.1.3 Conceptualization of Sustainability, Transparency, Traceability, and their Relationship .......................................................... 15
   2.1.4 Benefits of Transparency and Traceability ........................................... 16

2.2 Emergence of Transparency and Traceability Issues in the Textile and Apparel Industry ........................................................................................................ 17

2.3 Various Forces for Transparency and Traceability in TAI ............................. 19
   2.3.1 Global Level Regulations/Policies for Transparency and Traceability in TAI .......................................................... 19
   2.3.2 Government and EU Level Regulations for Transparency and Traceability in TAI .................................................................................. 22
   2.3.3 Voluntary Initiatives for Transparency and Traceability in TAI .......... 26
   2.3.4 Consumers’ Demand for Transparency and Traceability ................... 27

2.4 Selected Examples of Transparency and Traceability Practice in TAI ........... 28

2.5 Previous Studies on Transparency and Traceability in TAI .......................... 32

2.6 Evaluation Method for Transparency and Traceability in TAI ..................... 36
   2.6.1 Measurement Systems Available for Sustainability in TAI ................. 37
      2.6.1.1 The Global Reporting Initiative (GRI) on Sustainability Reporting ... 37
      2.6.1.2 Higg Index for Evaluating Sustainability Performance .................. 37
   2.6.2 Evaluation Methods Available for Transparency and Traceability in TAI . 39
      2.6.2.1 Fashion Transparency Index (FTI) .................................................. 39
      2.6.2.2 ASKET Own Developed Evaluation Method ............................... 44
4.4.3.1 Key Performance Indicators (KPIs) Used for the Evaluation of Transparency ............................................ 96

4.4.3.2 Evaluation of Traceability or Key Performance Indicators (KPIs) Used to Evaluate Traceability Efforts .......................................................................................................................... 97

4.4.4 Communication of Transparency and Traceability Efforts .................................................................................... 99

4.5 Addressing RQ# 4 ....................................................................................................................................................... 102

4.5.1 Importance of Transparency and Traceability Efforts to Companies’ Supply Chain or Strategic Decisions ........................................................................................................................................ 102

4.5.1.1 Priority for Transparency .................................................................................................................................... 102

4.5.1.2 Priority for Traceability ..................................................................................................................................... 104

Chapter 5: Discussions and Conclusions .......................................................................................................................... 108

5.1 Discussion .................................................................................................................................................................... 108

5.1.1 Discussions of Research Question 1 ......................................................................................................................... 108

5.1.2 Discussion of Research Question 2 .......................................................................................................................... 113

5.1.3 Discussions of Research Question 3 ......................................................................................................................... 118

5.1.4 Discussions of Research Question 4 .......................................................................................................................... 123

5.2 Implications ................................................................................................................................................................ 125

5.2.1 Theoretical Implications ......................................................................................................................................... 125

5.2.2 Practical Implications .............................................................................................................................................. 127

5.3 Limitations ................................................................................................................................................................ 128

References ........................................................................................................................................................................... 130

Appendices ........................................................................................................................................................................ 143

Appendix A: Institutional Review Board (IRB) Letter ........................................................................................................ 144

Appendix B: Recruitment Email ........................................................................................................................................... 145

Appendix C: Consent Form .................................................................................................................................................. 146

Appendix D: Interview Questions and Protocol ................................................................................................................ 149

Appendix E: Quotes from Interview .................................................................................................................................. 152
LIST OF TABLES

Table 1. Postulated Targets of SDG 12 with Issues Addressed................................................................. 20
Table 2. Government and EU Level Regulations and their Influences on Adoption of Transparency and Traceability................................................................. 25
Table 3. Selected Examples of Transparency and Traceability Practice in the TAI .................. 31
Table 4. Summary of Technology and Traceability Platforms Used by Selected Companies .... 32
Table 5. Previous Studies on Various Aspects of Transparency and Traceability in TAI ........ 34
Table 6. FTI Measurement System in Five Areas ......................................................................................... 41
Table 7. Interview Questionnaires and Protocol Excluding the Follow-up Questions .......... 54
Table 8. Sample Characteristics................................................................................................................ 58
Table 9. Specific Sustainable Practices Identified from the Responses .............................................. 64
Table 10. Summary of Research Question 1 Findings ............................................................................. 72
Table 11. Summary of Research Question 2 Findings ............................................................................. 89
Table 12. Technology Used to Evaluate/Communicate Transparency Efforts ............................ 91
Table 13. Traceability Technology Used Status for Products/Fibers/Materials Level by Companies ........................................................................................................ 93
Table 14. Evaluation of Transparency Efforts .......................................................................................... 97
Table 15. Key Performance Indicators (KPIs) for Evaluation of Traceability .............................. 98
Table 16. Summary of Research Question 3 Findings ............................................................................. 101
Table 17. Summary of Research Question 4 Findings ............................................................................. 107
Table 18. Summary of Findings for Research Questions 1-4 ................................................................. 109
### LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Three Types of Higg Index Tools</td>
<td>39</td>
</tr>
<tr>
<td>2</td>
<td>Description of Five Areas of FTI and their Corresponding Weighting Percentage</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>The Overall Findings of the FTI 2021 Report</td>
<td>43</td>
</tr>
<tr>
<td>4</td>
<td>How ASKET Discloses Traceability Information with Each Product on Its Website</td>
<td>46</td>
</tr>
<tr>
<td>5</td>
<td>Identified Sustainability Themes</td>
<td>59</td>
</tr>
<tr>
<td>6</td>
<td>Identified Sub-themes of the Dimension of Sustainability</td>
<td>61</td>
</tr>
<tr>
<td>7</td>
<td>Emerging Themes of Sustainability</td>
<td>65</td>
</tr>
<tr>
<td>8</td>
<td>Identified Themes about Transparency and Traceability</td>
<td>66</td>
</tr>
<tr>
<td>9</td>
<td>Identified Sub-themes of the Importance of Transparency and Traceability</td>
<td>67</td>
</tr>
<tr>
<td>10</td>
<td>Sub-themes of the Relationship Between Sustainability, Transparency, and Traceability</td>
<td>69</td>
</tr>
<tr>
<td>11</td>
<td>Relationship Between Sustainability, Transparency, and Traceability</td>
<td>71</td>
</tr>
<tr>
<td>12</td>
<td>External Forces for the Adoption of Transparency</td>
<td>74</td>
</tr>
<tr>
<td>13</td>
<td>Sub-theme of Consumers’ Motivation for the Adoption of Transparency</td>
<td>75</td>
</tr>
<tr>
<td>14</td>
<td>Sub-themes of Various Associations’ Pressure for the Adoption of Transparency</td>
<td>77</td>
</tr>
<tr>
<td>15</td>
<td>Sub-themes of Government Rules and Regulations Pressure the Adoption of Transparency</td>
<td>79</td>
</tr>
<tr>
<td>16</td>
<td>Internal Forces for the Adoption of Transparency</td>
<td>81</td>
</tr>
<tr>
<td>17</td>
<td>External Forces that Influenced Companies to Adopt Traceability</td>
<td>83</td>
</tr>
<tr>
<td>18</td>
<td>Sub-themes of Regulations’ Pressure on Companies for the Adoption of Traceability</td>
<td>84</td>
</tr>
<tr>
<td>19</td>
<td>Internal Forces for the Adoption of Traceability</td>
<td>86</td>
</tr>
</tbody>
</table>
Figure 20. Themes about the Technology Used for Traceability. ................................................ 91

Figure 21. Sub-themes of Technology for Tracing Products...................................................... 92

Figure 22. Relationships among Research Questions and Findings........................................ 110
CHAPTER 1
INTRODUCTION

1.1 Introduction and Research Background

The textile and apparel industry (TAI) is one of the oldest and most globalized industries in the world. Since the early 1990s, textile and apparel production in low-cost countries has been a widely accepted business practice among large brands (Baraldi et al., 2018). Western brands continually transfer the production to cheap labor countries like Vietnam, Bangladesh, and Cambodia to exploit low-cost labor. While outsourcing manufacturing activities from low-cost labor markets help brands obtain better quality products at a lower price and thus enhance competitive advantages, it is also associated with significant risks. In other words, outsourcing poses several social, environmental, and economic risks, collectively sustainability risks, such as inhuman working conditions, water pollution in the host country, etc. (Stevenson & Cole, 2018).

Although several actions have been taken against sustainability violations, still negative impacts on human rights, labor rights, and the environment are highly prevalent. However, this does not necessarily imply that those actions failed to improve the industry conditions. Indeed, significant changes such as sustainability concepts, reuse, redesign, circularity, etc., frequently observed today in the TAI are a result of those actions. For example, fur elimination became a top priority at the beginning of the 1980s, and many well-known apparel brands have now stopped using real fur completely (Henninger, 2015). Similarly, in the late 1980s, the sustainable fashion movement emerged, and now it is an important concept to be noted in the industry, both for businesses and consumers (Henninger, 2015). From the late 1990s, a private movement also appeared that pressured companies to disclose their global supplier factories’ names and locations (Doorey, 2011). This movement marked the beginning of transparency in the apparel
sector but did not achieve momentum until 2012. However, now, transparency and traceability are emerging and are the most talked-about topics in the TAI. Making supply chain information available to the relevant stakeholders is known as transparency (Guan et al., 2020). It was assumed that practicing transparency would increase the company's accountability for the working conditions in which, the product is manufactured and also improve labor practices over time (Doorey, 2011). The underlying conviction is that transparency can trigger learning and positive institutional change by enabling private watchdogs to monitor and pressure companies to alter their harmful behavior (Doorey, 2011; FTI, 2021).

Traceability is an essential tool for progressing towards greater transparency in managing global value chains (GVCs) and facilitating the flow of information (United Nations, 2018). Traceability is defined as the ability to follow materials and processes through the entire supply chain, ranging from raw materials to end-products to post-use waste processing (ISO, 2000). Examples of information that can be tracked include the geographic origin of inputs, supplier certifications, end-product telemetry data, and end-of-life disposal methods. Garcia-Torres et al. (2019), claimed that different social and environmental catastrophes witnessed in the apparel industry are due to the absence or incompleteness of traceability.

Recently, traceability has garnered more attention in the TAI, with some companies having become pioneers in implementing transparency and traceability in their supply chains. For example, the Swedish menswear brand ASKET allows consumers to trace the history of individual products from farm to final garment, while H&M provides only tier 1 (i.e., apparel manufacturers) suppliers' information to consumers (Bari & Jin, 2021). Further, many chains of custody (COC) system software provider companies for the cotton supply chain such as TextileGenesis, ChainPoint, TexTrace, Logility, NGC, and Serai have emerged. Discussion with
the executives of Cotton Incorporated revealed that these particular technologies are of great interest to cotton users in the supply chain. Although relatively few companies have adopted traceability to date, tracking, and tracing of goods all the way back through the supply chain is very much under the consideration of brands and retailers today and are inclined to share that information with their customers in the interests of transparency.

1.2 Problem Statements

While companies are adopting transparency and traceability in their supply chains, many factors of transparency and traceability are still unknown. Particularly, how companies distinguish or practically use the terms transparency and traceability, and the relationship between them and sustainability is still unknown. Whether transparency and traceability are two distinct topics or the same, what is the relationship between them and sustainability? Uncovering these issues would facilitate the implementation of transparency and traceability in the industry and create scope for further academic research. Although there are many definitions of the transparency and traceability in literature, those definitions are inconsistent and do not distinguish between the two. Further, the relationship between sustainability, transparency, and traceability has been unclear in the literature. For example, one viewpoint is that some researchers view traceability as the necessary condition for transparency (Garcia-Torres et al., 2019). While other groups of researchers hold an opposing view that transparency contributes to traceability by reducing information asymmetry (Beske et al., 2014; Egels-Zandén et al., 2015). Therefore, further research is needed on conceptualizing transparency and traceability.

Further, the underlying motivations for companies to adopt transparency and traceability are still unknown. Various driving factors might influence the adoption of transparency and traceability systems, for example, regulatory force. While there are stricter laws or regulations
for implementing transparency and traceability in the food industry, there are none such in the TAI. However, several global and government-level regulations have recently been developed in TAI that might enforce companies into adopting them. Examples are the issue of a Withhold Release Order (WRO) by the US Customs and Border Protection (CBP) that blocks shipments of cotton and cotton products originating from the Xinjiang Production and Construction Corps (XPCC), and the recent seizure of a Uniqlo shipment by the CBP.

Sustainability issues may be another reason for adopting transparency and traceability. The demand for sustainability is the result of various social and environmental disasters such as the manufacturing building collapse in Bangladesh, fatal fire accident in Pakistan, child labor in China, mass fainting of workers in Cambodian apparel factories, toxic chemicals, etc. (Haque & Azmat, 2015; Kawazu & Kim, 2019; Yadlapalli et al., 2019). Textile and apparel companies and supply chains may demand a higher level of sustainability through the implementation of transparency and traceability. Product recalls or reverse logistics might be another factor. A total of 2,435 recall notifications for non-food categories occurred in 2014. Among them, 530 recalls (nearly 22%) were in the textile and apparel product categories (Kumar et al., 2017); this indicates that textile and apparel are among the highest contributors to recalls in the non-food categories. This trend has been increasing over the last decades. The costs incurred due to a recall are high and can negatively impact companies’ profitability. Therefore, it is crucial to handle recalls efficiently, which essentially relies on tracing back the origin of the identified products for recalling (Kumar et al., 2017).

Besides the aforesaid reasons, there are several other factors such as consumer demand, protecting the brand name, assuring product claims/authentication, quality assurance, supply chain management, maintaining consumer confidence, and so on, might also prompt companies
to adopt transparency and traceability (Agrawal & Pal, 2019). It is crucial to identify whether these factors truly motivate companies to adopt transparency and traceability or whether there are any additional reasons for it. Revealing the reasons for adopting transparency and traceability will help policymakers take appropriate strategic decisions and the brands planning to adopt them. Despite the significance of identifying the actual reasons for transparency and traceability, the topic seems to have been ignored so far in the literature. Though many studies focus on various aspects of transparency and traceability (Agrawal et al., 2021; Garcia-Torres et al., 2019, 2021; Kumar et al., 2017), few have explored companies’ motivations for adopting them. As such, it is essential to identify companies’ true motivations for adopting transparency and traceability.

Given the increasing adoption of transparency and traceability by companies, their effects should be evaluated appropriately. To communicate the impact of transparency and traceability to consumers and other stakeholders, it is necessary to create a common means and language. Therefore, a common evaluation system both for transparency and traceability needs to be established. While there are numerous measurement systems for sustainability (e.g., global reporting initiative, Higg Index, etc.), there are only a few like the Fashion Transparency Index (FTI), with some fashion companies developing their own evaluating systems (e.g., Swedish brand ASKET’s traceability standard) for transparency and traceability.

The Fashion Revolution developed the FTI in 2016 to measure the extent of the textile and apparel companies' disclosure about their social and environmental policies, practices, supply chain, and their impacts. FTI ranks brands based on their public disclosure of human rights and environmental policies, practices, and impacts on their operations and supply chains (FTI, 2021). Although FTI measures transparency, it has several shortcomings. First, it ranks 250
brands based on their public disclosure on human rights and environmental issues across 239 indicators in five areas. However, with such a large number of indicators, it is difficult to comprehend by both brands and consumers. Second, the index does not verify any claims made by the brands (i.e., consumers cannot trace the information). Thus, ranking can be misleading, indicating that although brands may rank 1\textsuperscript{st} or 3\textsuperscript{rd} as per the FTI, this does not necessarily mean that these brands are sustainable. Third, only large brands and retailers were considered. Although some small companies or start-ups are performing well in terms of sustainability, they were not analyzed.

ASKET has developed its own traceability measuring system to track the products’ progress by grouping every garment into four major categories of production: manufacturing, milling, raw materials, and trims (Asket, 2021). Each category is further divided into sub-categories that are traced and rated according to the available information of ASKET. Finally, ASKET weighs and sums it all up to arrive at their traceability score: manufacturing (30%), milling (30%), raw materials (30%), and trims (10%), totaling 100% traceability (Asket, 2021). Consumers or other stakeholders can see this score for each product. Although ASKET allows consumers to trace tier 1 suppliers fully, it provides only the names of other tiers. Further, this traceability measurement system is ASKET’s own development; therefore, it poses a validity concern.

In the absence of an inclusive evaluation method, companies tend to communicate their efforts toward transparency and traceability in various ways (Bari & Jin, 2021), which may be difficult for consumers to comprehend. In these circumstances, the stakeholders and investors cannot compare performances among companies across the industry. Further, the lack of a comprehensive appraisal method may lead brands to greenwash and thus mislead consumers.
Therefore, it is necessary to evaluate companies’ methods for the assessment of transparency and traceability.

There has been an increasing trend of adopting transparency and traceability among apparel companies. Despite this, the importance of transparency and traceability initiatives to companies’ supply chain strategy is still unknown. Although many companies place strategic efforts in the aspects such as industry collaboration, working with traceability, or chain-of-custody platform providers (TextileGenesis, Oritain), it is difficult to ascertain the level of priority of these strategies to them. Few academic studies have explored this issue. Therefore, it is essential to determine companies’ degree of priority for transparency and traceability and the reasons for the varying degrees of priority.

1.3 Research Purpose

This study aims to examine supply chain transparency and traceability in the TAI. To this end, four research questions (RQs) will be addressed through a qualitative research method. This section will discuss these research questions.

The first research question (RQ 1) addresses, “How do companies describe transparency and traceability? Is there any distinction between these two from the companies’ point of view? Do companies’ definitions of transparency and/or traceability vary with their available definition in the academic literature?” The variations in conceptualizing and blurred boundaries of transparency and traceability in the literature limit comprehension of the relationships between them as well as with sustainability. Therefore, the first objective of this study is to conceptualize transparency and traceability and identify the relationships between them and sustainability.

The second research question (RQ 2) asks, “Why are companies adopting transparency and traceability? What are their true motivations behind it?” Brands and retailers may be self-
motivated to implement transparency and traceability, or influenced by external factors (e.g., regulations, NGOs, consumer pressure, etc.) and/or internal factors such as supply chain and risks management, product recall management, etc. Therefore, the second objective of this study is to identify and explore the factors that prompt the awareness on sustainability of brands and retailers and motivate them to adopt transparency and traceability.

The third research question (i.e., RQ 3) addresses: “How do companies evaluate their transparency and traceability effort? Do they use any existing tools or their own evaluation methods? How do they communicate their transparency and traceability to consumers and other stakeholders?” The literature reveals that there are some third party-developed tools for evaluation transparency (e.g., FTI); however, it is difficult to find such a third party-created assessment tool for traceability. Only some methods developed by companies themselves are available, but these have a credibility issue. Thus, the third objective of this study is to evaluate how companies assess their transparency and traceability efforts and to make recommendations for the evaluation of transparency and traceability in the textile and apparel industry.

The fourth research question (RQ 4) is: “How important are the transparency and traceability efforts to companies’ supply chain strategy? Are the efforts in practicing transparency and traceability the companies’ top priority? If companies assign varying degrees of priority to the effort, what would be the reasons for it?” Implementation of transparency and traceability may require capital and other investments, which require companies to take appropriate strategic decisions for it. Therefore, the fourth research objective of this study is to investigate companies’ priority levels for transparency and traceability in their supply chain strategies.
To address the above RQs, interviews were conducted with industry professionals in various apparel sectors who have experienced in the management of supply chain sustainability practices. After analyzing the interview data, propositions for each research question were made.

1.4 Contribution of this Study

This study makes several contributions to the literature by uncovering complex issues of transparency and traceability. First, it conceptualizes transparency and traceability and identifies the relationships between them and sustainability which are rarely studied in the literature. This finding fills the gap in the literature. Second, it reveals why apparel companies adopt transparency and traceability, which previous research has not studied, instead of developing the conceptual frameworks and technological aspects; this study identifies the true reasons of companies for adopting transparency and traceability by interviewing senior executives in diverse apparel sectors. Thus, it fills a significant void in the literature. Further, these findings assist in identifying the variables related to motivations such as regulations, consumers’ demand, etc. Future studies can focus on how those variables impact the perceived benefits of transparency and traceability.

Third, research question 3 evaluates the companies’ assessment methods for their supply chain transparency and traceability. Participants companies suggested some key performance indicators (KPIs) for evaluation of traceability. This study suggests those KPIs can be used to develop a comprehensive evaluation system for traceability efforts.

The last research question reveals the importance of transparency and traceability efforts in supply chain strategies of apparel companies. This finding helps policy makers and industry practitioners to allocate resources and make appropriate decisions regarding the implementation of transparency and traceability. Finally, based on findings, this study has proposed propositions,
which help develop new theories or refine the existing ideas and open the scope for new research.

Along with the theoretical contributions, this study also contributes to the industry. The conceptualization of transparency and traceability assists companies in understanding the function and performance of transparency and traceability. Uncovering the actual reasons for adopting transparency and traceability helps policymakers and brand managers take appropriate strategic decisions.

1.5 Limitations of the Study

This study's focus was limited to the following areas. First, the data was collected only from US-based companies. Therefore, it is recommended that future studies collect data from other countries' brands, such as European, to compare the actual reasons for adopting traceability and transparency across the globe. Second, this study collects data from mostly apparel brands. For obtaining more holistic results, it is suggested that future studies can collect data from textile companies and manufacturers of shoes and other accessories.

1.6 Definition of Terms

- **Fashion Transparency Index (FTI)** is a brand ranking system developed by the Fashion Revolution in 2016, based on the brands’ public disclosure of human rights and environmental policies, practices, and impacts in their operations and supply chains (FTI, 2021).

- **The Global Reporting Initiative (GRI)** has been providing reporting guidelines for companies that want to commit to sustainable improvement since 1997, and these guidelines apply to all sectors (Jestratijevic et al., 2020; Kozlowski et al., 2015).
The Higg index is an important tool to measure the impact of sustainable development in the textile and apparel industries (Gonçalves & Silva, 2021). It was developed by the Sustainable Apparel Coalition (SAC) in 2011 to create a common evaluation tool with comparable results to measure (and communicate) the sustainability performance of a company or product.

Transparency can be defined as the disclosure of information (Doorey, 2011). The information has been made available to all elements of the value chain in a standardized way, enabling common understanding, accessibility, clarity, and comparison. Transparency relates directly to relevant information being made available about all elements of the value chain in a harmonized way, permitting common understanding, accessibility, clarity, and comparison (BRS, 2021). Traceability is defined as the ability to “identify and trace the history, application, location, and distribution of products, parts, and materials to ensure the reliability of sustainability claims in the areas of human rights, labor (including health and safety), the environment and anti-corruption”; and “the process by which enterprises track materials and products and the conditions in which they were produced through the supply chain” (BRS, 2021).

1.7 Organization of Dissertation

This dissertation comprises five chapters. Chapter 1 provides a brief overview of the study with background information on the study topic, research gaps discovered in the current literature, research objectives, contributions, limitations, and the definitions of key terms. Chapter 2 discusses an extensive overview of relevant literature to further strengthen the research background. Chapter 3 indicates the research methods employed in this study. Chapters 4 and 5 present the study results and discussions, respectively.
CHAPTER 2

LITERATURE REVIEW

Transparency and traceability have become crucial topics in the textile and apparel industry (TAI). This chapter includes a comprehensive literature review to strengthen the research background and find the gaps in the existing research on transparency and traceability in the TAI. To this end, this chapter is organized as follows. First, the concepts of transparency and traceability, including their definitions, benefits, and relations with sustainability are presented. Next, the evolution of transparency and traceability in the TAI is discussed. Thereafter, various forces that might pressure companies to implement transparency and traceability are discussed. In the following section, the measurement of transparency and traceability is discussed. Finally, the importance of transparency and traceability efforts to companies' supply chain strategy is highlighted.

2.1 Concepts and Benefits of Transparency and Traceability

2.1.1 Definition of Traceability

There are numerous definitions of traceability in the literature, of which the most commonly used is that of the International Organization for Standardization (ISO). The ISO defines traceability as “the ability to identify and trace the history, location or application of an object including—the origin of materials and parts—the processing history—the distribution and location of product or service after delivery” (ISO, 2000). Subsequently, this definition was modified by several organizations. For example, according to Global Standard One (GS1), a global not-for-profit organization that develops standards for the global value chain, traceability can not only trace backward (as implied in the original definition of ISO) but also track forward (GS1, 2019); this notion is endorsed by Macchion et al. (2017).
The United Nations Global Compact (UNGC) modified the definition of traceability as "a method of substantiating the claims (particularly sustainability claims) relating to a product, service, or business process based on available information" (UN, 2016; United Nations Global Compact, 2014, p. 6). Though slight variations are observed in the definitions, a common thread among them is that all definitions explicitly or implicitly indicate that traceability provides all the industry stakeholders with access to reliable and complete data about their business activities and the associated environmental and social impacts (BSR, 2014; Papú-Carrone, 2020). In addition to the definition, the application purpose of traceability also varies across the textile and apparel industry. For instance, traceability in the food industry applies to confirming food safety, health concerns, and dietary restrictions and emphasizing animal welfare concerns, while in the apparel industry, it results in transparency. In other words, in the apparel industry, traceability informs consumers of the environmental impact of apparel, production, and the labor conditions involved in production and manufacturing (Joy & Peña, 2017).

Throughout the whole supply chain for ensuring traceability, a chain of custody (COC) system is required that "records and follows the trail as products, parts, and materials come from suppliers and are processed and ultimately distributed as end products" (BSR, 2014; Praxiom Research Group Limited, 2013). As such, traceability offers validated and authenticated information regarding the history or information of the components, products, parts, and materials, as well as information on their transformations. Particularly, in the context of sustainability, traceability is a valuable tool for ensuring and verifying sustainability declarations related to raw materials and products, confirming that no violations of human rights, labor rights, and the environment occurred throughout the supply chain (BSR, 2014). For example, traceability ensures that minerals do not come from armed conflict conditions (i.e., conflict
minerals), aiming at combating the human rights violations in conflict regions and avoiding the purchase of materials that could directly or indirectly finance and amplify these conflicts (BSR, 2014).

2.1.2 Definition of Transparency

Once the history of the components, products, parts, materials, and sustainability information is captured through a traceability system and is available for companies, transparency can enable all stakeholders to access information needed to make informed decisions (Papú-Carrone, 2020). Transparency, consequently, can be defined as the disclosure of information (Doorey, 2011; Egels-Zandén et al., 2015). In other words, transparency is the strategy of disclosing the supply chain and sourcing information to stakeholders (Norton, 2019). Similar to traceability, there are various definitions of transparency. For example, Doorey (2011) and Laudal (2010), equate transparency to traceability (defining transparency as the ability to track a product's flow throughout the production process and supply chain). Other authors (e.g., Cramer, 2008) still consider transparency as the disclosure of trustworthy information about sustainability conditions at the point of production or supply. Some other researchers consider financial transactions between buyers and suppliers (i.e., buyers' purchasing practices) as transparency (Schouten & Remmé, 2006). Buyers’ purchasing practice is an essential aspect of shaping the sustainability conditions in the suppliers’ firms because buyers’ downward price pressure and increasingly shorter lead time reinforce many poor working conditions (e.g., low living wages, long overtime, etc.) (Anner, 2018). By identifying the aforementioned dimensions concealed under the umbrella term “supply chain transparency” in previous research, Egels-Zandén et al. (2015) provided a more holistic definition for it. They proposed that supply chain transparency comprises corporate disclosure of (a) the names of the suppliers involved in
producing the firm's products (i.e., traceability), (b) information about the sustainability conditions maintained at these suppliers, and (c) the buying firms' purchasing practices.

From the above discussion, it can be inferred that transparency is the disclosure of information regarding supplier names, sustainability conditions at suppliers, and buyers’ purchasing practices, while traceability appears to be an essential tool to move towards greater transparency and facilitate the flow of information (ECE, 2021; Egels-Zandén et al., 2015; United Nations, 2018). In other words, traceability provides visibility to every aspect of the supply chain and areas to be improved, while transparency is the vehicle for companies to build trust with stakeholders and consumers.

### 2.1.3 Conceptualization of Sustainability, Transparency, Traceability, and their Relationship

There is limited agreement in the emerging literature on transparency and traceability in the conceptualizations of these two related constructs (Malik et al., 2021). For example, transparency is defined as the two-way of sharing information between a supplier and a customer (Stranieri et al., 2017), information disclosures to end-users and other companies in the supply chain (Marshall et al., 2016), and information disclosures to the public including consumers and investors (Doorey, 2011; Sodhi & Tang, 2019). Similarly, traceability is also sometimes described as the information a firm possesses regarding the location and processes of the product flow in a supply chain (Cousins et al., 2019). Therefore, the relationship between transparency and traceability is not very well-understood, with opposing views on the nature of their interaction. For instance, one perspective is that traceability is a necessary condition for transparency (Cousins et al., 2019; Joy & Peña, 2017). There is also a contrasting view that transparency may contribute to traceability by reducing the information asymmetry among supply chain members (Malik et al., 2021). It can be concluded that many authors use
transparency and traceability interchangeably and often confuse them with sustainability. Therefore, for the purpose of this study is to conceptualize the terms sustainability, transparency, and traceability.

Confusion about these concepts is evident in the literature about the relations between sustainability, transparency, and traceability. In this regard, Garcia-Torres et al. (2021) stated that TAI is required to clarify further the relationship between sustainability, transparency, and traceability. Transparency and traceability are not to be confused with sustainability (FTI, 2021). However, without transparency, achieving a sustainable, accountable, and fair textile and apparel industry will not be possible (FTI, 2021), as transparency and traceability underpin sustainability. Indeed, Garcia-Torres et al. (2021) found a general consensus among industry experts about this concept. The consensus among the industry experts is, “traceability is necessary for any company willing to be transparent, and only a traceable product can be sustainable” (Garcia-Torres et al., 2021, p. 8). Other than Garcia-Torres et al. (2021), very few studies clearly define each term and the relationships among the three. Therefore, the first research question will explore the relationships.

2.1.4 Benefits of Transparency and Traceability

Previous studies have underscored that the implementation of traceability in supply chains has numerous advantages. For example, ElMessiry and ElMessiry (2018) discussed that traceability enables companies and consumers to track and extract information about the value chain through data related to a specific product. According to Global Standard One (GS1), traceability promotes collaboration among business partners by implementing interoperable and integrated traceability systems (GS1, 2019). Thus, it helps with supply chain integration by expanding the boundaries of the information exchange of each actor in the value chain and
making them mindful of the relevant practices of their partners (Papú-Carrone, 2020). Kumar et al. (2017) also indicated the advantage of traceability during product recalls. Its ability to trace the origin of the identified products for recalling provides authentic information about product distribution from brands to the recall handling agencies, and thus efficiently manages the execution of product recalls (Kumar et al., 2017). The United Nations Economic Commission for Europe (UNECE) recently conducted an analysis of over 100 companies worldwide, from raw material producers to large brands and retailers, through targeted interviews, field visits, and detailed surveys. The study also revealed several benefits of traceability, including building trust with consumers, developing concrete networks with clients and suppliers, and identifying opportunities for efficient and sustainable management of resources (UNECE, 2019).

In addition, an advantage closely related to the implementation of traceability systems is the ability to monitor product quality, material flow, product defects, and logistics such as warehousing and transportation (Agrawal et al., 2018; Kumar et al., 2016). It also enables forecasts to better adapt to market changes and reduces the risks of demand uncertainty, for example, by enabling customer geolocation and purchasing behavior segmentation (Macchion et al., 2017).

2.2 Emergence of Transparency and Traceability Issues in the Textile and Apparel Industry

Initially, the primary application of traceability was limited to logistical purposes such as managing inventory and production; however, in the mid-1980s, it began to be used for ensuring food product safety (Joy & Peña, 2017; Papú-Carrone, 2020). Since then, the implementation of transparency and traceability has extended to various industries. While over the past decades, the importance of transparency and traceability has been highlighted in the food industry as well
to the various food scandals (e.g., mad cow disease, the Asian bird influenza, and the horsemeat scandal), in the not-too-distant past, a lack of transparency in the apparel industry would have been seen as a competitive advantage (BSR, 2014; Doorey, 2011; Goswami, 2014). Apparel companies wanted to keep their suppliers’ and manufacturers’ information confidential (McKinsey & Company, 2019). Indeed, corporate officials reacted hostilely toward suppliers' identity disclosure movements (Doorey, 2011). Although supplier factory disclosure movements started in the 1990s, they acquired momentum only in 2005 with adoption by Nike and Levi-Strauss; still, there was no significant progress observed for transparency and traceability in the TAI until 2012 (Doorey, 2011).

However, the scenario started to change, particularly after the fatal fire accidents in 2012 (Ali garment factory in Pakistan and Tazreern Fashion in Bangladesh) and most importantly, after the Rana Plaza collapse in Bangladesh in 2013 that resulted in the deaths of over 1,100 garment workers (Modi & Zhao, 2021). Other numerous recent incidents have captured public attention and revealed the unsafe working conditions in the industry. These incidents include but are not limited to the employment of child labor by Chinese apparel manufacturers, mass fainting of workers in Cambodian apparel factories, violations of human rights in Vietnamese apparel factories, and forced labor and human rights violations in respect of millions of Uighur people in the cotton supply chain in the Xinjiang region of China (Chua, 2021; Haque & Azmat, 2015; Kawazu & Kim, 2019; Kelly, 2020; Yadlapalli et al., 2019). Before these incidents, people were least concerned about where their apparel came from and the process it undergoes before it reaches them. However, when the activists found the brand labels in the rubble of Rana Plaza, the public started to criticize the brands and demanded transparency and total accountability (North, 2013). Some companies have begun to disclose the names of their suppliers through their
websites to assume responsibility for sustainable practices in their factories (Bari & Jin, 2021; Fashion Revolution, 2021).

Although only a few leading brands offer full traceability of their supply chain—suggesting that consumers can scan a barcode on a shirt and know the actual supply chain for that particular garment—it is now a hot topic in the industry (McKinsey & Company, 2019). Tracking products throughout the supply chain is very important to today's brands and retailers, and they aim for this information to be available to their customers and to be highly transparent. Similar to the food industry, traceability and transparency in the apparel industry originated from various incidents. Now, numerous sources such as new regulations, NGO pressures, and industry practices might accelerate the practice adoption, which is discussed in the following sections (Marshall et al., 2016).

2.3 Various Forces for Transparency and Traceability in TAI

Several forces might advocate the implementation of transparency and traceability in TAI. Numerous policies and regulations have been developed over the last few decades. In the following sections, such forces as global level regulations/policies, national and EU level regulations, voluntary initiatives, and consumers’ demand have been discussed.

2.3.1 Global Level Regulations/Policies for Transparency and Traceability in TAI

Despite the increasing trend of adoption of transparency and traceability practices by textile and apparel companies, their implementation is still in the rudimentary stage in the sector (Agrawal & Pal, 2019; Papú-Carrone, 2020). One of the reasons for this scenario is the absence of strict traceability rules and regulations. In other words, the absence of traceability rules and regulations is considered one of the vital reasons for the slow adoption of transparency and traceability in the industry (Agrawal & Pal, 2019; Kumar, et al., 2017; Richero & Ferrigno,
2016). Papú-Carrone (2020) suggested that global regulations play a significant role in securing transparency and traceability in the TAI. There are several globally recognized regulations: the UN Guiding Principles on Business and Human Rights, the UN Global Compact, the ILO International Labor Standards, and the Due Diligence Guidelines for Responsible Business Conduct by Organization for Economic Co-operation and Development (OECD). Although none of these guidelines or organizations directly compel companies to adopt transparency and traceability, it is highlighted as the right path. For example, the United Nations (UN) 2030 Agenda for Sustainable Development (i.e., the UN Guiding Principles on Business and Human Rights) is aimed at achieving sustainable development for all on a global scale. To this end, the UN established Sustainable Development Goal 12 (SDG 12), which is about "responsible consumption and production," and it postulates 11 targets for responsible consumption and production (UN, 2019). The 11 targets of SDG 12 focus on various issues illustrated in Table 1.

Table 1. Postulated Targets of SDG 12 with Issues Addressed

<table>
<thead>
<tr>
<th>Targets</th>
<th>Issues Addressed</th>
<th>Targeted Year of Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target 12.1</td>
<td>The implementation of relevant country-level policies and programs on sustainable consumption and production</td>
<td>2030</td>
</tr>
<tr>
<td>Target 12.2</td>
<td>Achieving sustainable natural resources management</td>
<td>2030</td>
</tr>
<tr>
<td>Target 12.3</td>
<td>Reduce global food waste by half</td>
<td>2030</td>
</tr>
<tr>
<td>Target 12.4</td>
<td>Ensure environment-friendly management of chemicals and all waste throughout their life cycle</td>
<td>2020</td>
</tr>
<tr>
<td>Target 12.5</td>
<td>Significantly reduce waste production through prevention, reduction, recycling, and reuse</td>
<td>2030</td>
</tr>
<tr>
<td>Target 12.6</td>
<td>Promote companies to embrace sustainable practices</td>
<td>No target year</td>
</tr>
<tr>
<td>Target 12.7</td>
<td>Promote public procurement practices that are sustainable, following national policies and priorities</td>
<td>No target year</td>
</tr>
<tr>
<td>Target 12.8</td>
<td>Ensure that people everywhere have the relevant information and awareness for sustainable development</td>
<td>2030</td>
</tr>
<tr>
<td>Target 12. A</td>
<td>Encourage developing countries to reinforce their scientific and technological capabilities</td>
<td>No target year</td>
</tr>
<tr>
<td>Target 12. B</td>
<td>Develop and implement tools to monitor sustainable development impacts for sustainable growth</td>
<td>No target year</td>
</tr>
<tr>
<td>Target 12. C</td>
<td>Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions</td>
<td>No target year</td>
</tr>
</tbody>
</table>

Source: SDG counting (2017)
Among the 11 targets, five are to be achieved by 2030, one in 2020, and five have no target years (see Table 1) mentioned. Among the targets, 12.8 is more relevant to transparency and traceability, apart from being an enabler for the achievement of other SDG targets (Papú-Carrone, 2020), because target 12.8 explicitly identifies the need for people everywhere to 'have the relevant information and awareness for sustainable development and lifestyles in harmony with nature' (UN, 2019). For this radical change, informed decision-making is a must. In this regard, industry practitioners and academics have identified transparency and traceability as essential tools (Chalmer, 2018; Kumar et al., 2017). Therefore, it is reasonable to say that SDG 12 might influence companies to adopt transparency and traceability throughout their supply chains; however, it is not binding and does not provide for sanctions if not adopted.

Similarly, other global regulations such as the ILO International Labor Standards and the OECD Due Diligence Guidelines for Responsible Business Conduct might also indirectly influence companies' transparency and traceability. For example, ILO is working with the United Nations Economic Commission for Europe (UNECE), the International Trade Center (ITC), the European Commission, and partners from the private sector, civil society, and academia for Decent Work and Transparency and Traceability Tool (UNECE, 2019). The aim is to help the sector to make risk-informed decisions and operate with a set of internationally agreed practices, thus increasing transparency to final consumers. In its Due Diligence guidelines, the OECD also suggests a traceability system as one of the mechanisms to achieve information symmetry, security, and accountability in the textile and apparel supply chain (Agrawal & Pal, 2019; OECD, 2017).
2.3.2 Government and EU Level Regulations for Transparency and Traceability in TAI

In addition to the global level regulations, some EU and national/government regulations also work for transparency and traceability to warrant that the final products are free from forced labor, human rights violations, and hazardous substances (Papú-Carrone, 2020). Examples of such regulatory forces for transparency and traceability in the textile and apparel industry and how they influence companies to adopt them are listed in Table 2.

National- or government-level regulations may influence more businesses to adopt transparency and traceability than global-level regulations (Birkey et al., 2018). For example, the most recent government regulation that increased concern in the textile and apparel industry is a Withhold Release Order (WRO). The US Customs and Border Protection (CBP) issued a WRO in January 2021, intending to remove forced labor from the supply chain. Specifically, it was against the use of forced labor, detainees, or prison labor in China's Xinjiang Uygur Autonomous Region (XUAR) and the cotton and cotton products produced therefrom (CBP, 2021; Taylor, 2020). The common forced labor indicators that CBP found through its investigation are debt bondage, restriction of movement, isolation, intimidation, threats, withholding of wages, and abusive living and working conditions (CBP, 2021). The anxiety among apparel companies increased with this WRO after CBP's recent seizure of a Uniqlo men's shirts shipment over a suspected forced labor case linked to Xinjiang (Chua, 2021). In the wake of these growing concerns, some textile and apparel companies are seeking ways to eliminate these conflict products from their supply chains. According to Taylor (2020), in this regard, digital supply chain traceability might be an appropriate solution that gives apparel companies the tools to document the chain of custody from component origin to importer of record.
Similarly, several slavery acts (e.g., the UK Modern Slavery Act, the California Transparency in Supply Chains Act, and the National Pact for the Eradication of Slave Labor) might motivate companies to adopt transparency and traceability. According to the UK Modern Slavery Act, companies whose annual sales exceed the US $49 million with some or all of their business in the UK must publish an annual statement on their websites (Modern Slavery Act, 2015). The statement must include information on refinements to organizational structures, policies, procedures, and supply chain management to eliminate all forms of modern slavery and human trafficking (see Table 2). Similarly, the California Transparency in Supply Chains Act requires large retailers and manufacturers to provide consumers with information regarding their endeavors to eradicate slavery and human trafficking from their supply chains. This law also educates consumers on how to purchase goods produced by companies that responsibly manage their supply chains, thereby improving the lives of victims of slavery and human trafficking (Pillsbury, 2010). In the same vein, another multi-stakeholder initiative, the National Pact for the Eradication of Slave Labor, demands that companies take significant steps to eradicate slave labor from their supply chains.

There are other laws related to Due Diligence, a process by which organizations identify, prevent, and address actual and potential adverse impacts (Richero & Ferrigno, 2016). Essentially, due diligence is the third level of traceability, indicating that apart from providing information about upstream actors, it prevents and mitigates harm (Richero & Ferrigno, 2016). For example, the Due Diligence on Child Labor Act requires companies selling goods and services to ultimate Dutch consumers to determine whether child labor is used in their supply chains. If so, companies must set out a plan of action to combat it and issue a due diligence statement on their investigation and plan of action (Business & Human Rights Resource Centre,
The French Duty of Vigilance Law also provides important lessons on an EU directive on due diligence. However, going beyond a simple due diligence obligation, this Law requires companies to create a 'vigilance plan' with reasonable but adequate measures to identify risks and prevent severe impacts on such rights. Companies' duty of vigilance' applies to human rights and fundamental freedoms, health and safety, and the environment.

While almost all these regulations focus on human rights, slave labor, and child labor issues, only a few laws regulate fiber identification and human and environmental safety from the potential chemical risks. According to the US Textile Product Identification Act, companies need to add a label for textile products containing the generic names and ratio of each fiber component in the product, the name under which the manufacturer or other responsible party does business or RN number, and the name of the country in which the product was processed or manufactured (USFIA, 2013).

Similarly, only the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) regulation (imposed in 2007 by the EU) demands improvement of human and environmental safety from chemical risks (Papú-Carrone, 2020). For this, the EU regulation places the 'burden of proof' on the businesses, which must identify and manage the chemical substances connected to the products they manufacture and market within the EU (REACH, 2019). In these cases, traceability can be a valuable tool to track chemicals and ensure that companies' business is in line with the regulations (Papú-Carrone, 2020).
Table 2. Government and EU Level Regulations and their Influences on Adoption of Transparency and Traceability

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Country/Region</th>
<th>Focus on Human Rights/Working Conditions</th>
<th>Focus on Human and Environmental Safety from Chemical Risks</th>
<th>Focus on Fiber Identification</th>
<th>How It Influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withhold Release Order (WRO)</td>
<td>USA</td>
<td>✓</td>
<td></td>
<td></td>
<td>It forces companies to adopt traceability and transparency by detaining cotton and cotton products produced with forced labor in China's Xinjiang Uygur Autonomous Region (XUAR) (CBP, 2021).</td>
</tr>
<tr>
<td>US Textile Product Identification Act</td>
<td>USA</td>
<td></td>
<td></td>
<td>✓</td>
<td>It requires brands to attach a label on textile products containing the generic names and weight% of each fiber in the product, the name under which the manufacturer or other responsible party does business or RN number, and the name of the country in which the product was processed or manufactured (USFIA, 2013).</td>
</tr>
<tr>
<td>The California Transparency in Supply Chains Act 2010</td>
<td>USA</td>
<td>✓</td>
<td></td>
<td></td>
<td>Large retailers and manufacturers need to provide information to consumers about their efforts to eradicate slavery and human trafficking from their supply chains (Pillsbury, 2010).</td>
</tr>
<tr>
<td>The UK Modern Slavery Act</td>
<td>UK</td>
<td>✓</td>
<td></td>
<td></td>
<td>Companies compulsorily need to publish an annual statement on their websites regarding their steps to eliminate all forms of modern slavery and human trafficking from the supply chain (Modern Slavery Act, 2015).</td>
</tr>
<tr>
<td>The National Pact for the Eradication of Slave Labor (PACT)</td>
<td>Brazil</td>
<td>✓</td>
<td></td>
<td></td>
<td>This law is dedicated to engaging national and international companies to maintain supply chains free of slave labor (FLA, 2012).</td>
</tr>
<tr>
<td>The Due Diligence on Child Labor Act</td>
<td>Netherland</td>
<td>✓</td>
<td></td>
<td></td>
<td>It requires companies selling goods and services to eliminate Dutch consumer to determine whether child labor is prevalent in their supply chains. If so, companies must set out a plan of action on how to combat it and issue a due diligence statement on their investigation and plan of action (Business &amp; Human Rights Resource Centre, 2019).</td>
</tr>
<tr>
<td>The French Duty of Vigilance Law</td>
<td>French</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>This law applies to human rights and fundamental freedoms, health and safety, and the environment (Clerc, 2021). It also provides important lessons for an EU directive on due diligence. However, going beyond a simple due diligence obligation, French Law requires companies to create a 'vigilance plan' containing reasonable but adequate measures to identify risks and prevent severe impacts on such rights (Clerc, 2021).</td>
</tr>
</tbody>
</table>

Source: Developed by the author
2.3.3 Voluntary Initiatives for Transparency and Traceability in TAI

Since there are few strict obligatory regulations for transparency and traceability in the textile and apparel value chains, voluntary initiatives have been acquiring momentum (Kumar et al., 2017). Voluntary organizations such as the Clean Clothes Campaign and Greenpeace continue campaigning, and activists work towards achieving effective brand information disclosure and transparent operations. Similarly, the Transparency Pledge (established after the Rana Plaza disaster in 2013 by a group of organizations-CCC, Human Rights Watch, ICAR, IRLF, Maquila Solidarity Network, Worker Rights Consortium, IndustriAll, UNI Global Union, and ITUC CSI IGB—works towards achieving transparency regarding value chains (Human Rights Watch, 2019). Transparency Pledge demands that each company take the pledge and commit to publishing manufacturing sites within three months of the commitment. Once the company commits to Transparency Pledge, it needs to fulfill the common standard of this pledge for supply chain transparency. That is, the Transparency Pledge requires companies to publish on their websites a list of the names, addresses, and other details of at least the factories involved in assembling, embellishing, and finishing their goods (called tier-I factories) regularly, twice a year.

Similarly, Fashion Transparency Index (FTI) is working for increased transparency in tandem with kindred allies such as the Transparency Pledge coalition and the Open Apparel Registry, inter alia (FTI, 2021). Although few studies have empirically examined whether voluntary initiatives influence apparel companies to adopt transparency and traceability, they might exert significant pressure on companies for traceability. Therefore, further investigation is required.
2.3.4 Consumers' Demand for Transparency and Traceability

Several studies in the literature emphasized consumers' expectations for transparency and traceability in the textile and apparel industry. For example, Kraft et al. (2018) pointed out that consumers are becoming increasingly interested in knowing where and how the products they buy are being produced. Kraft et al. (2018) claimed that consumers might be willing to pay an extra 2% to 10% for a company's products that offer greater supply chain transparency. Many other studies have highlighted that consumers are increasingly concerned about fair labor, sustainable resourcing, and environmental impacts (McKinsey & Company, 2019; Modi & Zhao, 2021). A survey report of 2016 by McKinsey & Company revealed that consumers want to support brands performing outstandingly in terms of sustainability, with 66% willing to pay more for sustainable goods. Some 42% of millennials intend to know what goes into products and how they are made before buying, compared to 37% of Gen Z (McKinsey & Company, 2019).

All these studies indicate that there is definite pressure on brands and retailers from consumers to adopt traceability and make their supply chain transparent. However, all these studies have been conducted from a consumer standpoint, i.e., data collected from consumers. Hence, consumers’ pressure on companies for transparency and traceability needs further investigation, particularly from the companies' viewpoint.

In conclusion, the above discussions highlight numerous potential forces that might pressure companies to implement transparency and traceability in their supply chains. Nonetheless, very few studies explore these aspects. Only Birkey et al. (2018), Kamal and Deegan (2013), and Macchion et al. (2017) claim that companies are adopting transparency and traceability due to external pressures such as NGOs, activist groups, consumer campaigns, and local or regional regulations. It is also crucial to note that except for Agrawal and Pal (2019), it is
rare to find academic studies investigating the reasons for adopting transparency and traceability by textile and apparel companies. Agrawal and Pal (2019), too considered only the companies’ internal motivations and essentially ignored the external pressures, identifying 14 factors for traceability implementation, but not for transparency. Therefore, it is vital to explore all possible factors, including external pressures such as regulations, consumers, NGOs’ demands, etc., to comprehend companies’ true motivations for implementing transparency and traceability.

2.4 Selected Examples of Transparency and Traceability Practice in TAI

Although transparency and traceability are still emerging concepts in the textile and apparel industry, there is a significant increase in the trend of companies adopting them (Agrawal & Pal, 2019). Many apparel companies have already moved towards radical transparency in the manufacturing process (McKinsey & Company, 2019; Papú-Carrone, 2020) and have started to disclose information about their suppliers' names, addresses, product origins, and the environmental impact of manufacturing on their websites or using advanced technologies (Bari & Jin, 2021). Examples of companies’ initiatives towards transparency and traceability in the textile and apparel industry are listed in Table 3 and organized by the mode of disclosure of the information. Table 4 summarizes the technology and traceability platform used by companies. All companies disclose traceable information by one of the two modes: online (company website, annual or sustainability report) or offline using a Near Field Communication (NFC) enabled label. For example, Designer Martine Jarlgaard, COS, and Arket use an offline mode to disclose traceable information, while the rest of the companies disclose the information online through their websites (see Table 3).

Through a partnership with Provenance, a blockchain technology company, and Fashion Innovation Agency (FIA), Designer Martine Jarlgaard has launched a pilot to track clothing from
raw material to the consumer (Arthur, 2017). Each step of the process is captured and tracked on the blockchain through the Provenance app, from farm to spinning, knitting, and finally to Martine Jarlgaard, at the designer’s studio in London (Arthur, 2017). Each apparel has a unique digital token or ID. This ID assists Provenance in verifying every step of its production and creating a digital history of that information, including location data, content, and timestamps. Finally, all this information is presented to consumers through an interface they can access through their item’s QR code or NFC-enabled label (Arthur, 2017). Similarly, H&M umbrella brands COS and Arket have recently started disclosing sustainability information to consumers using DNV DL's MyStory Product and VeChain blockchain technology (see Table 4) (Bari & Jin, 2021; CREAM, 2020). Consumers can scan the QR or NFC tag on their smartphones and see the entire traceability history of the product, complete with pictures and videos of the manufacturing process involving various sustainable materials (CREAM, 2020).

Among the companies that disclose traceable information on their websites, Nudie Jeans and ASKET are ahead of the others. Nudie Jeans aims to be transparent about how its products are manufactured (Egels-Zandén et al., 2015; Nudie Jeans, 2021). To this end, they launched their production guide in 2013, and in 2020, they presented product-level transparency on their website (Nudie Jeans, 2021). Now, consumers can see the name and address, the number of employees, and audit, or certification information of all actors from raw materials to the warehouse on Nudie Jean's website (see Table 3). Similarly, ASKET provides all this information on its website for each product (see Table 3). The only difference between ASKET and Nudie Jeans is that ASKET also provides a total cost breakdown to consumers for each product (not shown in Table 3) along with the product information (ASKET, 2021; Bari & Jin, 2021). It has been working extensively towards reaching full traceability by the end of 2019 and
has now achieved 100% of its full traceability goal (ASKET, 2021). This brand's traceability system is based on obtaining verified certificates per their established rules of performance for each subprocess of their value chain. This is coupled with onsite visits and travels to enhance the knowledge about their own and their partners' operations. Certification bodies and internal and external audits, therefore, become relevant for traceability systems. The traceable information is fed into a traceability scoring system which organizes the value chain processes into four main areas: manufacturing, milling, raw material, and trims, approximately tracing 400 sub-processes in their value chain (ASKET, 2021). The information traced is later connected to transparency practices, such as garment labeling or online disclosure, giving the consumer a much more informed overview than the usual “made in” label.

In 2019, H&M became the most significant global fashion retailer to publish product transparency (H&M, 2021; Howland, 2019). This information is available at www.hm.com for all H&M products and includes the manufacturing factory’s name, address, and location, however only for tier 1 suppliers. Similarly, San Francisco apparel company Everlane also published tier 1 suppliers on its websites for each product. It also offers its customers insight into materials, labor, and markup costs, besides information on the factory that produced the products at tier 1 suppliers (McKinsey & Company, 2019).

Patagonia and Icebreaker publish suppliers’ lists (supplier maps) on their websites, presenting an overview of the manufacturing facilities they work with, and sourcing points of their raw material (Egels-Zandén et al., 2015; Papú-Carrone, 2020). The retailer Reformation applies its "RefScale" methodology to measure the environmental impact of every garment it sells and discloses the results to its customers (not shown in Table 3). RefScale tracks the pounds of carbon dioxide and gallons of water used in production.
Table 3. Selected Examples of Transparency and Traceability Practice in the TAI

<table>
<thead>
<tr>
<th>Company</th>
<th>Origin</th>
<th>Mode of Disclosure</th>
<th>Raw Materials (Tier 4 Suppliers)</th>
<th>Tier 3 Suppliers (spinning)</th>
<th>Tier 2 Suppliers (weaving/knitting, dyeing, printer, embroiderer)</th>
<th>Tier 1 Suppliers (Apparel Manufacturers)</th>
<th>Suppliers Map or List (Excel Format)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martine Jarlgaard</td>
<td>England</td>
<td>Online/company website</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>COS</td>
<td>H&amp;M</td>
<td>Offline (NFC enable Label)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Arket</td>
<td>H&amp;M</td>
<td>Name &amp; address</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Nudie Jeans</td>
<td>Sweden</td>
<td>Name &amp; address</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>H&amp;M</td>
<td>Sweden</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ASKET</td>
<td>Sweden</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Patagonia</td>
<td>USA</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Everlane</td>
<td>USA</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Icebreaker</td>
<td>New Zealand</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Table 4. Summary of Technology and Traceability Platforms Used by Selected Companies

<table>
<thead>
<tr>
<th>Company</th>
<th>Origin</th>
<th>Technology Used</th>
<th>Traceability Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Blockchain</td>
<td>QR Code/NFC/RFID</td>
</tr>
<tr>
<td>Martine Jarlgaard</td>
<td>England</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>COS</td>
<td>Sweden</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Arket</td>
<td>Sweden</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>H&amp;M</td>
<td>Sweden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASKET</td>
<td>Sweden</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

2.5 Previous Studies on Transparency and Traceability in TAI

As transparency and traceability are relatively new concepts in the TAI, research on these topics is also limited. Still, several studies have focused on various aspects of transparency and traceability in the TAI, as shown in Table 5. Most of the earlier research on transparency and traceability in TAI focused on developing conceptual frameworks and detailing technologies used for transparency and traceability (see Table 5). For instance, Garcia-Torres et al. (2019) have developed a conceptual framework to describe traceability for sustainability as an evolving cycle, comprising three dimensions: governance, collaboration, and tracking and tracing, through an integrative and systematic literature review. Similarly, Kumar et al. (2017), presented a framework to implement traceability in the textile supply chain. Kumar et al. (2017), first defined the usage requirements of traceability and discussed a framework for implementing internal and external traceability. Agrawal et al. (2021) and Bullón Pérez et al. (2020) also proposed a blockchain-based traceability framework for traceability in multi-tier textile and apparel supply chains. Further, Agrawal, Koehl, et al. (2018), and Agrawal et al. (2018) proposed a system for the implementation of secured tag and blockchain-based traceability, respectively.
Another group of researchers has studied the conceptualization of transparency and traceability and their relations and impacts on sustainability (see Table 5). Applying the Delphi method, Garcia-Torres et al. (2021) conceptualized transparency and traceability and their interrelations with sustainability. They also uncovered the factors responsible for fostering and hindering the relationship between traceability, transparency, and sustainability in the TAI. Further, Egels-Zandén et al. (2015) defined supply chain transparency based on a case study approach covering a Swedish garment retailer Nudie Jeans Co.
Table 5. Previous Studies on Various Aspects of Transparency and Traceability in TAI

<table>
<thead>
<tr>
<th>Authors and Year</th>
<th>Various Aspects of Traceability and Transparency Research Focused on in Previous Studies</th>
<th>Research Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Development of Framework</td>
<td>Integrative and systematic literature review</td>
</tr>
<tr>
<td></td>
<td>Conceptualization of Traceability and Transparency</td>
<td>Case study</td>
</tr>
<tr>
<td></td>
<td>Technology Aspects (e.g., Blockchain, Tags, etc.)</td>
<td>Case study</td>
</tr>
<tr>
<td></td>
<td>Consumers’ perceptions</td>
<td>Case study</td>
</tr>
<tr>
<td></td>
<td>Contribution to Attaining Sustainability</td>
<td>Case study</td>
</tr>
<tr>
<td></td>
<td>Influencing Factors for Implementing Traceability</td>
<td>Delphi study</td>
</tr>
<tr>
<td></td>
<td>Supply Chain Collaboration for Transparency</td>
<td>Descriptive study</td>
</tr>
<tr>
<td></td>
<td>Measurement</td>
<td>A systematic approach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Case study</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interviews, semiology, and questionnaires</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Survey method</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social media analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Case study</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Review</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delphi method</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Qualitative study</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Secondary research method</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Secondary research method</td>
</tr>
</tbody>
</table>

Garcia-Torres et al. (2019) ✓
Kumar et al. (2017) ✓
Agrawal et al. (2021) ✓ ✓
Bullón Pérez et al. (2020) ✓ ✓
Rusinek et al. (2018) ✓ ✓
Garcia-Torres et al. (2021) ✓
Egels-Zandén et al. (2015) ✓
Joy and Peña (2017) ✓
Agrawal et al. (2018) ✓
Agrawal et al. (2018) ✓
Henninger (2015) ✓
Goswami (2014) ✓
Modi and Zhao (2021) ✓
Kumar et al. (2017) ✓
Papi-Carrone (2020) ✓
Agrawal and Pal (2019) ✓
Brun et al. (2020) ✓
Jestratijevic et al. (2020) ✓
Gonçalves and Silva (2021) ✓
Apart from conceptualizing and developing the framework and technological aspect, some studies focused on consumers’ perceptions of transparency and traceability (Goswami, 2014; Henninger, 2015; Modi & Zhao, 2021). However, there are limited studies on the factors that influence companies to adopt transparency and traceability, measurement system, and supply chain collaboration for transparency (i.e., how and to what extent building supply chain relations impacts transparency) except for a few studies (Agrawal & Pal, 2019; Buse, 2020; Jestratijevic et al., 2020).

Regarding the factors that influence companies to adopt transparency and traceability, Agrawal and Pal (2019) conducted a Delphi study and identified 14 factors influencing traceability implementation. However, they identified factors limited to companies’ internal motivations, such as business risk management, product authentication, and visibility of the supply chains, largely ignoring other factors such as external pressures (e.g., global, government level regulations, or consumer demand). Regarding the measurement, Jestratijevic et al. (2020) investigated the transparency status of sustainability disclosure but did not explore how to measure transparency and traceability. Through a case study, Brun et al. (2020) investigated how an apparel company creates supply chain relations that eventually influence its transparency performance. However, whether the supply chain collaboration is the company’s strategic decision for transparency and traceability effort is mainly unexplored. There is thus a significant void in the literature regarding companies’ true motivation for adopting transparency and traceability, the evaluation methods, and the importance of transparency and traceability efforts to companies' strategic decisions. Therefore, more research is needed on these aspects.
2.6 Evaluation Method for Transparency and Traceability in TAI

Activities relating to the evaluation and monitoring of transparency and traceability are vital initiatives that create a common means and language to communicate transparency and traceability to stakeholders and help consumers make informed decisions. For measuring performance, a metric is required that can be used to quantify the efficiency and effectiveness of a company’s activities (Tangen, 2005). Like sustainability measurement, the transparency and traceability evaluation method can be defined as a system of key performance indicators (KPIs) or simply indicators that the company records, retrieves, and traces as well as discloses to consumers and other stakeholders.

In this section, the evaluation/indexes used in the industry as well as academic studies on the measurement have been discussed. In TAI, there are several measurement systems for sustainability, but not for transparency and traceability. For example, the Higg Index and the Global Reporting Initiative (GRI) are widely used to measure sustainability performance, while only the Fashion Transparency Index (FTI) measures transparency in TAI, with some companies developing measurement systems for traceability. Since there are more measurement systems for sustainability than transparency and traceability, a separate discussion is needed on these two aspects. Although transparency and traceability are different from sustainability, achieving sustainable, accountable, and fair TAI will not be possible without them. Thus, it is worth discussing their measurement systems separately. To this end, the following section will highlight (a) measurement systems available for sustainability and (b) methods available for transparency and traceability.
2.6.1 Measurement Systems Available for Sustainability in TAI

2.6.1.1 The Global Reporting Initiative (GRI) on Sustainability Reporting

The Global Reporting Initiative (GRI) has been providing reporting guidelines, applicable to all sectors, for companies that pursue to commit to sustainable improvement since 1997 (Jestratijevic et al., 2020; Kozlowski et al., 2015). The GRI developed G3 guidelines (GRI, 2006), as also a complement to the G3 guidelines, known as the Apparel and Footwear Sector Supplement (AFSS), addressing the specific needs of the apparel industry (GRI, 2011). The AFSS is the first guideline available to the apparel industry related to the selection of sustainability indicators and reporting. The AFSS identifies 34 sector-specific performance indicators, which fall into four categories: supply-chain standards and practices, economic, environmental, and social (Castelo, 2013; GRI, 2011); however, it focuses primarily on supply chain issues and does not sufficiently capture all the key sustainability issues reported by apparel brands (Kozlowski et al., 2015). It is also voluntary, and companies have considerable freedom about what they want to report. Therefore, most companies follow their methods or others created within the industry for sustainability reporting, rather than those created by the scientific community, like GRI (Gonçalves & Silva, 2021). Hence, it is difficult to determine which brand is doing better in terms of sustainability (Sherman, 2009), indicating that GRI G3 or AFSS guidelines are not achieving their intended outcomes; this is not necessarily a fault of the guidelines but an illustration of the inconsistencies in their application (Kozlowski et al., 2015).

2.6.1.2 Higg Index for Evaluating Sustainability Performance

The Higg index is an important tool to measure the impact of sustainable development in the textile and apparel industries (Gonçalves & Silva, 2021). It was developed by the Sustainable Apparel Coalition (SAC) in 2011 to create a common tool with comparable results to measure
(and communicate) a company or a product's sustainability performance. SAC is an alliance of the footwear and textile industry for sustainable production, with more than 250 global members, including apparel brands, retailers, manufacturers, academic institutions, affiliates, governments, and non-government organizations.

The Higg index applies to products, factories, and retailers for evaluating sustainability performance. For this, it has three tools: (a) Higg Product Tools, (b) Higg Facility Tools, and (c) Higg Brand and Retail Tools. Under each tool, there are several sub-tools which are shown in Figure 1. The Higg product tools consist of Higg Materials Sustainability Index (Higg MSI), the Higg Product Module (Higg PM), and MSI Contributor (Figure 1).

Higg Facility Tools were developed to measure the social and environmental performance of manufacturing facilities. The environmental impact can be assessed with the Higg Facility Environmental Module (Higg FEM). The Higg Facility Social and Labor Module (Higg FSLM) is a tool dedicated to promoting safe and fair social and labor conditions for value chain workers globally and is directly informed by the findings of the Social and Labor Convergence Program (SLCP).

The Higg Brand and Retail Module (Higg BRM) can be used by apparel and footwear retailers to measure the environmental and social impacts of their value chain, enabling the identification of sustainability risks and impacts throughout the life cycle stages of a product: management system, product, supply chain, packaging, use and end-of-use, retail stores, offices, transportation, and distribution centers.

Although the Higg index is a widely used measurement tool for sustainability in TAI compared to GRI, it has its limitations. For example, the Higg index focuses only on two
dimensions of sustainability: environmental and social. Additionally, the tool is still at the development stage, and several areas are being considered for further development.

![Figure 1. Three Types of Higg Index Tools](image)

Source: HiggMSI (2020)

### 2.6.2 Evaluation Methods Available for Transparency and Traceability in TAI

As mentioned earlier, compared to sustainability, there are few established methods for measuring transparency and traceability. Only one established (e.g., FTI) tool and some companies’ own developed (ASKET) evaluation standards are available for transparency and traceability, all of which are discussed in the following sections.

#### 2.6.2.1 Fashion Transparency Index (FTI)

Fashion Revolution, an activist organization in the apparel industry founded in 2013, developed the fashion Transparency Index (FTI) in 2016 to measure the extent of the textile and apparel companies' disclosure about their social and environmental policies, practices, supply chain, and impacts. It is based on a questionnaire seeking information related to 239 indicators (FTI, 2021; Gonçalves & Silva, 2021). Each year, it ranks the world's biggest fashion brands and retailers based on their public disclosure of human rights and environmental policies, practices,
and impacts in their operations and supply chains. Brands receive points for publicly disclosed information on the brand or parent company website, through self-published annual reports, and through third parties where there is a link between the company’s website and the third-party disclosure.

The FTI reviews and benchmarks brands’ public disclosure on human rights and environmental issues across five areas: (a) policy and commitments, (b) governance, (c) supply chain traceability, (d) know, show, & fix, and (e) spotlight issues. Each area has different weights. The description of each area and its corresponding weighting% are summarized in Figure 2. Table 6 presents how each area is measured. Associated questions, the number of indicators, and the total possible points for each question and section are described in Table 6.

<table>
<thead>
<tr>
<th>Policy &amp; Commitment</th>
<th>Governance</th>
<th>Traceability</th>
<th>Know, Show, &amp; Fix</th>
<th>Spotlight Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>This section explores brands’ social and environmental policies for both their own employees and workers in the supply chain, how these policies are implemented, whether brands have relevant goals and targets in place and whether brands are reporting annual progress against these targets. For this year’s index, available points in this section were halved to place more emphasis on outcomes and impacts.</td>
<td>In this section, FTI looks at who on the executive board has responsibility for social and environmental performance, how this is implemented, how social and environmental improvements are linked to employee, CEO, and supplier performance, and whether the relevant department can be easily contacted by the public. This year FTI also looked to see whether there is worker representation on the board.</td>
<td>In this section FTI wants brands to publish supplier lists at three levels: manufacturing, processing facilities, and mills, and raw materials. FTI also looks for extra details such as supplier address, number of workers, gender breakdown, number of migrant workers, union representation and when the list was last updated.</td>
<td>Here FTI reviews what brands disclose about their due diligence processes, how they assess suppliers against their policies, what are the results of these audits and assessments, what brands do when problems are found, how workers can file complaints and how these are addressed.</td>
<td></td>
</tr>
<tr>
<td>Weighting %: 13.2%</td>
<td>Weighting %: 5.2%</td>
<td>Weighting %: 29.6%</td>
<td>Weighting %: 18.8%</td>
<td>Weighting %: 33.2%</td>
</tr>
</tbody>
</table>

Figure 2. Description of Five Areas of FTI and their Corresponding Weighting Percentage
Source: Adapted from FTI (2021)
## Table 6. FTI Measurement System in Five Areas

<table>
<thead>
<tr>
<th>Areas/Sections</th>
<th>Questions</th>
<th>Indicators</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Policy and Commitments</td>
<td>1.1 What are the company’s human rights and environmental policies?</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>1.2 What are the company’s vendor/supplier policies covering human rights and environmental standards across the supply chain? (e.g., Code of Conduct, Terms of Engagement, etc.)</td>
<td>29</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>1.3 Publishes the company’s human rights and environmental management procedures (i.e., how the company is putting its policies 1.1 and 1.2 into action)</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>1.4 Publishes a strategic plan toward progressively improving human rights and environmental impacts (i.e., roadmap or vision document). Must cover dates in the future</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1.5 Publishes annual sustainability or corporate social responsibility report that is audited or verified by an independent third party.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>83</strong></td>
<td><strong>33</strong></td>
</tr>
<tr>
<td>2. Governance</td>
<td>2.1 Publicly discloses contact details for the department of the company that has responsibility for human rights and environmental issues</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2.2 Publicly disclose the company board member or board committee accountable for human rights and environmental issues</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2.3 Publicly acknowledges how the company prioritizes money spent on managing and implementing CSR and sustainability activities</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2.4 Publishes how the company incorporates human rights and environmental performance into purchasing practices</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>8</strong></td>
<td><strong>13</strong></td>
</tr>
<tr>
<td>3. Traceability</td>
<td>3.1 Publishes tier-one factories (direct relationship with buyer e.g., production units, Cut Make Trim (CMT) facilities, garment sewing, garment finishing, full package production, and packaging and storage)</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>3.2 Publishes processing facilities (e.g., ginning and spinning, knitting, weaving, sub-contractors, dyeing and wet processing, tanneries, embroidering, printing, fabric finishing, dye-houses, laundries, etc.)</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>3.3 Publishes suppliers of raw materials such as fibers, hides, rubber, dyes, metals, etc. (e.g., raw material providers, farms, slaughterhouses, sewing yarn suppliers, filament and staple, chemical suppliers, etc.)</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>40</strong></td>
<td><strong>74</strong></td>
</tr>
<tr>
<td>4. Know, Show, &amp; Fix</td>
<td>4.1 Know, Show &amp; Fix; Publicly discloses human rights and environmental due diligence processes, outcomes, and what the brand is doing to remediate any issues identified. (Please note: Auditing by itself does not represent a due diligence process.)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4.2 Know: Publicly discloses how the company assesses the implementation of its supply chain policies (as described in section 1.2) by facility (e.g., at factories, processing facilities, and farms)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4.3 Show: Publicly discloses findings from its facility-level assessments (e.g., at factories, processing facilities, and farms)</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>4.4 A Fix: Publicly discloses the description and status of the remediation process</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4.4 B Fix: Publicly discloses how the company ensures human rights and environmental grievances from employees and workers are captured and addressed (no points given if whistleblowing is only for reasons of financial misconduct)</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>35</strong></td>
<td><strong>47</strong></td>
</tr>
<tr>
<td>5. Spotlight Issues</td>
<td>5.1 Decent work and purchasing practices</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>5.2 Gender and racial equality</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>5.3 Sustainable sourcing and materials</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>5.4 Over-consumption, waste, and circularity</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>5.5 Water and chemicals</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>5.6 Climate change and biodiversity</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>73</strong></td>
<td><strong>83</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>239</strong></td>
<td><strong>250</strong></td>
</tr>
</tbody>
</table>
There are 250 total possible points (see Table 6). Final scores have been converted into percentages (FTI, 2021). Each section/area has a different weight, as some sections are worth more points than others. For example, section 1 (i.e., policy and commitments) is worth 33 out of 250, and weightage is 13.2%, while section 5 is worth 83 out of 250, i.e., 33.2% (see Figure 3 and Table 6). The total score is given to a brand by adding the score awarded for the five different sections. To elaborate the scoring system, take the example of OVS, an Italian leading apparel brand that ranked 1st among 250 major fashion brands and retailers reviewed in the FTI in 2021. OVS final score is 78% calculated as follows:

- Section 1 score 94% of 33 (i.e., 31.02/33).
- Section 2 score 77% of 13 (i.e., 10.01/13).
- Section 3 score 93% of 74 (i.e., 68.82/74).
- Section 4 score 55% of 47 (i.e., 25.85/47); and
- Section 5 score 72% of 83 (i.e., 59.76/83)

The total points are 195.46 which is 78% (195.46/250)

Following this scoring system, FTI ranked 250 of the world’s largest fashion brands in 2021. The overall findings of the FTI 2021 report are shown in Figure 3, indicating that only one brand scored more than 70%, the average score is 23% (i.e., 57), and 20 (8%) brands scored 0%. The top-scoring brands are OVS (78%), H&M (68%), the North Face and Timberland (66%), C&A and Vans (65%), Gildan (63%), Esprit (60%), PVH (59%), and Gucci (56%).
Although the FTI is an established measuring system for transparency, it has some limitations. First, it uses 239 indicators across five areas for rating the brands. Such a large number of indicators are difficult for consumers and brands alike to comprehend, apart from being time-consuming. Second, the index does not verify the claims made by brands, i.e., consumers cannot trace the information. For example, if a brand states that there is no “harassment and violence” in the company, there is no way of confirming the veracity of the statement, indicating that the brand ranking 1st or 3rd in the FTI does not necessarily suggest that they are sustainable brands. Third, only large brands and retailers (e.g., annual turnover exceeding the US $400 million) were ranked by FTI. Large brands and retailers indeed have greater impacts on the environment and society; however, many small or start-up brands
nowadays perform better in implementing transparency and traceability than large brands such as ASKET, disclosing more supply chain information than many larger brands (Bari & Jin, 2021).

2.6.2.2 ASKET Own Developed Evaluation Method

ASKET, a Swedish menswear brand, provides full traceability opportunities to consumers for each product it sells. Full traceability is ASKET’s transparency standard, developed to identify every unique process in manufacturing its garments and the exact location of the farms, plants, factories, and facilities at which these processes are carried out. By traveling and visiting manufacturers, mills, and farms worldwide or through verified certificates, ASKET traces its apparel (Asket, 2021). ASKET has provided a weblink (Click here) where consumers and other stakeholders can see photos of their manufacturing and milling facilities.

ASKET has developed its own traceability measuring system to track its progress by grouping every garment into four major categories of production: manufacturing, milling, raw materials, and trims (Asket, 2021). Each category is divided into sub-categories that are traced and rated according to how much ASKET knows. Finally, ASKET weighs and sums it all up to arrive at their traceability score:

- **Manufacturing (30%)**: Tier 1 includes all steps from fabric to final garments, such as cutting, sewing, washing, pressing, and packing. It is the most labor-intensive part of the industry. ASKET visits all manufacturing factories in-person to know the working conditions (Asket, 2021).

- **Milling (30%)**: Tier 2, producing finished fabric from raw materials such as wool, cotton, etc.; it includes spinning, weaving, knitting, dyeing, and finishing. These processes consume energy, water, and chemicals. Therefore, ASKET aims to trace energy and water consumption and the chemicals used for processing.
• **Raw Materials (30%)**: Tier 3 includes cotton farms or wool sheep that produce the basic raw materials of a garment. These sectors use water, soil, and pesticides. ASKET aims to know the harmful effects of cotton growing and, in the case of wool, animal welfare.

• **Trims (10%)**: This generally, refers to the remaining components of garments such as buttons, zipper, sewing thread, etc.

All these four sections produce 100% or full traceability (Asket, 2021). Consumers or other stakeholders can see this score for each product by following these steps: (a) on the ASKET website select any product, (b) at the end of the selected product consumers can see “100% or other percent traceability” (see the red circle in Figure 4), (c) by clicking on it, consumers can see the percentage of traceability of each section (see the yellow circle Figure 4), (d) if consumers click on any section (e.g., manufacturing, milling), it will show the name of the facility as shown in the blue circle in figure 4, (e) when consumers click on facility name, it will provide detailed information on the facility including name, address, number of workers, salary paid to workers, working hours, and some photos.

Although ASKET allows consumers to fully trace tier 1 suppliers (i.e., manufacturing), it only provides names of other tiers. Further, this traceability measurement system is of ASKET’s development; therefore, it has a validity issue.
Although limited evaluation methods for transparency and traceability are found in the literature, there might exist other companies’ development methods like ASKET. Therefore, it is important to research how companies evaluate their transparency and traceability efforts, which will help to modify the existing methods or provide suggestions for the development of a new method. Further, it is also critical to identify how companies communicate transparency and
traceability to consumers and other stakeholders because it will assist consumers in better understanding companies’ efforts and making informed decisions.

2.6.3 Academic Studies Related to Evaluation of Transparency and Traceability in TAI

Limited academic studies have focused on evaluating transparency and traceability practices in TAI. Jestratijevic et al. (2020) benchmarked the transparency status of sustainability disclosures among globally recognizable apparel brands. The study utilizes FTI's rating methodology to benchmark brands' disclosure across five areas, such as policy, governance, traceability, audits, and negative impact reporting, using the same sample as the FTI. Thus, the factors used in the study cannot be helpful to develop a new standard or measuring system for traceability and transparency in the TAI. Gonçalves and Silva (2021) also reviewed the top global brands using the initiatives and measures of sustainability. The authors shared the procedures and norms of sustainability applied to apparel products such as products' environmental footprint (environmental life cycle assessment/analysis; e-LCA), social issues (including the social life cycle assessment/analysis; s-LCA), and transparency in reporting sustainability (i.e., disclosing sustainability information). Though the authors highlighted transparency in reporting sustainability a little, their focus was mostly limited to sustainability measurement standards. There are significant voids in the academic literature on how companies evaluated and communicated their transparency and traceability efforts, which encourages the exploration of how brands and retailers evaluate their transparency and traceability, as well as how to communicate to consumers.
2.7 Importance of the Transparency and Traceability Efforts to Companies' Strategic Decisions

Since the adoption of transparency and traceability among apparel companies is rising, the importance of relative initiatives to companies’ strategic decisions should also be high. To adopt transparency and traceability, many companies are taking various strategic initiatives such as industry collaboration, working with traceability, or chain-of-custody platform providers. For example, mass-market player H&M has recently started working with TextileGenesis (a Global Change Award winner company) on its traceability platform (H&M, 2021). H&M also introduced a pilot that tracked three materials through their five-level supply chain using traceable digital fibercoin technology. Similarly, Cone Denim is partnering with Oritain, a product, and supply-chain traceability specialist that uses forensic science and statistics to identify “origin footprints,” to become the first denim mill to adopt this high level of end-to-end traceability for the cotton it uses (Warren, 2020).

All the aforesaid instances prove that companies have made strategic decisions toward transparency and traceability. Still, it is difficult to say whether these strategies are a top priority for them. To the best of our knowledge, few academic studies have yet to explore this issue. Therefore, it is essential to determine companies’ degree of priority for transparency and traceability, and the reasons behind varying degrees of priority.
CHAPTER 3

METHODOLOGY

This study aimed to investigate supply chain transparency and traceability in the textile and apparel industry. Particularly, this study explored: (1) how companies describe sustainability, transparency, and traceability and what are the relationships between them; (2) what motivates the apparel companies to adopt transparency and traceability; (3) how companies evaluate and communicate their transparency and traceability efforts; and (4) how important are the transparency and traceability efforts to companies’ supply chains or strategic decisions.

A qualitative research method was utilized to address this study’s research questions by conducting one-on-one in-depth interviews with the executives of the apparel companies. This chapter first describes the qualitative research method to address research questions (e.g., RQ#1, RQ#2, RQ#3, and RQ#4) including sample recruitment, data collection, and data analysis.

3.1 Qualitative Research Method

Qualitative research is “an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyses words, reports detailed views of informants and conducts the study in a natural setting” (Creswell, 2014, p. 15). Since this study addressed complicated issues and required a comprehensive understanding of the topics, a qualitative approach was deemed to be appropriate because this method helps thoroughly address complex issues (Webster, 2014). Further, a qualitative approach allows participants to reflect on the problems creatively and expand their perceptions and experiences (Webster, 2014). Thus, this approach enabled participants to share their experiences, knowledge, and insights regarding transparency and traceability. In this study, one-on-one in-depth interviews were conducted with
semi-structured questionnaires. These interviews helped the study to stay true to the objective and obtain more information about the research questions.

3.1.1 Sample/Participants and Requirements

3.1.1.1 Sample/Participants

The target population for this study was apparel companies’ executives in the US, with varying degrees in diverse apparel sectors such as large vs. small companies, and brands/retailers vs. manufacturers. Eight companies that have adopted a certain extent of transparency and traceability were selected. One or two participants from each company were recruited and a total of 11 participants were interviewed. Previous qualitative studies have used an ideal sample size of 5-25 for employing in-depth interviews to collect data (Creswell, 2014). The recruitment of companies and participants was done in two ways. First, companies and participants were recruited by the researcher with the help of a US-based non-profit company. Several criteria were employed when selecting participants: (1) holding a top management position including, i.e., the participants for this study were either supply chain or sustainability managers or others employed in decision-making roles in the company; (2) having sufficient knowledge of transparency and traceability, supply chain or value chain, and sustainability; (3) associated with transparency and traceability implementation planning; (4) in charge of supply chain strategy. These selection criteria helped ensure that the participants have hands-on experience in implementing traceability and transparency and strategic decision-making.

Second, the snowball non-probability sampling method was also utilized to recruit the research participants for this study. The snowball sampling technique was deemed suitable for this study because it helps identify and select experienced and knowledgeable participants.
Creswell and Poth (2018) emphasized this by stating that "participants need to be carefully chosen to be individuals who have all experienced the phenomenon in question” (p. 81).

3.1.1.2 Recruitment

A research participation invitation was sent through email to identify participants for one-on-one in-depth interviews with semi-structured questionnaires. The email briefly explained the research purpose, the eligibility criteria to participate, and the participation procedures.

Before the interviews, the interested and eligible participants’ consent was obtained to participate in the study by forwarding them the informed consent form link (Qualtrics link) through email with the Institutional Review Board (IRB) approval. The informed consent form conveyed the interview procedure and other details such as risk/discomforts and benefits of participation. Participants did not receive any benefit or compensation for participating in this study. The consent form also informed how the interview would be audio recorded for subsequent transcription and data analysis all the while maintaining anonymity. Further, the informed consent form contained the contact information of the University's IRB for questions about the study and participant rights. Finally, a convenient time was scheduled with each eligible interested participant by sending a calendar invitation with zoom links for the interview.

3.1.2 Data Collection

Data was collected through the responses obtained from the semi-structured, in-depth interview process with open-ended questions, as they enable the collection of sufficient and valuable information (Creswell & Poth, 2018). The primary researcher conducted the interviews from February 2022 to April 2022. All interviews were conducted through video conferencing over zoom. Once the participants agreed to interviews, the researcher sent a zoom link to each
participant through email to schedule interviews. A reminder email was sent with the Qualtrics link for the consent form a day before the interview, prompting them to confirm their attendance. The interviews were semi-formal and of a conversational type.

Upon the participants’ consent and following the IRB protocol, the video and audio recordings of the interviews were obtained to ensure the clarity and accuracy of the data transcription and analysis. All data sources such as transcriptions, and audio and video recordings of the interviews were stored as per the storage protocols. This researcher used a password-protected laptop to store data. In other words, the collected data, including video and audio recordings of zoom interviews and transcriptions provided through zoom, were stored in the researcher’s laptop and deleted after the defense. No data was transferred into a hard copy. Tape recordings were transcribed after the interviews. The interview transcripts were made available to participants upon request to ensure suitable and accurate interpretations. The transcribed interviews were entered into the qualitative data software program NVivo.

3.1.3 Instrument Development

A semi-structured interview protocol was devised to guide the interview process and explore the research questions. The protocol consisted of the introductory script, interview questions with relevant follow-up questions or probes, and a finishing script. Table 7 summarized only the introductory script, main interview questions (part 1 to part 4), and finishing script. The details of the interview protocol including follow-up questions are presented in Appendix D. According to Bhattacherjee (2012), during semi-structured interviews, follow-up questions enable the researcher to avoid deviating from the research topic. Each interview commenced with a brief explanation of the purpose of the study. Then, the researcher briefly went over the informed consent form and asked whether the interviewees have any questions.
about the interview or the interviewer. Thereafter, the main interview session started. The pace
and order of the questions during each interview depended on the participant’s previous
responses. The main interview lasted between 45 and 60 minutes.
Table 7. Interview Questionnaires and Protocol Excluding the Follow-up Questions

<table>
<thead>
<tr>
<th>Introductory Script</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hello, how are you? I am Bari and conducting this research as part of my Ph.D. dissertation at NC State University. This research will focus on supply chain transparency and traceability in the textile and apparel industry. In particular, I am examining companies' motivations for the adoption of policies and practices toward transparency and traceability. I want to record our conversation for transcription and analysis. Are you ok with that? The information you will provide will use for the dissertation and subsequent publication. But your and your company name will be not used anywhere in the report. Before we begin, I need your consent for participation. I have sent you a link please consent to it and do you have any questions regarding the interview or about me?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Explain the importance of sustainability that means to your organization, and how your stakeholders define it.</td>
</tr>
<tr>
<td>2. Within the context of sustainability in your supply chain, what is the role of transparency and how is it operationalized?</td>
</tr>
<tr>
<td>3. Within the context of sustainability in your supply chain, what is the role of traceability and how is it operationalized?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What motivated your company to adopt transparency?</td>
</tr>
<tr>
<td>2. What motivated your company to adopt traceability?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What technologies and analytics are used for transparency efforts? How does your company evaluate the success of transparency efforts?</td>
</tr>
<tr>
<td>2. What KPIs are used to assess transparency?</td>
</tr>
<tr>
<td>3. Do you think there should be a common evaluation system for transparency? Why or why not?</td>
</tr>
<tr>
<td>4. What technologies and analytics are used for traceability efforts? How does your company evaluate the success of traceability efforts?</td>
</tr>
<tr>
<td>5. What KPIs are used to assess traceability?</td>
</tr>
<tr>
<td>6. Do you think there should be a common evaluation system for traceability? Why or why not?</td>
</tr>
<tr>
<td>7. How does your company communicate its transparency and traceability efforts?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How much impact do the transparency efforts have in relation to your company's supply chain strategies?</td>
</tr>
<tr>
<td>2. How much does traceability factor into your company's supply chain strategies?</td>
</tr>
<tr>
<td>3. What are your company’s plans (short-term and long-term) for transparency and traceability?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finishing Script</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thank you so much for participating in this research. The information you provided will be a valuable resource for the study to achieve accurate results. I will appreciate the opportunity to follow up with you for cross-checking the information you provided after the transcription of the data. If you think someone else from your company or another company would be able to help me, I would greatly appreciate the contact information or your assistance to reach them. If you have any more information for this study regarding the questions I asked you or the topic of this research, please email me at (<a href="mailto:mbari@ncsu.edu">mbari@ncsu.edu</a>). Thank you again and hope you have a great day!</td>
</tr>
</tbody>
</table>
3.2 Data Analysis and Validation

3.2.1 Data Analysis

The thematic analysis approach, a widely used research method for semi-structured interview analysis, was applied to the data analysis. Thematic analysis is “a method for identifying, analyzing, and reporting patterns within qualitative data” (Braun & Clarke, 2006, p. 79). Apart from counting the exact words or phrases, the thematic analysis also focuses on identifying and describing both implicit and explicit ideas within the data (i.e., themes) (Guest et al., 2012). This method of data analysis enables extracting broader and rich information from data to foster trustworthiness in interpretations. The first step in the thematic data analysis process involves transcription. The interviews were transcribed word by word by the primary researcher, who re-reviewed the interview transcriptions to check for errors and to be familiar with the data in preparation for further analysis.

After completing the data verification process, the interview scripts were coded using the qualitative research software NVivo 12, and themes were searched for those with broader patterns of meanings. The coding was guided by considering each line/phrase/paragraph of the transcripts from the interview study, while broadly keeping a constant tab on the research questions to be answered. New codes (themes) were added, and the description of initial codes was refined to include new findings, as more transcripts were analyzed. Later, the themes were reviewed to ensure that they fit the data obtained through the interviews.

3.2.2 Data Validation

For the validation of the analysis, the following steps were followed:
• Respondents’ references and credentials were checked in advance. Publicly held companies were relatively easier to screen, as much of the information was readily available online. Most private companies followed similar practices, and respondents' information could be accessed and checked via organizational websites.

• The researcher reviewed each company's website, and organizational reports where applicable, before the interview. This approach corroborated information provided to the researcher during interviews and provided further evidence of the company's approaches.

• To ensure a consistent interview process, the interview questions were simultaneously reviewed by multiple academic researchers and industry experts. Based on their suggestions, questionnaires were revised and finalized for interviews.

• Follow-up questions with participants were utilized to record their comments on the findings, when appropriate. Such questions helped the researcher to avoid digressing from the research topic during the semi-structured interviews and ensure confirmation and clarity (Bhattacherjee, 2012).

• The researcher re-examined the interview transcriptions obtained from zoom multiple times for precision and removed any discrepancies such as grammatical or spelling errors.
CHAPTER 4
RESULTS AND FINDINGS

This study aimed to explore supply chain transparency and traceability in the textile and apparel industry. Particularly, this study investigated: (1) how companies describe sustainability, transparency, and traceability (i.e., how they differentiate between transparency and traceability and their relationship with sustainability); (2) what motivates companies to adopt transparency and traceability; (3) how companies evaluate and communicate their transparency and traceability efforts; and (4) how important are the transparency and traceability efforts to companies’ supply chain or strategic decision. This chapter presents the results and findings obtained from the qualitative data analysis.

4.1 Sample Characteristic

The primary data source for the study was 11 in-depth one-on-one semi-structured interviews conducted by the researcher with the representatives or executives of eight US companies between February 2022 and April 2022. Various companies (e.g., large, medium, small, brands, retailers, and manufacturers) were sampled to ensure that a range of views and perspectives were captured on the problem and possible responses to it (Gehman et al., 2018). Almost all the participant companies had an annual turnover of more than or equal to the US $1.0 billion except for Company E, which had nearly US $0.012 billion turnovers annually. They were also representative of textile and apparel companies in the US. Among eight companies, six were apparel brands, one was a retailer, and one was a textile manufacturer. Sampled companies’ information and participants’ information are presented in Table 8. According to the US Small Business Administration (SBA), small companies are those that have fewer than 1,500 employees. Table 8 shows only three companies (e.g., Company E, Company G, and Company
H) had employees fewer than 1,500. Based on SBA’s definition, companies A, B, C, D, and F are large companies, and E, G, and H are small companies. All participants held top management positions in their respective companies’ sustainability and supply chain areas, including the Vice President (VP) of sustainability, Manager of Sourcing and Sustainability, and so on (see Table 8). Thus, those participants had in-depth knowledge of supply chain transparency and traceability issues.

Table 8. Sample Characteristics

<table>
<thead>
<tr>
<th>Company</th>
<th>Company Type</th>
<th>Approx. No. of employees</th>
<th>Approx. annual revenue (billions of US $)</th>
<th>Participants</th>
<th>Participants’ role in the company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>Brand</td>
<td>16,400</td>
<td>$5.68</td>
<td>Participant 1</td>
<td>Sr. Director of Sourcing Services</td>
</tr>
<tr>
<td>Company B</td>
<td>Brand</td>
<td>61,000</td>
<td>$7.35</td>
<td>Participant 2, Participant 3</td>
<td>VP and Chief Sustainability Officer, Director, Energy, and Sustainability</td>
</tr>
<tr>
<td>Company C</td>
<td>Brand</td>
<td>8,900</td>
<td>$3.13</td>
<td>Participant 4</td>
<td>Director of Social Responsibility</td>
</tr>
<tr>
<td>Company D</td>
<td>Brand</td>
<td>50,000</td>
<td>$9.24</td>
<td>Participant 5</td>
<td>Global Sustainability Manager</td>
</tr>
<tr>
<td>Company E</td>
<td>Brand</td>
<td>129</td>
<td>$0.012</td>
<td>Participant 6</td>
<td>Strategic Sourcing Manager</td>
</tr>
<tr>
<td>Company F</td>
<td>Textile Manufacturer</td>
<td>15,000</td>
<td>$2.0</td>
<td>Participant 7, Participant 8</td>
<td>VP, EHS, and Sustainability and Customer Compliance Manager</td>
</tr>
<tr>
<td>Company G</td>
<td>Brand</td>
<td>1,000</td>
<td>$1.0</td>
<td>Participant 9, Participant 10</td>
<td>Traceability Manager, Lead Material Developer</td>
</tr>
<tr>
<td>Company H</td>
<td>Retailer</td>
<td>595</td>
<td>$2.0</td>
<td>Participant 11</td>
<td>Manager, Sustainability</td>
</tr>
</tbody>
</table>

Note: EHS (Environment, Health, and Safety)

4.2 Addressing RQ#1

The first research question addresses how companies describe sustainability, transparency, and traceability. This question further identifies the distinction between transparency and traceability and their relationship with sustainability from the companies point of view as well as how companies’ definitions vary from those mentioned in the academic literature. To this end, the researcher first established common themes or activities on
sustainability, transparency, and traceability from the responses. The companies’ ideas on sustainability, transparency, and traceability are described in the following section:

4.2.1 How Companies Address Sustainability

The participant companies indicated rich knowledge of sustainability concepts, which was evident throughout their discussions of sustainability. Various themes regarding sustainability were also recognized from the responses, which included: (a) core/top corporate initiative, (b) important but not core corporate initiative, (c) dimension, (d) sustainable practices, and (e) definition. Most of the companies responded with one theme or more than one theme.

Figure 5 shows each theme with the respective number of responses.

Figure 5. Identified Sustainability Themes.

Note: The number in the parenthesis represents responses received for each theme.

In the following section, a description of each theme is presented with some selected quotes.

More representative quotes for each theme can be found in Appendix E (Table E1).
**Core/Top Corporate Initiative.** One of the significant themes was that the companies showed sustainability as their top priority. From Figure 5, it can be seen that among 11 participants of eight companies, three responded that sustainability was one of their core corporate initiatives. All responses to this theme are illustrated in Appendix E (Table E1). Here, only one response was given that provided evidence for this theme. For example, Participant 1 stated:

> “Sustainability has become a core competency, I would even say, within our company, and we use sustainability through the lens of performance. We believe that sustainability is not in competition with material performance; rather, we can actually get benefits from sustainability. The whole company has put sustainability as a top priority corporate initiative, and it’s built-in everything we do, from our products through our people and the planet” (Company A Participant 1).

These companies conveyed a sense that they were sustainable companies and that sustainability was their core activity or top priority.

**Important but Not Core Corporate Initiative.** While some companies considered sustainability their core corporate initiative, it was not the case for one company (see Figure 5). This company thought sustainability was essential to the company but not the top corporate initiative. The participant of this company stated that the importance of sustainability has eventually grown to them as it enhanced throughout the industry, and their real drive was from the company values. For example, here was a statement from Company H (Participant 1) that provided support for this theme:

> “For our organization, sustainability has really come out of our company values. We are family owned and operated, [...] it has been really important to us to be a good corporate citizen. As the world has changed and the industry has evolved, that has grown to include sustainability. I think it has grown in importance as it has grown importance across the industry. Hence, we're obviously paying attention to that, but the kind of the real drive is from our family values to do the right thing for our community and the world at large” (Company H, Participant 1).
Dimension of sustainability. Another theme identified regarding sustainability was dimensions. Seven of the 11 participants (see Figure 5) stated various aspects of sustainability (i.e., dimension). Various sub-themes under this central theme are listed in Figure 6.

Figure 6. Identified Sub-themes of the Dimension of Sustainability.

Note: The number in the parentheses represents the responses for each sub-theme.

Social, product, and environment: Elkington’s (1994) triple-bottom-line (TBL) concept (i.e., economic, environmental, and social) has three dimensions or aspects of sustainability. It was found that most of the participant companies used Elkington’s dimensions. However, a few companies used product dimension instead of economic aspect. Figure 6 shows two responses that supported this sub-theme. Here, only one quote is provided; for more quotes for this sub-theme, see Appendix E (Table E1):

“We define sustainability, we kind of have a few different banners for it, but we use the three P, but a little bit tweaked so instead of people planet profit, we use people planet product because really we recognize that our product there's so much in how we make and distribute the product” (Company H Participant 11).
Only Environmental aspects: Apart from social, environmental, and product aspects, it was found that some companies only highlighted the environmental elements of Elkington’s dimension when operationalizing sustainability. Four responses were obtained that endorsed this sub-theme (see Figure 6). Environmental factors were crucial to these companies, and sustainability meant reducing the environmental impacts by using alternative energy sources or dropping water usage, reselling, influencing consumers for reduced consumption, and adopting circularity. The extract from Company G (Participant 10) provided the evidence for it:

“We used to say we were in the business to build the best product and cause the least amount of unnecessary harm, and that’s still important, but we look at it from several ways; one is our own footprint as a company, so the headquarters and our shops our distribution centers trying to make those places be the least impactful in a number of ways, so energy usage water usage, etc.” (Company G Participant 10).

More examples regarding circularity, reselling, and influencing consumers for less consumption (i.e., environmental aspects) can be found in Appendix E (Table E1).

Only product aspects. It was also found that some companies operationalized sustainability by using responsible materials to produce their products and have stated clear targets of sustainability for 2025 or 2030. This indicates that these companies only focused on the product aspect of sustainability when operationalizing it. Nine responses were obtained regarding this topic (see Figure 6). For example, participant 2 stated that they were sustainable because they used responsible materials in their products (see Appendix E, Table E1 for more support).

“We source 100% organic cotton. Almost all of our synthetics are recycled. By 2025 our goal is for 100% of our materials to be either recycled or renewable. By renewable, we mean organic cotton or hemp or responsible wool or responsible down, so we're finding the best material possible the least impactful, and it's now extending towards trims and packaging” (Company B Participant 2).

Environmental and social aspects: This company utilized both social and environmental factors of Elkington’s dimension when operationalizing sustainability. Figure 7 shows, only one
response was obtained for this sub-theme. For instance, participant 7 (Company F) reflected both social and environmental aspects as follows:

“The metrics we are looking for are in regularly evaluating our water usage, greenhouse gas emission, and waste reduction targets. And then also there is a social side of it. Which is making sure that our manufacturing environments are a safe place to work and that we are meeting all of the local and global international labor in our organization guidelines for good social practices” (Company F Participant 7).

**Sustainable Practices.** Almost all companies involved sustainable practices and 16 responses were obtained (see Figure 5). It was witnessed that companies used social, environmental, and product as the dimensions of sustainability. Therefore, specific sustainable practices regarding environmental, social, and product dimensions were extracted from the responses of the participant companies. The identified sustainable practices around these three areas are depicted in Table 9. It was found that sustainable practices regarding environmental and product/materials dimensions were more diversified than social ones. Sustainable practices about social issues were limited to labor practices with minimum explanation. The following quotes demonstrated some selected examples of sustainable practices exercised by participant companies: “restricted substance list (RSL)” (Participant 7), “sustainable fibers certifications of Organic Content Standard (OCS)” (Participant 10), “circularity” (Participant 1), and more examples can be found in Appendix E (Table E1).

**Definition.** How companies define sustainability was another identified theme. In Figure 5, it can be seen that two responses were obtained for this theme. The widely accepted definition of sustainability in the literature is “meets the need of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, p. 41). However, it was found that some companies’ sustainability definitions differed from the WCED definition.
Participant 1 (Company A) discussed what was meant by sustainability to their company by stating that:

Table 9. Specific Sustainable Practices Identified from the Responses

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Issues</th>
<th>Sustainable Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td>Chemicals/water pollution</td>
<td>Chemical management zero discharge hazardous chemicals (ZDHC), manufacturing restricted substance list (MRSSL), restricted substance list for finished products (RSL), anti-microbial, out of active biocides (e.g., zinc, coppers, etc.)</td>
</tr>
<tr>
<td></td>
<td>Water consumption</td>
<td>Reduce water usage</td>
</tr>
<tr>
<td></td>
<td>Carbon emissions</td>
<td>Greenhouse gas reduction</td>
</tr>
<tr>
<td></td>
<td>Waste</td>
<td>Circularity, reuse, recycle, resale, repair</td>
</tr>
<tr>
<td>Social</td>
<td>Labor</td>
<td>Responsible sourcing, fair labor practices, living wages, labor compliance auditing, diversity, and inclusion</td>
</tr>
<tr>
<td></td>
<td>Animal</td>
<td>Animal welfare</td>
</tr>
<tr>
<td>Products/materials</td>
<td>Plant-based materials</td>
<td>Organic cotton, Organic Content Std. (OCS) certified cotton, Recycled Claim Std. (RCS) or Global Recycled Std. (GRS) certified cotton, BCI cotton, organic hemp</td>
</tr>
<tr>
<td></td>
<td>Animal-based materials</td>
<td>Responsible wool/responsible wool std. (RWS) certified wool, RCS or GRS certified wool, responsible down</td>
</tr>
<tr>
<td></td>
<td>Synthetic based materials</td>
<td>Recycled polyester or RCS/GRS certified polyester</td>
</tr>
</tbody>
</table>

“For us, sustainability means measuring our environmental impact and then setting targets around climate and other things to kind of” (Company A Participant 1).

While some companies’ definitions were paired with the WCED’s (1987) widely accepted description, for example, participant 8 stated that their various stakeholders and organization defined sustainability as follows:

“Stakeholders that are our investors and then our employees and manufacturing groups and our definition of sustainability is meeting the needs of the present without sacrificing the needs of the future” (Company G Participant 8).

The overall themes and sub-themes related to sustainability from companies' points of view have been illustrated in Figure 7.
From the analysis, it can be surmised that the term sustainability has been used in various ways in the industry and academic worlds. For example, it can be seen that some companies claimed they were sustainable because they promote slow fashions. In comparison, other companies claimed themselves sustainable as they used organic cotton or responsible materials such as responsible down, wool, recycled polyester, etc.

4.2.2 Transparency and Traceability Addressed by Companies

The terms “transparency” and “traceability” are evolving topics in the textile and apparel industry. There are many schools of view on defining these two terms in the academic world. Therefore, it is crucial to comprehend how textile and apparel companies represent and utilize these two terms. By analyzing the responses, the researcher identified several themes related to
“transparency” and “traceability.” The identified themes included: (a) distinction in definition, (b) the importance of transparency and traceability, (c) transparency depends on companies’ decisions, and (d) the relation between sustainability, transparency, and traceability. Figure 8 shows all of them.

![Identified Themes Regarding Transparency and Traceability](image)

Figure 8. Identified Themes about Transparency and Traceability.

**Distinction in Definition.** Of the 11 participants, five considered transparency and traceability two distinct topics (see Figure 8). They identified traceability as “the ability to know back into the supply chain or the ability to back up against any claims they made.” On the other hand, transparency was regarded as “what chose to disclose about those traceability efforts.” This distinction was reflected in many participants’ statements. For example, the following quote endorsed this theme; for more, see Appendix E (Table E1):

“I think those are almost completely different concepts. Traceability is your ability to identify back into your supply chain, and transparency is what you choose to disclose about those traceability efforts. I think that those are two almost completely distinct
concepts. Often, work together, but they're very distinct, they would be almost very different concepts” (Company B Participant 2).

It can be concluded that according to this group of companies, the functions of transparency and traceability are entirely different. They emphasized that transparency and traceability are two distinct things. Transparency meant publicly disclosing where their products were made, while traceability was their ability to trace the products’ progress through their supply chain around any claims they made about sustainable products.

**The Importance of Transparency and Traceability.** Five of the participants stated this theme (see Figure 8). Two sub-themes were identified. The sub-themes included: (a) putting equal importance on transparency and traceability and (b) emphasizing more on traceability. These sub-themes are shown in Figure 9.

![Sub-themes of the importance of transparency and traceability](image)

**Figure 9.** Identified Sub-themes of the Importance of Transparency and Traceability.

Note: The number in the parentheses represents responses for each sub-theme.

*Equal importance for transparency and traceability:* Within the context of sustainability in companies’ supply chains, the importance of transparency and traceability differed among
them. Figure 9 shows one company considered both transparency and traceability as the critical part of its overall sustainability mission. Meaning that it provided equal importance for transparency and traceability. For example, the following quote demonstrated evidence regarding the equal importance of transparency and traceability:

“For us, transparency means publicly disclosing where our products are made, and we do that already. [...] So, we firmly believe that transparency is critical part of this overall sustainability and corporate responsibility mission. I would say traceability is critical if you are making a product, especially for making product claims. So, you are saying something is organic, or something is recycled, or it is responsible like responsible down responsible wool. You have got to be transparent, your supply chain as well, you have to be good at to be able to trace your supply chain or the backup that claim” (Company C Participant 4).

Emphasized more on traceability: As opposed to equal importance, it was also found that some companies emphasized "traceability" more than “transparency.” Four responses were obtained for this sub-theme (see Figure 9). For example, some participants described that traceability was mandatory to them, but transparency depended on the decision of the board or many other factors. More quotes about this theme are shown in Appendix E (Table E1). Here only one quote was provided.

“To our company, traceability is more like capability. So, one is how capable you are in tracing your supply chain and is knowing your supply chain to me that it’s traceability and in terms of company C and we are doing a fantastic job in tier 1. We are doing quite a good job in tier 2, [...] When you are done with this traceability thing, here comes the transparency. which is more like your disclosure because you might be able to trace your entire supply chain, but then your board might decide that while we are not going to disclose it as of now” (Company D Participant 5).

Transparency Depends on Companies’ Decisions. Two responses were obtained for this major theme (see Figure 8), which are provided below:

“Transparency is more like your disclosure because you might be able to trace your entire supply chain, but then your board might decide that while we are not going to disclose it as of now” (Company C, Participant 4).
“Because of whatever reason, competitive. […] found something in your supply chain which is not very promising, and you don’t want to disclose it. […] a lot of your peers are not disclosing […] the demographic you are serving does not have the appetite for transparency. […]” (Company D Participant 5).

The Relations Between Sustainability, Transparency, and Traceability. Figure 9 shows five companies discussing the relationships between sustainability, transparency, and traceability. Two sub-themes were identified: relation (a) between transparency and traceability and (c) between sustainability, transparency, and traceability. Figure 10 presents each sub-theme with the number of responses.

<table>
<thead>
<tr>
<th>Sub-themes of the relations between sustainability, transparency, and traceability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relation between sustainability, transparency and traceability (3)</td>
</tr>
<tr>
<td>Relation between transparency and traceability (2)</td>
</tr>
</tbody>
</table>

Figure 10. Sub-themes of the Relationship Between Sustainability, Transparency, and Traceability.

Note: The number in the parentheses represents responses for each sub-theme.

Relation between transparency and traceability: It was already seen that transparency and traceability are two distinct concepts. Therefore, the researcher first tried to find the relationship between transparency and traceability. The researcher identified traceability works that companies needed to do first. Then transparency, which means transparency depends on
traceability. Without traceability, transparency is meaningless. Figure 10 shows two responses that were obtained for this sub-theme. Company D stated that tracing the information or supply chain information (i.e., traceability) comes first, followed by transparency when discussing both transparency and traceability. More evidence can be found in Appendix E (Table E1).

“If you don’t mind, I think probably you can start by traceability and go to transparency because, to be honest to me in mind and in the traceability comes first. And then it goes to transparency” (Company D Participant 5).

Relation between sustainability, transparency, and traceability: Then the researcher identified how transparency and traceability related to sustainability. According to the participants, sustainability is a big theme, and transparency and traceability are part of sustainability. Traceability and transparency were essential to verify and validate the claims companies made about sustainability. Three responses supported this sub-theme (see Figure 10). The following statements supported it, and more evidence can be found in Appendix E (Table E1):

“I think sustainability we're publishing a sustainability report tell you is focused on the activities of people product and planet. In some instances, we see traceability as a part of sustainability to ensure that we're truly traceable from start to finish with our products and processes. And then transparency to us is showing. All that good or bad, and that is the whole point of us publishing our sustainability report this year, and it looks some of that's not going to be great, some of its going to be outstanding, but to be transparent to you have to show everything and show there is that we're going to get better, so that's our plan this year.” (Company A Participant 1).

It can be concluded that the prerequisite for transparency is traceability; similarly, if the companies have collected the data there is no reason to hide that. Therefore, it is safe to say that transparency depends on traceability. Without traceability, the company cannot be transparent. Eventually one can state that transparency and traceability are the prerequisites to sustainability. The relationships between sustainability, transparency and traceability are shown in Figure 11.
The researcher has drawn the following conclusions from the aforementioned analysis of research question 1. In other words, the summary of research question 1 is given in Table 10.
Table 10. Summary of Research Question 1 Findings

<table>
<thead>
<tr>
<th>Topics</th>
<th>Key findings</th>
<th>Illustrative quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainability</td>
<td>- While some companies adopted sustainability as their core corporate initiative, a few companies did not consider it a top corporate initiative.</td>
<td>“The whole company has put sustainability as a top priority corporate initiative, and it’s built-in to what we do, from our products through our people and the planet” (Company A, Participant 1). “[…]. Hence, we’re obviously paying attention to that, but the kind of the real drive is from our family values to do the right thing for our community and the world at large” (Company H, Participant 11).</td>
</tr>
<tr>
<td></td>
<td>- A few companies used the product aspect instead of the economic aspect along with the social and environmental dimension.</td>
<td>“We define sustainability, we kind of have a few different banners for it, but we use the three P, but a little bit tweaked so instead of people planet profit, we use people planet product because we really recognize that our product there’s so much in how we make and distribute the product” (Company H Participant 11).</td>
</tr>
<tr>
<td></td>
<td>- The company also focused on only environmental or product or both social and environmental aspects.</td>
<td>“[…]. one is our own footprint as a company, so the headquarters and our shops our distribution centers trying to make those places be the least impactful in a number of ways, so energy usage water usage, etc.” (Company G Participant 10).</td>
</tr>
<tr>
<td></td>
<td>- Sustainable practices regarding environmental and product/materials dimensions were more diversified than social ones.</td>
<td>“We source 100% organic cotton. Almost all of our synthetics are recycled. […]” (Company B Participant 2).</td>
</tr>
<tr>
<td></td>
<td>- The definition of sustainability varies.</td>
<td>“The metrics we are looking for are in regularly evaluating our water usage, greenhouse gas emission, and waste reduction targets. And then also there is a social side of it. […]” (Company F Participant 7).</td>
</tr>
<tr>
<td>Transparency and traceability</td>
<td>- Companies identified transparency and traceability as two separate topics.</td>
<td>“For us, sustainability means measuring our environmental impact and then setting targets around climate and other things to kind of” (Company A Participant 1).</td>
</tr>
<tr>
<td></td>
<td>- Most companies emphasized more on traceability than transparency although some companies put equal importance on transparency and traceability.</td>
<td>“I think those are almost completely different concepts. Traceability is your ability to identify back into your supply chain, and transparency is what you choose to disclose about those traceability efforts. I think that those are two almost completely distinct concepts. Often, work together, but they’re very distinct, they would be almost very different concepts” (Company B Participant 2).</td>
</tr>
<tr>
<td></td>
<td>- Transparency depends on companies’ decisions.</td>
<td>“To our company, traceability is more like capability. So, one is how capable you are in tracing your supply chain and is knowing your supply chain to me that it’s traceability […] When you are done with this traceability thing, here comes the transparency, which is more like your disclosure because you might be able to trace your entire supply chain, but then your board might decide that while we are not going to disclose it as of now” (Company D Participant 5).</td>
</tr>
<tr>
<td></td>
<td>- Transparency depends on traceability and both are prerequisites of sustainability.</td>
<td>“Because of whatever reason, competitive. […] found something in your supply chain which is not very promising, and you don’t want to disclose it. […] a lot of your peers are not disclosing […] the demographic you are serving does not have the appetite for transparency. […] And also, many times, it has to come with your annual sustainability report, […] and others to deliver that information in a digestible format. Because if I disclose all our supply chain […], our consumers will not even understand what it means. […] Well, once you know your traceability, how much transparency do you want to be” (Company D Participant 5).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“I think sustainability we’re publishing a sustainability report tell you is focused on the activities of people product and planet. In some instances, we see traceability as a part of sustainability to ensure that we’re truly traceable from start to finish with our products and processes. And then transparency to us is showing. All that good or bad, and that is the whole point of us publishing our sustainability report this year, and it looks some of that’s not going to be great, some of its going to be outstanding, but to be transparent to you have to show everything and show there is that we’re going to get better, so that’s our plan this year.” (Company A Participant 1).</td>
</tr>
</tbody>
</table>
4.3 Addressing RQ#2

Research question 2 investigates companies’ motivation to adopt “transparency” and “traceability.” In order to answer this question, participants were asked various open-ended questions pertinent to incentives for adoption “transparency” and “traceability.” In the following section, first, why companies adopt transparency will be discussed, followed by the reasons for traceability will be highlighted.

4.3.1 Reasons for Adoption Transparency

The data analysis revealed that most companies were motivated to adopt transparency either by external or internal forces. Many companies acknowledged numerous external and internal pressures to embrace transparency. For example, participant 4 (Company C) stated that:

“I think there are a lot of reasons why we do it, some are internal, and some are external” (Company C Participant 4).

A similar response was obtained from Company D (participant 5):

“I think there is not one single reason why it happened because one of the things, I mean let’s put it two ways internal and external forces” (Company D Participant 5).

The external and internal forces mentioned by companies that influenced them to adopt transparency are discussed below:

4.3.1.1 External Forces for the Adoption of Transparency

The findings revealed that many companies were motivated to adopt transparency because of external pressures (see Figure 12). The following section discusses how these external forces influenced companies to adopt transparency with selected quotes. More extracts are listed in Appendix E (Table E2).
Figure 12. External Forces for the Adoption of Transparency.

**Consumers.** Figure 12 shows that nine of the 11 participants mentioned that consumers have been placing increasing pressure to disclose the supply chain. The following sub-themes were noticed regarding consumers’ pressure for the adoption of transparency: (a) direct pressure from end consumers, (b) indirect pressure from end consumers, and (c) educating consumers. All of these sub-themes are listed in Figure 14 with the number of responses for each.

*Direct pressure from end consumers:* Figure 13 shows five responses obtained for this sub-theme. Nowadays, consumers are more concerned about the whole history of the products that they buy. Evidence can be found from the following participant's responses. Here only one response was given; more quotes can be found in Appendix E (Table E2):

“I think we feel like, one of the things consumers want to know about where the product is made” (Company C Participant 4).
Figure 13. Sub-theme of Consumers’ Motivation for the Adoption of Transparency.

Note: The number in the parentheses represents responses for each sub-theme.

*Indirect pressure from end consumers:* One response was obtained for this sub-theme (see Figure 13). The manufacturer had faced indirect pressure from the end consumers because their business type was B2B, not B2C. In other words, their main customers are brands and retailers. For example, Company F (Participant 7) stated that they face pressures mainly from the customers, that is, from big brands:

“I think primarily the influence has been through our customers. One of our bigger customers, Levi’s, got a lot of pressure from Greenpeace to address the detox issues with Zero Discharge Hazardous Chemicals (ZDHC), so we are kind of feeling that from them. Being in the middle of the supply chain, more of our pressure comes from customers and government and NGOs, I guess is what I am saying” (Company F Participant 7).

*Educate consumers:* Another crucial finding was that companies adopted transparency or disclosed their supply chain or traceability efforts to consumers not only for consumers’ demand but also for companies’ intent to educate consumers about their sustainability initiatives. Three
responses were obtained for this topic (see Figure 13). One response was given here; for more evidence, see Appendix E (Table E2):

“I think it was to provide this information to our customers that’s the main driver, and that is because some customers were requesting the information, but the other was to help educate customers in what supply chains look like, but also to be fully open. If you want to learn more about how your product was made, you can learn about the materials and provide you with that information, or you can look at who the finished goods factories are. And the mills as well and, you can dig in further there as well, so that’s it really was the impetus was, for that was for, first of all, the customers” (Company G Participant 10).

From the above discussion, it can be concluded that end consumers significantly impact companies’ adoption of transparency. This pressure propagates to the upstream partners of the supply chain, such as manufacturers, indirectly through the brands or retailers. It was also found that companies often adopted transparency to educate consumers.

**Various Associations’ Pressure.** Eight of 11 participants acknowledged that various associations greatly influenced them into adopting transparency (see Figure 12). It was noticed that various associations such as Fair Labor Association (FLA), Transparency Pledge, Open Apparel Registry, Greenpeace, and B Corp highly pressed companies to adopt transparency. By analyzing the data, the researcher identified some sub-themes related to associations' influences shown in Figure 14.

*Membership of associations/organizations:* The first sub-theme identified from the responses was “membership of associations/organizations.” Three responses were obtained for this sub-theme (see Figure 14). For example, company C (i.e., participant 4) stated that they were part of various associations or organizations, such as the Fair Labor Association, and those associations have requirements for participating members to disclose supply chain information publicly on the associations’ websites. Here, only one quote is provided; for more evidence, see Appendix E (Table E2).
Figure 14. Sub-themes of Various Associations’ Pressure for the Adoption of Transparency.

Note: The number in the parentheses represents responses for each sub-theme.

“We are part of the Fair Labor Association; they expect us to list our supply chain. There is the Transparency Pledge, an NGO pushing brands to be transparent. There are people at Open Apparel Registry who will also publicly list. So many groups are doing this kind of work, and we are supporting their work by disclosing our supply chain information” (Company D Participant 4).

Influence of NGOs: Figure 14 shows that two responses were obtained for this sub-theme. Companies conceded that NGOs have some degree of influence to embrace transparency, or their effect would be acute in the next two or four years. The evidence can be found in the following companies’ responses. For example, Company F (Participant 8) stated that:

“Greenpeace was an NGO, and they started the whole they worked with zero discharge of hazardous chemical (ZDHC) to create the manufacturers’ restricted substance list (MRSL). All of the tools that have come out of there, so I would say there was some NGO influence there” (Company F Participant 7).

More pieces of evidence are given in Appendix E (Table E2).

Afraid of being rated by associations: The third sub-theme identified was “afraid of being rated,” meaning that some associations such as Fashion Revolution, Fashion Transparency Index,
and many others ranked companies based on their public disclosure. Some apparel companies have considered this rating seriously and disclosed their supply chain information. This sub-theme was supported by three responses (see Figure 14). For example, Company G was afraid of rating from the Fashion Transparency Index and therefore disclosed its supply chain information to the highest possible extent.

“We also have regular requests from non-government organizations or civil society, asking us to explain our sustainability job. Very often, they will rate a company based on publicly available information, so it's an important engagement with NGOs and civil society” (Company G Participant 10).

From the above discussion, it is clear that various organizations significantly impact companies adopting transparency. They have taken various initiatives to hold companies accountable for their activities, eventually pushing them to embrace transparency.

**Government Rules and Regulations’ Pressure on the Adoption of Transparency.**

Figure 12 shows that six participants responded that regulatory force was another reason for the adoption of transparency. However, it was found that the regulatory forces did not have a strong influence similar to consumers and associations. Many regulatory forces are just emerging such as Withhold Release Order (WRO) by the custom broader protection (CBP), New York Fashion Bill, European Green Act, Washington Fashion Bill, etc. To further explain the impact of the regulations on transparency, the researcher identified some sub-themes, which are shown in Figure 15 and discussed below:
Figure 15. Sub-themes of Government Rules and Regulations Pressure the Adoption of Transparency.

Note: The number in the parentheses represents responses for each sub-theme.

**Withhold release order (WRO):** The first theme of how regulatory forces influenced companies to adopt transparency was withhold release order (WRO) on cotton grown with slave labor in Xinjiang. Companies' reactions were mixed regarding the impact of this WRO on adopting transparency. It has been found that some companies were conscious of this regulation but were not serious. Figure 15 shows two responses that were obtained for this sub-theme. The following statements provided evidence of how companies react to this WRO:

“In certain countries, especially in the last couple of years, it's become very important to do this for legislative reasons, because in the United States, the farm on cotton from Xinjiang is one that's very important” (Company G Participant 10).

**New emerging laws:** The second theme about regulations was “many new emerging laws” related to transparency. Two responses supported this sub-theme (see Figure 15). The responses showed that various new fashion transparency rules, such as New York Fashion Acts and European Green Acts, Washington Fashion Bill are emerging in the US and European
Union. Companies’ reactions were to these new laws, they are observing what is going on, and others highlighted that adopting transparency might be mandatory by the regulatory forces in the future. More quotes about this theme are provided in Appendix E (Table E2).

“As far as government requirement, I think we are just starting to see how that is affecting us. We adopted ecotex testing several years ago, which can also help with proposition 65 requirements, so I guess you could say that is an influence. But ultimately, like the bills that are coming out now, the European Green Acts and New York fashion bill, I think those are the new bills emerging. (Company F Participant 7).

Different laws across the world: Two responses supported this sub-theme (see Figure 15). Laws vary from region to region, country to country, and have been gaining momentum. For example, the following extract from Company C supported the notion that transparency rules are not the same across the world; still, they have some impact on companies. More quotes are given in Appendix E (Table E2).

“We are a global company. We saw it with the world, and regulations around that vary from country to country, so I would say the change in an organization of change in our industry takes place in a couple of different ways one is regulatory. But I think it is a complex landscape that is good because it is not as if we have one regulation globally, one outside the US, one for Canada. From a regulatory perspective around disclosing chemicals, you talk about your emissions; how did you get that number and how you validated the creation, so regulation is gaining momentum globally” (Company C Participant 4).

From the above discussion, it is clear that many external forces such as consumers, NGOs and associations, and regulatory forces push companies toward adopting transparency. However, consumers and NGOs are the main external forces. Although various regulatory forces exist worldwide, their impact is not as severe as that of consumers and NGOs.
4.3.1.2 Internal Forces for Adoption Transparency

As mentioned earlier, companies were motivated to adopt transparency due to internal and external pressures. However, in this case, the analysis uncovered that those internal forces have less impact than external forces. Self-motivation and creating a competitive edge were the internal forces (Figure 16), and how these internal forces influenced companies have been discussed below:

**Self-motivation.** Only three participants mentioned that they were self-motivated to adopt transparency (see Figure 16). However, they were highly motivated to disclose their sustainability and responsible activities to consumers and other stakeholders, and thus became pioneers in practicing transparency. Here, only one supportive quote is provided. More quotes are provided in Appendix E (Table E2).

![Internal forces for adoption transparency](image)

**Figure 16. Internal Forces for the Adoption of Transparency.**

“Years ago, we created something pretty pioneering at a time. It was called with footprint protocols, so basically, what we did was provide this of our suppliers’ finished goods and also our mills and as far back as we possibly could, including some farms where cotton was being grown, and we posted this on our website. We would also link that to the product. So we would on a product landing page on our website, you can dig deep into it, and it would reveal to you finished good factory and fabric mill, and so that was at the
time were pioneering is now adopted by many other companies” (Company G Participant 10).

**Creating Competitive Edge.** Only two participants mentioned transparency as the marketing strategy (see Figure 16). One company stated that they used the practice of transparency to create a competitive advantage in the marketplace:

“The reason for transparency is probably one added thing: oftentimes, we can utilize transparency to create our competitive edge in the marketplace. We can go to the market on it, […] we can go to consumers, our stakeholder, NGO, and watchdog saying look, we are much better than the rest of our peers, in terms of traceability and here is our disclosure, here we are opening it to the public. Not everyone is doing that public disclosure. We see it as a competitive advantage for us” (Company D Participant 5).

The above analysis shows that external pressures such as consumers, associations, and regulations primarily motivate companies to adopt transparency. However, some companies are self-motivated and adopt transparency before external stakeholders demand it. Although the numbers of self-motivated companies are few, they are the leaders in this area.

**4.3.2 Reasons for Traceability Adoption**

Similar to transparency, it was found that companies adopted traceability both for internal and external reasons. In the following section, the first external reason for the adoption of traceability will be discussed; then, internal reasons will be highlighted.

**4.3.2.1 External Forces for the Adoption of Traceability**

Figure 17 shows the external forces that influenced companies to adopt traceability. In the following section, a detailed description of how these external forces influenced companies to adopt traceability is given:
Consumers’ and Stakeholders’ Pressure. Only two responses were obtained in support of these forces (see Figure 17). It was found that consumers and stakeholders significantly influenced companies to adopt transparency. Contrary to this finding, the data analysis revealed that consumers and stakeholders had a certain impact on the adoption of traceability but not as much as they impacted the adoption of transparency. From the following statements, it can be seen that consumers have some influence on companies to adopt traceability but were not the main drivers:

“I think there is general consumer sentiment that they want more information about where their products are made” (Company C Participant 4).

More evidence is given in Appendix E (Table E2).

Regulations. The researcher has identified some sub-themes to better understand how regulatory forces influenced companies to adopt traceability, as shown in Figure 18. While it was found that regulations have less impact on companies’ adopting transparency, for traceability they were a vital factor. Six of 11 participants acknowledged that regulation was one of the primary drivers for implementing traceability (see Figure 17).
Figure 18. Sub-themes of Regulations’ Pressure on Companies for the Adoption of Traceability.

Note: The number in the parentheses represents the responses for each sub-theme.

Withhold release order: The first theme was the Withhold Release Order (WRO) by the US Customs and Border Protection (CBP). WRO accelerated the adoption of traceability. Four responses were obtained for this sub-theme (see Figure 18). Particularly, it was clear from Company H's (Participant 11) statement; for more evidence, see Appendix E (Table E2):

“Traceability is, I think, a combination of the regulatory environment. But that is coming from a very grave human rights issue of what's happening in Xingjian. I think the regulatory pressures because of this human rights issue kind of like ramped it up and made the efforts kind of moved more quickly than maybe they would have if we were just if we just had kind of the environmental peace and kind of the like doing good for the sake of doing good […], but I think it just like ramped the speed with which people were working on it really increased after WRO” (Company H Participant 11).

Although many companies emphasized that WRO significantly impacted adopting traceability, some companies hold different viewpoints. The latter acknowledged that WRO had no impact on their companies because they were advanced in adopting traceability and excluding this conflict about cotton from their supply chain before this law emerged. The following extract supported this viewpoint (for more, see Appendix E: Table E2):
“I know, definitely for other brands, it certainly did because that's something where the government is pushing the industry where they need to know where their cotton is coming from. I’d say that's much more influential than previous laws or things the government may have done for us. We were already pulling out of risk cotton, a region that had been shown to be at risk for quite some time before the government intervened. So, it didn't have a huge influence on us, because as social awareness came of what was going on, we pulled out and ensured that we were not getting cotton from that region, ahead of the government” (Company G Participant 9).

Other laws (e.g., modern slavery acts): The second theme identified regarding regulations was that various modern slavery acts were introduced such as the UK Modern Slavery Act, and California Transparency Act. Two responses were obtained for this issue (see Figure 18). The following quote provided evidence for it:

“There is the UK modern slavery act. There is a German supply chain due diligence act there is an Australian modern slavery act to do right drafting and working. They are kind of holding, then the California transparency. Hence, in the US, it also depends on the state on the federal vs. the state government to put that mandate on the company to say you have to disclose your supply chain at a certain level. You have to explain if there is a modern slavery practice in their supply chain. Now how do we know if there is modern slavery? How do they know my supply chain is not connected to the Uyghur community in China if I'm not able even to trace my supply chain? So, of course, the regulatory has a big impact, […]” (Company D Participant 5).

From the above discussion, a conclusion can be drawn that companies have their internal traceability systems before emerging the regulations. However, it cannot be denied that regulations, particularly the recent laws such as CBP withhold release, accelerated traceability adoption.

Various Standards’ Requirements. Figure 18 shows one response supported by this sub-theme. Companies that are members of certain standards, such as the Organic Content Standard (OCS), need to adopt traceability. It was clear from the following company’s statement:

“And then there's another driver at as well, which depends on the claim we have if we're claiming that some item is certified to a certain standard and those standards have requirements as well. We are certified to the responsible down standard. And we've been certified in the past, responsible wool standards they have specific requirements around
traceability and documentation that need to be collected, and that's where a claim” (Company G Participant 10).

4.3.2.2 Internal Forces for the Adoption of Traceability

Figure 19 lists the name of the internal forces that influenced companies to implement traceability and how they influenced have been discussed in the following section:

![Internal forces for the adoption of traceability](image)

Figure 19. Internal Forces for the Adoption of Traceability.

**Verification or Authentication of the Claims/Products.** Verification or authentication of various claims that brands made about their products, processes, materials, and many others was one of the vital reasons for traceability adoption by textile and apparel companies. Figure 20 shows that six participants acknowledged that. The claims were related to sustainability, such as organic cotton, recycled polyester, etc. Various themes emerged about this reason for traceability adoption, such as (a) sustainability claims and (b) product claims/paying a premium for the right products.

*Sustainability claims:* The first and foremost theme of this issue was “provide evidence against sustainability claims,” which means that nowadays, almost all companies claimed
themselves as sustainable. In other words, they claimed that they are doing business responsibly or that their products are sustainable. Whether the companies were genuinely sustainable or adopted a greenwashing approach was very difficult to evaluate. Most of the companies admitted that it was crucial to know everything about the supply chain and provided solid or documented evidence against any claims to distinguish their companies from greenwashing.

Three responses supported this issue. The following statements from the companies provided support for this theme (for more evidence, see Appendix E, Table E2):

“We have with a sustainability program we have always said we are doing things the right way trust us. But transparency and traceability are becoming more important because now the whole feeling of the industry is everyone says that they are doing business the right way, but also need to prove that. So you need to show verified data that you are doing what you say. So that is the demand and wanting to have something ourselves to show look we are walking the walk; we are not just telling you that we are doing things correctly. We want to be able to show that to you” (Company G Participant 7).

**Paying a premium for the right products:** The next theme was “paying the premium for the right products,” meaning that many companies stated that they purchased organic materials (e.g., organic cotton, responsible wool, down), and recycled materials such as recycled polyester. For purchasing these products, companies needed to pay extra costs. The companies stated they adopted traceability to verify that they are paying the premium for the right products. Three responses provided evidence for it. For example, Company G noted that one of the reasons for implementing traceability was to make sure that we are paying for the right products:

“I think to make sure that what we're paying for is happening, but then, also for the consumers if a consumer questions like, how do you know this is happening. We want to be able to have evidence to back it up and not be guilty of false claims and make sure that even just to ensure that the customer is getting what they're paying for and also what we're paying for is actually the truth and happening” (Company G Participant 9).

**Identifying Supply Chain Risks.** Companies stated that they were internally motivated to adopt traceability because it helped to identify supply chain risks and mitigated them early.
Simply put, companies adopted traceability to identify supply chain risks. Two responses were obtained for this theme (see Figure 19). The following extract from Company C and D provided evidence for this reason:

“Internal forces are as a company, we want to raise I mean we want to increase our bottom line, and we want to get a better return to our shareholders. And to do that, we have to make sure that we are managing all the risk that is exposed to our business and supply chain, and we are mitigating those risks actively. [...] And so clearly, traceability is one of those things, so we need to know where our supply chains alone get to and what kind of problems those areas face. [...] we have more than 700 tier 1 factories and thousands tier 2 factories. To know where they are working, how they are working and what kind of risk they are exposed to and then how do we mitigate those, so that’s one of the key internal reasons why we do traceability” (Company D Participant 5).

It can be concluded from the above findings that the company adopts traceability for various internal reasons such as to validate the claims they made, provide documented evidence against the claims, and identify supply chain risks.

The overall findings’ summary of research question 2 is demonstrated in Table 11:
### Table 11. Summary of Research Question 2 Findings

<table>
<thead>
<tr>
<th>Topics</th>
<th>Key findings</th>
<th>Illustrative quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reasons for adopting transparency</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>External forces</strong></td>
<td>- Consumers impact the majority of companies to adopt transparency in various ways such as directly forcing brands and retailers, but indirectly manufacturers. Also, companies adopted transparency to educate consumers.</td>
<td>“I think we feel like, one of the things consumers want to know about where the product is made” (Company C Participant 4). “[…] that and is because some customers were requesting the information, but the other was to help educate customers in what supply chains look like, but also to be fully open. [...]” (Company G Participant 10).</td>
</tr>
<tr>
<td></td>
<td>- Various associations (e.g., Fair Labor Association) motivated companies to adopt transparency through membership requirements and rating companies.</td>
<td>“We are part of the Fair Labor Association; they expect us to list our supply chain. There is the Transparency Pledge, an NGO pushing brands to be transparent. There are people at Open Apparel Registry who will also publicly list. So many groups are doing this kind of work, and we are supporting their work by disclosing our supply chain information” (Company D Participant 4).</td>
</tr>
<tr>
<td></td>
<td>- Compared to consumers and associations, regulatory forces had minimum impact on companies to adopt transparency.</td>
<td>“As far as government requirement, I think we are just starting to see how that is affecting us. We adopted ecotex testing several years ago, which can also help with proposition 65 requirements, so I guess you could say that is an influence. But ultimately, like the bills that are coming out now, the European Green Acts and New York fashion bill, I think those are the new bills emerging.” (Company F Participant 7).</td>
</tr>
<tr>
<td></td>
<td>Only a few companies were motivated to adopt transparency internally to be leaders or to create a competitive edge in the marketplace.</td>
<td>“The reason for transparency is probably one added thing: oftentimes, we can utilize transparency to create our competitive edge in the marketplace. We can go to the market on it, […] we can go to consumers, our stakeholder, NGO, and watchdog saying look, we are much better than the rest of our peers, in terms of traceability and here is our disclosure. Here we are opening it to the public. Not everyone is doing that public disclosure. We see it as a competitive advantage for us” (Company D Participant 5).</td>
</tr>
<tr>
<td><strong>Internal forces</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall external pressures such as consumers, associations, and regulations primarily motivated companies to adopt transparency. However, a few companies are self-motivated and adopt transparency before external stakeholders demand it. Although the numbers of self-motivated companies are few, they are leaders in this area.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Reasons for adopting traceability | **External reasons** | For traceability consumers had minimum influences compared to transparency. Regulations such as withhold release order (WRO), and modern slavery acts (e.g., UK modern slavery acts) accelerated the adoption of traceability. Some companies were well advanced in adopting traceability and even they excluded conflict cotton before the WRO advent. Various standards necessitated companies to adopt traceability like NGOs and associations. |
| | **Internal reasons** | Companies adopted traceability to authenticate the sustainability product claims they made. Companies also adopted traceability to identify their supply chain risks. |

| | **Illustrative quotes** | “I think there is general consumer sentiment that they want more information about where their products are made” (Company C Participant 4). “Traceability is, I think, a combination of the regulatory environment. But that is coming from a very grave human rights issue of what's happening in Xingjian. […], but I think it just like ramped the speed with which people were working on it really increased after WRO” (Company H Participant 11). “And then there's another driver at as well, which depends on the claim we have if we're claiming that some item is certified to a certain standard and those standards have requirements as well. We are certified to the responsible down standard. And we've been certified in the past, responsible wool standards they have specific requirements around traceability and documentation that need to be collected, and that's where a claim” (Company G Participant 10). “I think to make sure that what we're paying for is happening, but then, also for the consumers if a consumer questions like, how do you know this is happening. We want to be able to have evidence to back it up and not be guilty of false claims and make sure that even just to ensure that the customer is getting what they're paying for and also what we're paying for is actually the truth and happening” (Company G Participant 9). “And so clearly, traceability is one of those things, so we need to know where our supply chains alone get to and what kind of problems those areas face. [… ] we have more than 700 tier 1 factories and thousands of tier 2 factories. To know where they are working, how they are working and what kind of risk they are exposed to and then how do we mitigate those, so that's one of the key internal reasons why we do traceability” (Company D Participant 5). |

Except for the regulatory forces (e.g., WRO, Modern slavery acts) all external forces had minimum impact on adoption traceability. Overall internal forces have higher impacts than external forces.
4.4 Addressing RQ#3

Research question 3 consists of two parts. The first part deals with companies’ transparency and traceability evaluation systems, mainly whether the companies utilize existing tools or develop their methods to evaluate their transparency and traceability efforts. The second part addresses companies’ transparency and traceability communication systems with consumers and other stakeholders. To achieve these goals, the participants were asked various open-ended questions regarding technologies, analytics, key performance indicators (KPIs), etc., used for evaluating transparency and traceability. Various noteworthy insights were obtained from the respondents related to evaluation and communication systems of transparency and traceability. The following section will first discuss the technology and analytics used for transparency and traceability by the companies. Then how companies evaluate their transparency and traceability will be highlighted. Finally, how companies communicate their transparency and traceability efforts will be provided.

4.4.1 Tool/Technology and Analytic Used to Evaluate/communicate Transparency Efforts

The data analysis revealed that companies did not use any advanced technology for transparency or disclosing information. Companies used soft, simple, inexpensive tools or technologies such as interactive maps, websites, and QR codes to communicate or evaluate transparency efforts. As demonstrated by these quotes: “We have an interactive map on our website, [...] I think, since 2013 publicly available on our website” (Participant 4), “And then that’s the information that would go on to our website for providing transparency, so it doesn’t require sophisticated technology in that sense it's fairly analog in a way” (Participant 10), and “I’ll get back to AI that we are thinking of using the QR code and communicating that information” (Participant 5). More supportive quotes are provided in Appendix E (Table E3).
Table 12 shows the technologies used or piloted by companies for their transparency efforts.

Table 12. Technology Used to Evaluate/Communicate Transparency Efforts

<table>
<thead>
<tr>
<th>Company</th>
<th>Interactive maps</th>
<th>Websites</th>
<th>QR codes (piloting)</th>
<th>CSR report/excel sheet</th>
<th>Higg material sustainability index (MSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company B</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company C</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company D</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Company E</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Company F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Company G</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

In conclusion, it was found that companies mostly used soft tools or pilot AI-based technologies such as QR codes for disclosing supply chain information.

4.4.2 Technology and Analytic Used to Evaluate Traceability

The data analysis identified the following themes regarding technology for traceability which are shown in Figure 20.

![Major themes for traceability technology](image)

Figure 20. Themes about the Technology Used for Traceability.

Note: The number in the parentheses represents responses for each theme.
4.4.2.1 Technology for Tracing Products

Figure 20 shows that 11 responses were obtained about the technologies for tracing the fibers. Companies adopted various advanced traceability technologies and were involved in various standards as listed in Table 13. The grey shaded rows of Table 13 represent standards. It was also noticed that although there were numerous technologies or digital traceability systems out there, companies did not actively use them for various reasons discussed below. Three sub-themes were identified shown in Figure 21.

![Sub-themes of technology for tracing products](image)

Figure 21. Sub-themes of Technology for Tracing Products.
Note: The number in the parentheses represents the responses for each sub-theme.

**Oritain:** It can be seen from Table 13 that Oritain was the only technology for tracing the products (i.e., fibers). Two responses were obtained for this sub-theme (see Figure 21). The data analysis discovered that only two companies (Company G and F) started to use Oritain, and other companies are still exploring its application (see Table 13 and Figure 21). Company G (Participant 10) stated that they started using Oritain to verify the provenance of the cotton:
“We conduct other verification of our material and including using novel technology such as Oritain which can test the origin of the farming of that cotton” (Company G Participant 10).

The quote of Company F is presented in Appendix E (Table E3).

Table 13. Traceability Technology Used Status for Products/Fibers/Materials Level by Companies

<table>
<thead>
<tr>
<th>Technologies/Standards</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oritain</td>
<td>e</td>
<td>e</td>
<td>e</td>
<td>e</td>
<td>e</td>
<td>✓</td>
<td>✓</td>
<td>e</td>
</tr>
<tr>
<td>Textile Exchange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>US Cotton Trust Protocol</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global Organic Textile Standard (GOTS)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Organic Content Standard (OCS)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recycled Claim Standard + Global Recycled Standard (RCS+GRS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsible Wool Standard (RWS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Note: “e” represents exploring/not utilizing; “✓” presents utilizing.

*Other technologies:* It was found that the rest of the technologies, such as TextileGenesis, TexTrace, FiberTrace, and Blockchain (not shown in Table 13), were different from Oritain. All of these technologies work as traceability or chain of custody (CoC) platforms. Companies adopted none of the technologies. Five responses were obtained for this sub-theme (see Figure 21). The participant companies’ opinion was that they are exploring the technology that would best fit their companies’ traceability goals. Company B (Participant 3) and Company C (Participant 4) stated that they are exploring all these technologies. Here only one quote was given and the rest of the quotes are given in Appendix E (Table E3).

“I would say, and we are not alone, that the ability to systematically trace and record those tracing efforts is in its relative infancy. And we are actively and aggressively looking at how we can enhance our systems to be able to better manage these issues traceability. But it’s very complex, and it, especially when you go down to a product level, gets very complex very quickly and so. The systematic way of managing this, I do believe is its relative infancy. […] I would say we’re aware of some of those technologies out there, so in my opinion, I think blockchain of some sort will have to be part of that technology scheme” (Company B Participant 3).
Fiber certifications standards: It was also found that many companies were involved or using various fibers certification standards (see the grey shaded rows of Table 13). Those standards work as traceability platforms or chains of custody of certifications. Four responses supported this sub-theme (see Figure 21). This can be evident from the extract of Company G; for more see Appendix E (Table E3):

“For Organic Cotton, for example, we require all of our suppliers, which requires all the supply chain from the farm through to finished product to be certified either to the Organic Content Standards (OCS) or to the global organic textile standards (GOTS). Either of those two would work for us, and we also require tracing transaction certificates for every purchase that we make” (Company G Participant 10).

It was also found that companies are using the chain of custody certification platforms for cotton or natural fibers and certification platforms for synthetic fibers. Those certification platforms have built-in traceability systems for recycled polyester or other synthetic fibers. This was highlighted in the response of Company G (Participant 10):

“We also try to obtain traceability for recycled material it's not to the same degree, because there aren't the same drivers, as there are for cotton. But it's an important material for us in terms of our portfolio it represents quite a lot, because a lot of our products are technical, alpine mountain climbing and skiing snowboarding, etc. So, we do need to back up our content claims and we do that through third-party certification mostly and those systems have traceability built in them” (Company G, Participant 10).

4.4.2.2 Technology for Tracing Environmental Aspects

Unlike other companies, it was found that manufacturers used some technologies for tracing environmental aspects, such as zero discharge hazardous chemicals (ZDHC) and Higg environmental modulus. In this regard, Company F provided evidence:

“I would have to point back to the tools we’re using through ZDHC like creating the in-check reports for effort against the manufacturing restricted substance list (MRSL) and then Higg modules for environmental. […] Then the software we use to generate in check reports is called clean chain, and the clean chain has dashboards for us where we can see how many products out of our company are confirm it with the MRSL which facilities
are generating and check reports where they stand in terms of their progress towards 100% conformance. We use all of that data on monthly basis and then Higg modules our annual, so the facilities enter their information once a year and then have it verified by a third party” (Participant 8).

4.4.2.3 Standard for Tracing Social Aspects

Similarly, for the environmental aspects, the manufacturers used International Labor Organization (ILO) standards.

“For traceability, we are also in the last couple of years began requiring our suppliers to sign a vendor code of conduct which is also aligned with the ILO standards to make sure that we are sourcing from responsible companies” (Company F Participant 7).

4.4.2.4 Technology for Tracing Overall Supply Chain (SC)

Companies’ responses were varied regarding the technology used for overall supply chain traceability. Again, it was found that there was not any comprehensive technology for overall supply chain traceability. It was noticed that some are still looking for low-tech technology. The following extracts provided evidence:

“But in terms of technologies and analytics and effort, I would say that there is a lot of AI-based solution, a lot of blockchain-based solution that is emerging in the apparel industry, and we are trying all of them. But at the same time, we're also trying to see some of the low-tech solutions that we can work with until the big technology breakthrough is scalable and ready for the industry. So, in how we are trying, some low-tech simple processes to trace and track and work with it, but also to match the industry speed, we are trying some blockchain and AI-based solutions to see if they can really bring the solution as the promise” (Company D Participant 5).

If the company’s supply chain is small, it is not required to utilize sophisticated technology. It was reflected in the following quote:

“Our supply chain is fairly small enough that we don't really need to rely very much on online platforms to map our supply chain. Particularly for tier 1 and tier 2 we've already gotten that which is the information that we tend to provide anyway. We don't really
mean to be using any kind of sophisticated platform for that we do. […] We also tend to use our invoicing system for collecting documents” (Company G Participant 10).

4.4.3 Evaluation of Transparency and Traceability

The following section discusses how companies evaluate their transparency and traceability efforts. It was found that companies evaluate transparency and traceability separately. Therefore, the first evaluation of transparency and then traceability will be discussed in the following section:

4.4.3.1 Key Performance Indicators (KPIs) Used for the Evaluation of Transparency

The participants were asked what key performance indicators (KPIs) were used to evaluate transparency or how they evaluated their transparency efforts. Meaning that what was a measurable value that indicated progress towards transparency outcome. Two major themes were spotted: (a) relied on external evaluation systems and (b) KPIs that were used. Table 14 shows which companies used the external systems and which used key performance indicators (KPIs).

Relied on External Evaluation Systems. The first theme was companies relied on external or third-party evaluation systems such as Fashion Transparency Index or other NGOs’ ranking and Higg modules (see Table 14). For example, Company G stated they did not have their own metrics or key performance indicators for evaluation transparency. However, NGOs' ranking was an important metric to them:

“I would imagine that it is sometimes it's about NGO ranking. How are we scored according to different NGOs who use publicly available information? They base everything off publicly available information that's an important metric for us internally. Other than that, I don’t know if there are other ways that we measure this or not.”

(Company G Participant 10).
Table 14. Evaluation of Transparency Efforts

<table>
<thead>
<tr>
<th>Company</th>
<th>External Evaluation Systems (NGO’s ranking: FTI)</th>
<th>Key performance indicators (KPIs) used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company G</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Company H</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Key Performance Indicators (KPIs).* It was found that most companies did not use specific KPIs or methods to evaluate transparency efforts (see Table 14). Company A supported it; more evidence is shown in Appendix E (Table E3):

“So, evaluate the success of our transparency efforts here, I would say we're still developing that. We haven't completely defined success. […] So, I would say we're still developing that” (Company A, Participant 1).

It can be surmised from the above findings that there is still a lack of comprehensive evaluation systems or listing of key performance indicators to evaluate companies’ transparency efforts. Still, companies depend on NGOs’ ranking such as FTI.

**4.4.3.2 Evaluation of Traceability or Key Performance Indicators (KPIs) Used to Evaluate Traceability Efforts**

Specific KPIs for evaluation traceability were extracted from all participants' responses and are shown in Table 15. The extracted key performance indicators enabled the researcher and the industry to understand companies’ evaluation systems of their traceability efforts comprehensively.

It was found that no participating companies have their traceability evaluation systems or key performance indicators (KPIs) for evaluating their traceability efforts. No participant
companies also used external methods like the FTI to assess their traceability efforts. The KPIs that are shown in Table 15 are based on the companies’ suggestions meaning that they mentioned that they did not evaluate their traceability efforts, instead, they suggested some potential KPIs that can be used to evaluate the traceability efforts. For example, Company F stated that they did not evaluate their traceability efforts and even did not have any specific KPIs for it, but they mentioned some potential KPIs; more supporting quotes can be found in Appendix E (Table E3).

Table 15. Key Performance Indicators (KPIs) for Evaluation of Traceability

<table>
<thead>
<tr>
<th>Company</th>
<th>Key Performance Indicators for Traceability Evaluation Mentioned by the Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>√</td>
</tr>
<tr>
<td>Company B</td>
<td>√</td>
</tr>
<tr>
<td>Company C</td>
<td>√</td>
</tr>
<tr>
<td>Company D</td>
<td>√</td>
</tr>
<tr>
<td>Company E</td>
<td>√</td>
</tr>
<tr>
<td>Company F</td>
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<tr>
<td>Company G</td>
<td>√</td>
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<tr>
<td>Company H</td>
<td>√</td>
</tr>
</tbody>
</table>

Note: Manufacturing restricted substance list (MRSL).

“We do not have any KPIs specifically for traceability. The KPIs that we are tracking there are our emissions total emissions, so we are trying to align those with our science-based targets goals. For greenhouse gas reductions, we are committed to a 25% water use reduction by 2025 with the 2016 baseline, so we are tracking reductions there as well and then with recycling, just the KPI is improving the like waste reduction. So, […] the KPIs would be the ZDHC improvements […] And then for with Higg modules just achieving a better score, each year is the KPI […]” (Company F Participant 8).

It can be concluded that although companies did not evaluate their traceability efforts, their suggested key performance indicators such as fully understanding the supply chain,
tracking total emission, etc. (see Table 18) would help create a comprehensive traceability evaluation method.

4.4.4 Communication of Transparency and Traceability Efforts

Firstly, companies used their websites to share their traceability efforts. Evidence for this theme can be observed in many participants’ responses, e.g., the extract from Company C provided proof of it; more quotes are given in Appendix E (Table E3).

“Maybe I have talked a little bit about our external facing transparency map and all that a lot of information we put in our corporate stones build the report we do an annual report every year. We also have a website which deals with details a lot of this information” (Company C, Participant 4).

Secondly, companies sought digital disclosing methods such as QR codes instead of using traditional hangtags or labels. Digital disclosing methods enabled companies to disclose multiple pieces of information in a digestible format, and consumers can also see that information by simply scanning the respective code. The extract from Company A provided evidence for it:

“We're disclosing kind of all of the required information, maybe a little extra that means country of origin, size, content, we're displaying that in 27 languages, I believe on our tags right now. That's what the consumer could easily and readily accessible. What we want to see is what else can we unlock for that consumer, especially through a digital unlock? So what else can we unlock instead of a printed hangtag or a printed label sewn in, given the fact we do it digitally? (Company A Participant 1).

However, different scenarios were observed among manufacturers. For example, manufacturing companies did not directly post product information on their websites; rather, they provided that information to their customers, such as retailers or brands. The following statements provided evidence for it:
“Because we are a tier 2 manufacturer, we do not really have our products listed online because we are business to business, we are not business to the consumer we don’t have any digital e-commerce or anything like that. […] What end consumers could obtain from us through the initiatives we are undertaking? We are working with the Higg materials sustainability index to create impact scores for our fabrics on requests from our customers, brands and retailers. Then, they could build that data into their final product to give consumers the like emissions created from that product, the water used.” (Company F, Participant 8).

It can be concluded from the above findings that comprehensive evaluation methods for transparency and traceability were not developed yet. But, some significant KPIs were identified, particularly for traceability evaluation. It was also found that there was still a lack of comprehensive communication systems for transparency and traceability efforts. The overall summary of research question 3 is presented in Table 16.
Table 16. Summary of Research Question 3 Findings

<table>
<thead>
<tr>
<th>Topic</th>
<th>Key findings</th>
<th>Selected quotes</th>
</tr>
</thead>
</table>
4.5 Addressing RQ# 4

Research question 4 addresses the importance of transparency and traceability efforts to companies' strategic decisions. Participants were asked various open-ended questions to achieve this research goal. The findings revealed some crucial insights regarding companies' strategic priority for transparency and traceability efforts.

4.5.1 Importance of Transparency and Traceability Efforts to Companies’ Supply Chain or Strategic Decisions

Companies demonstrated various levels of importance towards transparency and traceability efforts in their supply chain strategies. The following themes were identified from the analysis of responses: (a) priority for transparency and (b) priority for traceability.

4.5.1.1 Priority for Transparency:

Two sub-themes were identified for this major theme, which included: (a) the importance of transparency efforts and (b) the importance of transparency in supplier selection.

*Importance for Transparency Efforts.* Most of the companies provided top priority for their transparency efforts in their supply chain strategy. Here only some quotes were provided that supported this theme (more quotes are provided in Appendix E, Table E4). One participant stated that transparency was their top strategic priority, so they were early adopters.

“It is an important part. I mean, I don't know how to quantify that for you. But I know that it's been something we've done for a long time, and I think we were an early adopter of providing that information to customers” (Company G Participant 10).

Company B (Participant 2) also stated the importance the transparency efforts top in their supply chain strategy, and they developed a sustainability website to disclose the information:
“There's a clear recognition that we've got to be more transparent every day on what we're doing in this space. We've got a commitment to being far more transparent than we were 10 years or 20 years ago. And therefore, we developed XXX (pseudonym of the website) sustainability website to begin with to significantly enhance our overall transparency across a range of sustainability issues” (Company B Participant 2).

However, only one company did not consider transparency as its top strategy. For example, Company C stated that transparency was not an overall key strategy. The following quote provided support for it:

“...It fits in with our manufacturing and corporate responsibility strategies. I don’t know if it would be if you look at Company C’s overall strategy; I don’t think it’s probably one of the key strategies. But I think when you talk about manufacturing and talk about corporate responsibility, it’s definitely key strategies” (Company C, Participant 4).

Although most companies considered transparency their top strategic priority, some did not. Thus, it can be concluded that the strategic priority for transparency among companies was diverse.

Importance of Transparency in Supplier Selection. Participants were asked whether transparency affects the choice of products that they decided to source or the suppliers they worked with. Most of the companies acknowledged that transparency had some impact on supplier selection. This quote was an example of this (more quotes are provided in Appendix E, Table E4):

“If they are not being transparent with us and show documentation, we will not work with them, so it's required that very high levels of transparency” (Company G Participant 10).

From the above discussion, it was clear that transparency impacted some companies on supplier selection that they worked with.
4.5.1.2 Priority for Traceability

Three sub-themes were identified under this major theme, which included: (a) importance of traceability efforts, (b) importance of traceability in product sourcing, and (c) plans (short or long term) for traceability efforts.

Importance for Traceability Efforts. While it was found that companies showed mixed results against strategic priority for transparency, they displayed high levels of importance for traceability. Most of the companies stated that they considered traceability as their top strategy. Only a few quotes were provided here (more can be found in Appendix E, Table E4). For example, the following quote exemplified the priority level for traceability:

“We only have a handful of top initiatives each year and traceability is one of them. So, it's a strategic initiative within the company, not within one department. It's even built into our goal, like some of our goals, this year have sustainability. We have sustainability and traceability-specific goals if that makes sense. It's literally part of our company operating this year now its strategic initiative is built around it” (Company A Participant 1).

Another quote supported this theme:

“For certified fibers, the product that we are providing full traceability on through the chain of custody certification is a top priority. Because we cannot put a certified label on our products if it does not start with certified raw materials. And then, of course, that’s true for the cotton as well, like it’s really a high importance that we are not sourcing from restricted risk origins. I would also say it's a very high priority for the traceability or transparency efforts as far as product safety goes. […]” (Company F Participant 7).

In conclusion, it was proved that companies provided top importance to their traceability efforts in their supply chain strategy.

Importance of Traceability in Product Sourcing. Participants were asked whether traceability affects the choice of products that they decided to source or the suppliers they worked with. Most of the companies acknowledged that traceability had some impact. It was found that traceability impacted companies’ product sourcing that they decided to source for.
The following quotes provided the evidence for it (more quotes can be found in Appendix E, Table E4):

“As we continue to implement traceability standards further and further back in our supply chain over time, it will be part of the requirements of doing business with us. So again, I would say, as a general rule, when we implement a requirement, our expectation is that requirement is satisfied, and if it's not, we won't do business with you” (Company B Participant 3).

However, it was found that consideration of traceability did not impact the products they sourced or the supplier they worked with—their driving factor was cost or other issues. Traceability had an influence only when the customers demanded it. The following statement provided evidence for it:

“I think where we are now is still highly driven by cost. But it’s all really based on what our customers, the brands, and retailers are looking for and like their initiatives on it. Because if they say we need a higher volume of recycle content standard (RCS) certified polyester fabrics we are going to go out and look for as much of that RCS certified fabric is as they want. But it’s sort of like a push poll as far as the demand for it goes ultimately cost is still our highest driver. But the traceability pieces of it’s like if it does not have to be certified recycled, then we probably would not look for specifically certified recycled product” (Company F Participant 7).

Traceability impacted the product sourcing of the majority of companies that they decided to source for. But to a few companies, traceability did not matter in product sourcing.

Plans (short or long term) for traceability. It was found that most of the companies adopted short-term and long-term plans for traceability efforts. The following quotes supported it; more examples are given in Appendix E (Table E4):

“I think finding a robust system provider would be a strategy in the short term. But I think secondarily would be to find a traceability provider. First of all, product of visibility into the country is probably a key because no one wants to get withhold from the US government, so that’s probably a first priority. And I would see a second priority would probably be a system that’s more on external traceability it is I think the important but probably short term” (Company C Participant 4).
Another quote:

“So, I would say most of our strategies would be classified as a near term within the next two to five years because the goals that we have for sustainable fibers are 2025. We are looking to meet those” (Company F Participant 7).

The overall findings of RQ#4 have been summarized in Table 17.
## Table 17. Summary of Research Question 4 Findings

<table>
<thead>
<tr>
<th>Topic</th>
<th>Key findings</th>
<th>Selected quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic priority for transparency</td>
<td>• Most companies considered transparency their top strategic priority, but some did not.</td>
<td>“There’s a clear recognition that we’ve got to be more transparent every day on what we’re doing in this space. We've got a commitment to being far more transparent than we were 10 years or 20 years ago. And this is why we developed XXX (pseudonym of the website) sustainability website to begin with, with is to significantly enhance our overall transparency across a range of sustainability issues” (Company B Participant 2).</td>
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<tr>
<td></td>
<td>• Most of the companies included transparency as an important part of supplier selection.</td>
<td>“It fits in with our manufacturing and corporate responsibility strategies. I don’t know if it would be if you look at Company C’s overall strategy; I don’t think it’s probably one of the key strategies. But I think when you talk about manufacturing and talk about corporate responsibility, it’s definitely key strategies. […] It’s certainly there, but I would not say it’s one of the top overall strategies.” (Company C, Participant 4).</td>
</tr>
<tr>
<td></td>
<td>• If they are not being transparent with us and show documentation, we will not work with them, so it's required that very high levels of transparency” (Company G Participant 10).</td>
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<tr>
<td>A strategic priority for traceability</td>
<td>• Most Companies provided top importance for traceability efforts in their supply chain strategy</td>
<td>“For traceability for certified fibers, the product that we are providing full traceability on through the chain of custody certification is a top priority. Because we cannot put a certified label on our products if it does not start with certified raw materials. And then, of course, that’s true for the cotton as well, like it’s really high importance that we are not sourcing from restricted risk origins. I would also say it’s a very high priority for the traceability or transparency efforts as far as product safety goes. […]” (Company F Participant 7).</td>
</tr>
<tr>
<td></td>
<td>• They also considered traceability as an important deciding factor for product sourcing.</td>
<td>“It's a very big deciding factor because we pretty much only use nominated inputs, so if they're not able to provide the traceability for it, then we won't do business with them. If we're going to work with the supplier and also for specific materials that we may be sourcing, it's demanded whatever the claim is of the material that the traceability paperwork be right, or else we nor buy it” (Company G Participant 9).</td>
</tr>
<tr>
<td></td>
<td>• However, a few companies did not consider traceability as an important factor for product sourcing.</td>
<td>“I think where we are now is still highly driven by cost. But it’s all really based on what our customers, the brands, and retailers are looking for and like their initiatives on it. Because if they say we need a higher volume of recycling content standard (RCS) certified polyester fabrics we are going to go out and look for as much of that RCS-certified fabric is as they want. But it’s sort of like a push poll as far as the demand for it goes ultimately cost is still our highest driver. But the traceability pieces of it’s like if it does not have to be certified recycled, then we probably would not look for specifically certified recycled product” (Company F Participant 7).</td>
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</tbody>
</table>
|                                      | • Almost all companies adopted some short-term and long-term plans for their traceability efforts. | “The short-term plan would be to continue to work with our vendors on tracing or complying with all the certifications (Company F Participant 7)  
“So I would say most of our strategies would be classified as a near term within the next two to five years because the goals that we have for sustainable fibers are 2025 (Company G Participant 9).” |
CHAPTER 5
DISCUSSIONS AND CONCLUSIONS

The purpose of this study was to explore supply chain transparency and traceability in the textile and apparel industry. Specifically, this study was conducted to achieve four objectives. The first objective was to investigate how companies differentiate between transparency and traceability and their relationship with sustainability. Secondly, this study investigated the motivation of companies to adopt the concepts of transparency and traceability. Thirdly, the author aimed to examine the evaluation strategies and communication of companies’ transparency and traceability efforts. The last objective was to investigate the importance of transparency and traceability efforts to companies’ supply chain or strategic decisions. The overall findings of this study are summarized in Table 18 and Figure 22. In this chapter, first, discussions about each research question's findings are presented, and based on the discussions, propositions have been made, then implications and contributions are discussed, and finally, limitations and future research recommendations are highlighted.

5.1 Discussion

5.1.1 Discussions of Research Question 1

The findings of this study provide answers to the intended research question 1. Some companies (e.g., Company A, C, D, and F) consider sustainability as their core corporate initiative. This finding is consistent with previous studies (Li & Leonas, 2022) and suggests that companies now put more importance on sustainability than 10 or 20 years ago. Because nowadays, sustainability issues have been attracting increased attention from various stakeholders such as consumers, governments, NGOs, trade unions, and so on (Li & Leonas, 2022). Therefore, more and more companies have started publishing annual sustainability reports
or have developed websites dedicated to sustainability which means that companies have adopted sustainability as their core corporate project.

Table 18. Summary of Findings for Research Questions 1-4

<table>
<thead>
<tr>
<th>RQs</th>
<th>Key findings</th>
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<tbody>
<tr>
<td><strong>RQ#1</strong></td>
<td><strong>Sustainability</strong></td>
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<td></td>
<td>• While some companies adopted sustainability as their core corporate initiative, a few companies did not consider it a top corporate initiative.</td>
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<td></td>
<td>• Most companies used Elkington’s three dimensions of sustainability, the only exception is that few companies did not use the term economic, instead, they used the more practical term product to represent economic aspects.</td>
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<td></td>
<td>• Sustainable practices regarding environmental and product/materials dimensions were more diversified than social ones.</td>
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<tr>
<td><strong>Transparency and traceability</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Companies identified transparency and traceability as two separate topics.</td>
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<tr>
<td></td>
<td>• Most companies emphasized more on traceability than transparency although some companies put equal importance on transparency and traceability.</td>
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<tr>
<td></td>
<td>• Transparency depends on companies’ decisions.</td>
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<td></td>
<td>• Transparency depends on traceability, and both are prerequisites of sustainability.</td>
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<tr>
<td><strong>RQ#2</strong></td>
<td><strong>External reasons for adoption transparency</strong></td>
</tr>
<tr>
<td></td>
<td>• Consumers impact companies to adopt transparency in various ways such as directly forcing brands and retailers, but indirectly manufacturers. Also, companies adopted transparency to educate consumers.</td>
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<td></td>
<td>• Various associations (e.g., Fair Labor Association) motivated companies to adopt transparency through membership requirements and rating companies.</td>
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<tr>
<td></td>
<td>• Compared to consumers and associations, regulatory forces had minimum impact on companies to adopt transparency.</td>
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<tr>
<td><strong>Internal reasons for adoption transparency</strong></td>
<td></td>
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<tr>
<td></td>
<td>• Companies were motivated to adopt transparency internally to be leaders or to create a competitive edge in the marketplace.</td>
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<tr>
<td></td>
<td>• However, a few companies were motivated</td>
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<tr>
<td><strong>RQ#3</strong></td>
<td><strong>Tool/Technology for transparency and traceability</strong></td>
</tr>
<tr>
<td><strong>Transparency</strong></td>
<td></td>
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<td></td>
<td>• Companies used soft and inexpensive tools such as websites, interactive maps, and QR codes for transparency.</td>
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<tr>
<td><strong>Traceability</strong></td>
<td></td>
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<tr>
<td></td>
<td>• The technology used for traceability is divided into four groups: technology for (a) tracing products, (b) tracing environmental aspects, (c) tracing social aspects, and (d) tracing the overall supply chain.</td>
</tr>
<tr>
<td></td>
<td>• For tracing fibers, companies used Oritain only.</td>
</tr>
<tr>
<td></td>
<td>• Other technologies for tracing fibers such as blockchain, and TextileGenesis companies still searching and providing reasons for not implementing them.</td>
</tr>
<tr>
<td></td>
<td>• Only manufacturers used technology for tracing social and environmental aspects.</td>
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<td></td>
<td>• For tracing the overall supply chain, companies are still searching for technologies.</td>
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<tr>
<td><strong>Evaluation and communication of transparency and traceability</strong></td>
<td></td>
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<tr>
<td><strong>Transparency</strong></td>
<td></td>
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<tr>
<td></td>
<td>• For transparency evaluation companies depends on external systems such Fashion Transparency Index.</td>
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<tr>
<td><strong>Traceability</strong></td>
<td></td>
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<tr>
<td></td>
<td>• For traceability, companies suggested various key performance indicators.</td>
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<td>• Companies disclose their information to consumers or stakeholders using websites or QR codes.</td>
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<tr>
<td><strong>RQ#4</strong></td>
<td><strong>Priority for transparency</strong></td>
</tr>
<tr>
<td></td>
<td>• Most companies considered transparency their top strategic priority, but some did not.</td>
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<tr>
<td></td>
<td>• Most of the companies included transparency as an important part of supplier selection.</td>
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<td><strong>Priority for traceability</strong></td>
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<td></td>
<td>• Most Companies provided top importance for traceability efforts in their supply chain strategy</td>
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<td></td>
<td>• They also considered traceability as an important deciding factor for product sourcing.</td>
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<tr>
<td></td>
<td>• However, a few companies did not consider traceability as an important factor for product sourcing.</td>
</tr>
<tr>
<td></td>
<td>• Almost all companies adopted short-term and long-term plans for their traceability efforts.</td>
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</table>
While many companies regard sustainability as their core corporate initiative, a few companies (e.g., Company H) did not. This finding contradicts the well-established notion that sustainability is one of the top priorities for all textile and apparel companies. However, by careful analysis, it can be seen that companies do not adopt sustainability as their top corporate project because of the company’s characteristics or target audiences/consumers. For example, families-owned or privately held companies that sell apparel or clothing to specific customers, such as schools and teams, local governments, and small businesses, consider sustainability important but not a core corporate initiative. Neither do they have obligatory pressure like a
publicly held company nor have pressure from end consumers to adopt sustainability as their core corporate strategy. Therefore, it is reasonable to deem that large companies such as those Fortune 500 or publicly held companies have adopted sustainability as their top corporate initiative. In contrast, small companies whose target customers are limited to a specific group (e.g., schools and teams) have not considered it their top corporate initiative.

It was also found that the majority of companies used Elkington’s three dimensions of sustainability. However, a few companies (e.g., Company A and H) used product aspects instead of economic aspects along with social and environmental factors. Although this finding is inconsistent with Elkington's (1994) three dimensions of sustainability, its meaning is essentially the same. Instead of using economic, some companies have used more practical terms and products. This finding, that is, substituting economic with product aspect is new to the literature as most of the previous studies related to sustainability (e.g., Garcia-Torres et al., 2019; Li & Leonas, 2022) have used Elkington’s three dimensions (e.g., social, economic, and environment) while describing full-spectrum of sustainability approach. Contrary to this popular notion, a few companies have substituted the economic aspect with the product aspect. It is probably because through products they can effectively achieve economic sustainability. Thus, in practice, some companies specifically prioritize the product aspect, rather than the general economic aspect.

It was also found that companies' sustainable practices were more diversified in the environmental and product aspects than social aspects (see Table 9). This finding is partially in line with previous studies (Li & Leonas, 2022). In the prior study, Li and Leonas (2022) aimed to identify the sustainable practices developed in the textile and apparel industry by a text mining-based magazine article analysis. They found that much more environmental topics were discussed in magazine articles than social and economic topics. Similarly, the current study's
finding uncovers that companies are practicing environmental and product sustainability issues more than social ones. The possible reasons for fewer social practices in the textile and apparel industry might be that suppliers need to practice social sustainability, not apparel companies. The lack of standards for social sustainability might be also explained by fewer social sustainability practices. On the other hand, there are many advanced technologies and standards, such as life cycle analysis (LCA), global organic textile standards (GOTS), etc., for measuring environmental and product aspects. Therefore, more sustainable practices and measures are required for social aspect of sustainability for this industry.

This study identified and conceptualized transparency and traceability as two separate topics. This is one of the main contributions of this study because most of the previous studies related to transparency and traceability were unable to distinguish between them. For example, Egels-Zandén et al. (2015) and Garcia-Torres et al. (2021), conceptualized traceability as a part or dimension of transparency. In practice, they are two separate topics. Traceability is the companies’ ability to trace the supply chain and provide proof against their claims. Transparency is the disclosure of information that depends on companies’ internal decisions and other factors (e.g., consumer demand, traceability). This indicates that traceability is mandatory, and transparency depends on various factors such as companies’ broad decisions.

Another significant finding of this study is increased clarity regarding the distinctions between sustainability, transparency, and traceability. If a company adopts transparency, it must adopt traceability first. However, if a company adopts traceability, it does not necessarily need to be transparent. That is, traceability is an important prerequisite for achieving transparency (see Figure 22). Both transparency and traceability are parts of sustainability. This insight contributes
to the literature as most previous studies do not distinguish clearly between these related
concepts. Based on the above discussion, the author proposed the following propositions:

P1a: Company size potentially impacts the adoption of initiatives that pursue sustainable
practices related to the environment and society.

P1b. Company initiatives which address social sustainability have not developed in a
comparable extent (frequency, breadth) compared to initiatives that address
environmental sustainability.

P1c: From a corporate responsibility perspective, transparency and traceability are
distinct concepts whereby traceability and other factors collectively comprise
transparency (e.g., companies’ broad decisions, stakeholders' demands, etc.) and both
traceability and transparency comprise essential parts of sustainability in supply chains.

5.1.2 Discussion of Research Question 2

It was found that most companies were motivated to adopt transparency and traceability
by external and internal forces. However, their level of influence was different both for
transparency and traceability. For most companies adopting transparency, external forces (e.g.,
consumers, various associations, and regulations) had a higher effect than internal forces (e.g.,
self-motivation). Among the external forces for adopting transparency, the consumer was one of
the vital factors and influenced companies in various ways. First, consumers directly forced
companies (e.g., Company A, B, C, and D) to adopt transparency. For example, consumers are
now more interested in knowing where their clothing is made, what material has been used, and
what was the sustainability condition in the manufacturing firms (Kraft et al., 2018; McKinsey &
Company, 2019). Furthermore, consumers directly ask for that information from brands and
retailers. Given the direct pressure from consumers, brands and retailers publicly disclose their
supply chain information on their websites or by using QR codes. While brands and retailers have direct pressure from consumers to be more transparent, end consumers indirectly influence manufacturers (Company F) to be transparent. In other words, end consumers’ pressures propagate through brands and retailers to manufacturers, that is, brands and retailers force their suppliers or manufacturers to be more transparent.

Second, some companies (e.g., Company G) disclosed suppliers’ lists and supply chain information to educate the consumers. The adoption of transparency to inform consumers is inconsistent with the literature. Despite this inconsistency, some companies’ pioneering efforts increased consumers' appetite for transparency and placed pressure on the other companies. In other words, consumers’ demand for transparency started to grow due to these pioneers’ efforts, and these demands further accelerated due to the many recent accidents (e.g., the Rana Plaza collapse and forced labor in Xinjiang) in the industry.

Although most companies acknowledged that consumers’ pressure is one of the main factors in their adoption of transparency, they did not mention that implementation of transparency increases product sales, which is in line with the previous studies. It is rare to find previous studies that investigated the adoption of transparency enhanced product sales. Except for a few prior studies (e.g., Kraft et al., 2018; McKinsey & Company, 2019) that claimed consumers might be willing to pay an extra premium for a company's products that offer more supply chain transparency. These prior studies, however, did not exhibit any concrete evidence for it. Similarly, the current study does not find any relation between adopting transparency and product sales. Instead, this study found consumers' connection to adoption transparency in various ways (e.g., direct end consumers’ pressure, indirect pressure, and educating consumers).

Various associations’ pressure is another vital external factor of adoption transparency.
In the last couple of years, many non-profit associations have developed, such as the Fair Labor Association (FLA), Transparency Pledge, Open Apparel Registry, Fashion Transparency Index, Greenpeace, and B Corp. Their objective was to force companies to increase accountability and transparency of their business activities and thus ensure the conduction of responsible business. It was found that many companies (e.g., Company B, D, G, and F) adopted transparency due to the direct pressures of these associations. Particularly, members of these associations need to disclose supplier lists on the associations’ websites. Furthermore, some associations (e.g., Fashion Transparency Index) rate the companies based on their publicly available information. Thus, companies adopt transparency to meet the requirements of the various associations. This finding is new in the literature and can be explained through the lens of the absence of formal regulations for transparency. Since there are few strict compulsory regulations for transparency in the textile and apparel industry, various associations (e.g., FLA, and other NGOs) are acquiring momentum and forcing companies to adopt transparency (Kumar et al., 2017).

Compared to consumers and various associations, among the external forces, regulations have a minimum impact on companies adopting transparency (see Table 18 and Figure 22). Their impact is still unknown, and participant companies continue to face their impact. The potential reasons might be that most of the regulatory forces for transparency (e.g., New York Fashion Bill, European Green Act, Washington Fashion Bill, etc.) are in the drafted stage. Thus, companies (e.g., Company B, C, D, G, and F) are observing their impact but the majority of companies suggested that the regulations might be acute in the future.

As seen earlier, only a few companies (e.g., Company A and D) were motivated to adopt transparency by internal forces (e.g., self-motivation, creating competitive advantage). In other words, internal forces had minimum impact on companies to adopt transparency. The potential
reason for less impact of self-motivation and/or creating competitive advantage (i.e., external forces) on the adoption of transparency might be that transparency is not very helpful for companies to identify internal processes (e.g., business risk identification). Transparency mostly meets the consumers' or external stakeholders’ demands. Therefore, most companies did not adopt transparency due to internal forces. Still, it was found that a small number of companies (e.g., Company A and D) adopted transparency by self-motivated or to create a competitive edge even before consumers and other stakeholders demanded it. Their intent might be to be the leaders or pioneers in this area. This finding is supported by previous studies. For instance, Doorey (2011) and Egels-Zandén et al. (2015) highlighted some companies' attempts to become the most transparent companies in the world and become forerunners for other companies.

Contrary to transparency, it was found that internal forces had more impact on companies to adopt traceability than external forces. The potential reasons might be the goals of transparency and traceability, which are essentially different. For instance, the purpose of transparency is to meet the external stakeholders' demands (e.g., to inform the external stakeholders about companies’ activities toward sustainability). In contrast, traceability mostly meets companies’ internal necessities and some external ones. Therefore, internal forces (e.g., identification of supply chain risks) have a more significant impact on traceability adoption than external forces (e.g., consumers). For example, most companies adopt traceability to authenticate the claims they made about the sustainability of the product as well as to identify and reduce supply chain risks. This finding is also new in the literature, and it can be concluded that companies adopt traceability due to its numerous benefits.

The opposite scenario was noticed for external forces (e.g., consumers, regulations, etc.) in the adoption of traceability. Specifically, consumer pressure had the lowest impact on
companies adopting traceability. Only a few companies (e.g., Company C and G) admitted that consumers and other stakeholders have some sort of demand for traceability. However, the majority of companies did not consider consumer pressure as a vital factor. The reason might be that many companies have some sort of traceability about their supply chain even before it reaches consumers’ expectations. Since companies already have a traceability system, they did not assume pressure when consumers started to demand it. Instead of experiencing pressure, companies must disclose traceable information to consumers in a digestible format.

Although most companies did not consider consumers’ pressure as one of the top reasons for adoption traceability, it was found that they considered regulations (e.g., WRO, Modern Slavery Acts) as the significant external factors. Further, while it was found that regulations have less impact on companies adopting transparency, they accelerated the adoption of traceability. As mentioned earlier, many companies already have traceability systems only to meet some of their internal business needs. But when regulations combine with this, it speeds up the adoption of traceability. Particularly, the recent laws such as withhold release order by CBP, UK modern slavery act, California transparency act, Australian modern slavery act, and so on are much more influential than previous laws the government may have done for the industry. The regulatory pressures made the traceability adoption move more quickly; otherwise, it would not be possible if companies only would do it to meet their internal needs. This finding is new in the literature as previous studies only provided claims and suggestions about the impact of regulations. For example, many prior studies (e.g., Agrawal & Pal, 2019; Papú-Carrone, 2020; Kumar, et al., 2017; Richero & Ferrigno, 2016) claimed that the absence of traceability rules and regulations is one of the vital reasons for the slow adoption of traceability in the industry. They suggested that
regulations can play a significant role in securing traceability in the TAI. The findings of the current study have proved these claims and suggestions.

Another finding shows that companies adopted traceability due to the requirements of various standards. For example, many companies are members of various standards, such as global organic textile standards (GOTS), requiring that their members adopt traceability. This finding is new in the literature, as rarely have previous studies discovered this finding. Based on the above discussion, the author proposed the following propositions:

P2a: Companies have adopted transparency mainly due to external pressures (e.g., consumers, NGOs, regulations), and due to some companies’ early adoption of transparency consumers’ appetite for transparency has also been enhanced.

P2b: Traceability is implemented to fulfill the internal requirements such as authentication of the claims and identifying supply chain risks, as well as to meet some external demands (e.g., regulatory demands).

5.1.3 Discussions of Research Question 3

In communicating their transparency efforts, it was found that most of the companies used soft, inexpensive tools and technologies such as websites, interactive maps, and QR codes. The use of soft tools such as interactive maps and websites can be explained from various perspectives. First, it can be explained that consumers are now more involved in online purchasing than in-store shopping (Goswami, 2014). Therefore, companies might view websites or interactive maps as more advantageous for disclosing supply chain information than advanced technologies. Second, the inherent characteristics of the textile and apparel industry are that companies look for tools and technologies which is economical and simple enough for all supply chain partners to understand and operate. Websites or interactive maps also fulfill the
requirements. Finally, small companies (Company G) or companies (e.g., Company C) that meet the minimum thresholds of transparency requirements, such as disclosing suppliers’ information, including names, locations, and workers, do not need sophisticated tools or technologies.

On the other hand, the big companies (e.g., Company A, D) that act more proactively and disclose additional information on key operational and sustainability-related issues (e.g., materials information, sustainability information) and can differentiate themselves from their competitors may look for QR codes. Also, a company (e.g., Company H) that sells products to specific consumers (e.g., school) and does not sell products online uses QR codes. Based on the above discussion, the following propositions have been proposed:

P3a: Small companies or companies that fulfill the minimum transparency requirements (i.e., only disclose suppliers’ names and locations) use soft and inexpensive tools such as websites or interactive maps.

P3b: Big companies that disclose additional information on key operational and sustainability-related information (e.g., product or material information, carbon emissions, etc.) or companies that do not sell products online use QR codes.

Contrary to transparency, companies are using advanced technology and various standards for their traceability efforts. It was found that companies used technologies for four different areas: tracing products, environmental aspects, social aspects, and overall supply chain information. In the first area of traceability (i.e., tracing the products), companies adopted advanced technology and various standards. Some companies such as big companies (Company F) and the company that has been created based on the sustainability philosophy (Company G) have already adopted Oritain. Each geographic location has different soil composition and other environmental factors that give the cotton an inherent and distinct fingerprint. Oritain calls this
the Origin Fingerprint and tests by applying forensic science and statistics. Tracing the origins of raw materials is a crucial factor for sustainability and verification of the originality of the products. Because in 2020, a grave human rights violation and forced labor practices were observed in China’s biggest cotton farming region, Xinjiang and the US have already implemented WRO to exclude that cotton. Furthermore, it was identified that twenty thousand metric tons of Indian cotton were falsely certified as global organic textile standard (GOTS)-approved organic cotton (Doyle, 2021). Considering the business risks, companies have started to invest in advanced technology for tracing products.

Numerous advanced technologies and chain of custody platform providers (e.g., Blockchain, FiberTrace, TextileGenesis) are also available for tracing the products. However, none of the participants' companies adopted them. Most companies are still considering which would be their best partner. There are many factors for not adopting these technologies. In other words, many challenges are associated with the implementation of these technologies. For example, companies are looking for a comprehensive technology that can be easily applied to all fibers as well as to farm levels. However, none of these technologies have yet been sufficiently advanced to meet these requirements. For instance, one technology provides companies with material traceability, and the other provides supply chain traceability. Companies have yet to find one that does both perfectly.

It was also found that some companies (e.g., B, C, and G) use various standards to trace fibers because consumers seek labels for trusted claims and certifications. Therefore, companies are turning to certifications such as Textile Exchange’s Recycled Claim Standard, Global Recycled Standard, and Responsible Wool Standard to prove their use of recycled content (e.g., recycled polyester down, wool). Companies also used the Organic Content Standard and Global
Organic Textile Standard (GOTS) to verify organic claims on textiles. These standards use a strong chain of custody framework as well as look at social, chemical, and environmental practices of the supply chain to track organic content throughout the whole supply chain. Therefore, consumers can be confident that the garment contains the specified amount of organic material. All these findings regarding the technology used for tracing the products are new additions to the literature.

Regarding the technology used for tracing environmental and social aspects, it was found that companies adopted various sustainable practices such as chemical management/water pollution, water consumption, greenhouse gas emission, and waste management towards environmental aspects of sustainability. Despite these sustainable practices around environmental aspects, only a few companies adopted some technologies for tracing only some environmental practices. Particularly, a manufacturer (Company F) used Zero Discharge Hazardous Chemicals (ZDHC) tools to create in-check reports against Manufacturing Restricted Substance List (MRSL) and Restricted Substance List (RSL) for finished products and Higg Environmental Modulus. Similarly, Company F also used some standards (e.g., International Labor Organization, ILO standards) for tracing social aspects. Manufacturers’ use of technologies for tracing environmental and social aspects can be explained by the fact that most of the environmental and social violations occurred in manufacturing firms. Therefore, brands and retailers demand more documented records about the environmental and social aspects of sustainability from manufacturers and force manufacturers to adopt some technologies for that.

It was also found that there are a few comprehensive technologies to trace the overall supply chain. Most of the companies acknowledged that they are still searching for such technologies. Due to the absence of comprehensive technology, many companies manually do
their overall supply chain traceability activities. Particularly, the companies whose supply chains are small collect information from their suppliers through invoicing documentation and manage it manually. Therefore, it can be concluded that a comprehensive technology for tracing the overall supply chain needs to develop. Based on the above discussion, the author proposed the following propositions:

P3c: Companies with adequate resources and a sustainable focus invest in technology and various standards’ certification systems for tracing materials (e.g., fibers) to exclude conflict materials from their supply chain and to verify the claims or originality of the products (e.g., organic claims).

P3d: Brands and retailers influence manufacturers’ adoption decisions for traceability technologies or standards related to environment and society.

It was found that there is a lack of evaluation methods of transparency in the industry. This finding is supported by the initial claims in the literature. Through the extensive literature review, the author claimed that there are limited evaluation systems for transparency except for the Fashion Transparency Index (FTI) and some companies developed their own systems. Aligning with this claim, it was found that, in practice, there is indeed a lack of comprehensive evaluation systems of transparency. The majority of the participants’ companies admitted that they do not have any key performance indicators (KPIs) for measuring the success of their transparency efforts. Only a few companies disclosed that they depend on external assessments such as FTI or other associations that rated and ranked companies based on their publicly available information. Therefore, it is reasonable to say that a comprehensive evaluation system for transparency needs to be developed.
It was also found that there is a significant lack of a comprehensive evaluation method of the companies’ traceability efforts. It was found that participant companies acknowledged that they have neither their own key performance indicators (KPIs) nor external assessment systems for evaluating their traceability efforts. However, they have suggested some KPIs for the evaluation of traceability. Therefore, it is essential to develop a comprehensive evaluation system for traceability.

5.1.4 Discussions of Research Question 4

Since companies are adopting transparency and traceability, it is crucial to identify the importance of transparency and traceability efforts in their supply chain strategies. The finding shows that a significant number of companies (six out of eight) place the highest importance or priority on transparency in their supply chain strategies. This finding can be explained as the natural progression because there is no reason to direct resources (e.g., time, effort, and money) toward transparency efforts if companies do not consider it an important supply chain strategy. Further, the big and sustainable companies (e.g., Company B, C, D, and G) consider their transparency efforts a top priority. This finding is supported by previous studies (e.g., Doorey, 2011) that discovered that large companies usually intend to do business more responsibly and put top importance on transparency. In addition, it was also found that the majority of companies (who put top importance on transparency) included transparency as an important part of their supplier selection; this is another evidence of putting importance on transparency.

As opposed to this finding, it was also found that only a few companies (Company E and F) did not consider transparency efforts as their top priority in their supply chain strategies. This finding can be explained by the companies’ characteristics. For example, small companies and manufacturers (Company E and F) whose customers are not the end consumers do not put top
priority on their transparency efforts. As these companies do not sell their products to the end consumers, they do not face direct pressure from them. Therefore, transparency is not a top priority to them compared to innovation and marketing. Based on the above discussion, the following propositions are proposed:

P4a: Most large and sustainable companies provide the top importance for transparency efforts in their supply chain strategy and consider it a crucial part of supplier selection.

It was found that compared to transparency, most of the companies (e.g., Company A, B, C, D, F, G, and H) placed their traceability efforts as a top priority in their supply chain strategy. This finding can be explained through the lens of performance goals (outcomes and result-focused). It was found that companies adopted traceability to verify product authenticity as well as to reduce supply chain risks. In other words, traceability assists companies in authenticating the originality of organic cotton, recycled polyester, responsible wool, hemp, and many others for which they pay a high price. Since traceability is directly connected to companies’ vital decisions or performance goals, it is reasonable to conclude that most companies prioritize traceability in their supply chain strategies.

It was also found that traceability impacted the majority of companies’ product sourcing. This also endorsed that companies have adopted traceability as an important part of their supply chain strategies. However, it was found that traceability did not impact the product sourcing of a few companies. This discrepancy can be explained through the lens of companies’ nature. By carefully analyzing, it can be seen that traceability is not an important factor for the product sourcing to small companies and manufacturers (Company E and F) whose target customers are brands and retailers, not the end consumers. Because they are still driven by the costs. If only
their customers such as retailers or brands asked for certified fibers, then traceability plays an important role. Otherwise, costs are their main driving factors for product sourcing.

Further, it was also found that most of the companies (e.g., Company B, C, F, and G) adopted short-term and long-term plans for their traceability efforts which is another indication of putting importance on traceability. Based on the above discussion, the following propositions can be deduced:

P4b: All types of companies (e.g., large, small, manufacturer) provide top priority for their traceability efforts in their supply chain strategies and adopt short-term and long-term plans for it.

P4c. Large companies include traceability as an important part of product sourcing due to its benefits, but small companies and manufacturing companies do not.

5.2 Implications

This study offers both theoretical and practical implications, which are discussed in the following sections:

5.2.1 Theoretical Implications

From a theoretical perspective, little is known in the literature regarding transparency and traceability, their relationship with sustainability, companies’ motivation for adopting them, evaluation of transparency and traceability efforts, and companies’ strategic importance for transparency and traceability efforts. This study fills these voids by adding empirical analysis to the existing transparency and traceability literature. Except for Egels-Zandén et al. (2015) and Garcia-Torres et al. (2021), there is a dearth of studies conceptualizing transparency and traceability and their relationship with sustainability. However, these above-mentioned previous
studies conceptualized traceability as one of the dimensions of transparency. Contrary to this conceptualization, this current study identifies transparency and traceability as two separate topics. Transparency depends on traceability and many other factors (e.g., companies’ broad decisions), and both are essential components of sustainability. Therefore, the findings of this study add substantial information for the establishment of more refined relationships among three concepts (sustainability, transparency, and traceability).

It is also rare to find previous studies that analyzed technologies or tools and motivations by transparency vs. traceability. From this perspective, this study is new and adds much new knowledge to the literature. For example, this study identifies various external and internal factors both for transparency and traceability that influence the companies to implement them. Particularly, this study identifies that external forces are more influential to adopt transparency than internal forces and vice-versa for traceability. This piece of findings opens a new door for further studies and also those identified factors (e.g., consumers’ pressure, regulatory forces) can be used as the variables for future quantitative studies.

Another example of new information added to the existing literature is that this study exposes that most companies used soft tools (e.g., websites) for their transparency efforts except for some large companies who used QR codes. However, for traceability, particularly for tracing the materials/products, companies use advanced technology (e.g., Oritain) and various standards (e.g., GOTS). This new finding opens the scope for further studies. In addition to that, previous studies have rarely highlighted companies’ priorities for transparency and traceability. This study also fills this gap. Finally, based on the findings, the author has proposed some propositions. These propositions open new scopes for future studies or development of the new theories.
5.2.2 Practical Implications

Along with the theoretical implications, this study also provides several practical implications. The findings of this study are helpful for sustainability managers in various ways. First, companies that plan to implement transparency and traceability obtain clear concepts about transparency and traceability and their relationship with sustainability. For example, this study identifies transparency and traceability as indispensable parts of sustainable textile and apparel supply chains. Therefore, it helps companies to allocate significant efforts and resources for transparency and traceability to further enhance sustainability in the industry. Further, the findings of this study show that traceability helps companies to verify the originality of the products and to identify supply chain risks. This finding informs other companies about this benefit of traceability and further encourages them to implement traceability to benefit from it.

Second, this study identifies various regulations such as WRO, California Transparency Act, UK Modern Slavery Act, and so on that influence companies to adopt traceability. This finding facilitates enhanced industry collaboration. For example, companies can collaborate with technology developers (e.g., Oritain or TextileGenesis) to identify the origins of the cotton.

Third, the findings of this study also suggest that using simple, inexpensive, and soft tools facilitates companies’ meeting consumers’ demand for transparency. The essence of this finding is that for communication of transparency efforts, companies often do not need advanced and expensive technologies. This finding encourages other companies that have financial and technological barriers to communicate their transparency. Instead of using advanced technologies or investing extensive resources, the companies that have financial restrictions can be transparent with simple and inexpensive tools such as websites, and QR codes, and thus fulfill the consumers’ and other stakeholders’ demands. The findings of the study further revealed that
several companies are looking for a technological solution for traceability. The finding shows that there is still a dearth of technologies for tracing the overall supply chain. However, for tracing cotton, there is a well-developed technology (e.g., Oritain) and companies are using various standards (e.g., recycle content standard, global organic textile standard, etc.). This finding suggests that there is a need for developing a comprehensive technology or more standards similar to the global organic textile standard (GOTS) for other fibers.

Last but not least, since companies are investing resources (e.g., money, time, and efforts) for transparency and traceability initiatives, it is necessary to evaluate their success. This study reveals that they lack a comprehensive evaluation system both for transparency and traceability. However, this study obtains some suggestions from participants' companies on key performance indicators (KPIs) for measuring the success of traceability efforts. These identified KPIs further help to create an evaluation system for traceability.

5.3 Limitations

This study collected data only from 11 participants of eight US-based companies through one-on-one semi-structured interviews. Since this study collected data only from US-based companies, it is recommended that future studies can be extended to companies in other countries, such as European-based companies to fully comprehend the transparency and traceability issues. Because European countries might have stricter obligations on companies for the adoption of transparency and traceability than the US, and thus may provide different outcomes. Furthermore, this study mostly was performed considering large companies (e.g., five large and three small companies). Therefore, it is also recommended that future studies can conduct using comparable numbers of both large and small companies to see whether they produce similar or different results.
Another limitation is that this study used unequal numbers of brands and manufacturers. For example, this study collected data from six brands, one retailer, and one manufacturer. Balanced numbers of brands, retailers, and manufacturers in the study sample might provide more generalizable findings. Furthermore, apparel or textile manufacturers that do not sell products to end consumers might generate different findings regarding traceability and transparency. Therefore, it is also suggested that future studies can analyze those companies to see the impact of these settings.
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APPENDICES
Appendix A: Institutional Review Board (IRB) Letter

Dear Byoungho Jin:

Date: February 17, 2022
IRB Protocol 24760 has been assigned Exempt status
Title: Supply Chain Transparency and Traceability in the Textile and Apparel Industry
PI: Jin, Byoungho Ellie

The research proposal named above has received administrative review and has been approved as exempt from the policy as outlined in the Code of Federal Regulations (Exemption: 46.101. Exempt d.2). Provided that the only participation of the subjects is as described in the proposal narrative, this project is exempt from further review. This approval does not expire, but any changes must be approved by the IRB prior to implementation.

1. This committee complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU projects, the Assurance Number is: FWA00003429.
2. Any changes to the protocol and supporting documents must be submitted and approved by the IRB prior to implementation.
3. If any unanticipated problems or adverse events occur, they must be reported to the IRB office within 5 business days by completing and submitting the unanticipated problem form on the IRB website: http://research.ncsu.edu/sparcs/compliance/irb/submission-guidance/.

Please let us know if you have any questions.

********************************************************************************

NCSU IRB Office

*Please contact ncsuirboffice@ncsu.edu if an official PDF approval letter with signature is required by your funding source.*
Appendix B: Recruitment Email

Dear (Name of Participant):

My name is Md Sadaqul Bari, and I am a Ph.D. student at Wilson College of Textiles, North Carolina State University. I am conducting a research study as a part of my Ph.D. dissertation under the direction of Dr. Byoungho Ellie Jin. My research aims to discover the supply chain transparency and traceability in the textile and apparel industry. If you have hands-on experience in implementing supply chain transparency, traceability, and strategic decision-making processes in the textile and apparel industry, I would like to invite you to participate in my research.

If you choose to participate, you would do a one-on-one interview that will last between 45 to 60 minutes over Zoom or in-person. During the interview, I’ll ask you open-ended questions about supply chain transparency and supply chain traceability and your opinions about them. I plan to audio the interview to make sure that I catch everything you share with me accurately. I also might ask some participants to do follow-up for cross-checking or validation of the information they provided or contact information of someone else from their company or other company. All research data will be handled confidentially.

Participation is completely voluntary. Participation in this study isn’t a requirement nor expectation of your job or of any relationship you may have with any member of the research team.

There is minimal risk to participating. The results from this study will be valuable inputs for generating recommendations for policymakers and practitioners like you.

If you want to participate, please access the online consent form and to let me know your interview availability through the link: ______.

If you have any questions about the study, please email me at mbari@ncsu.edu or call at 347-749-4713. You can also contact my faculty advisor for this research, Dr. Byoungho Ellie Jin, at bejin@ncsu.edu and 919-515-5977.

Thank you for your consideration.

Sincerely,
Md Sadaqul Bari
Appendix C: Consent Form

Title of Study: Supply chain transparency and traceability in the textile and apparel industry (eIRB # 24760)
Principal Investigator(s): Md Sadaqul Bari, mbari@ncsu.edu, and 347-749-4713
Funding Source: Cotton Incorporate
NC State Faculty Point of Contact: Dr. Byoungho Ellie Jin, bejin@ncsu.edu, and 919-515-5977

What are some general things you should know about research studies?
You are invited to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate, and to stop participating at any time without penalty. The purpose of this research study is to gain a better understanding of supply chain transparency and traceability in the textile and apparel industry. We will do this through asking you to participate in a one-on-one in-depth interview.

You are not guaranteed any personal benefits from being in this study. This research poses minimal risks to those who participate. You may want to participate in this research because the results will help industries in understanding supply chain transparency and traceability and helping industry practitioners and policymakers to take appropriate decisions for the implementation of transparency and traceability. You may not want to participate in this research because the interview asks questions related to your company’s transparency and traceability efforts and you might feel uncomfortable sharing that.

Specific details about the research in which you are invited to participate are contained below. If you do not understand something in this form, please ask the researcher for clarification or more information. A copy of this consent form will be provided to you. If, at any time, you have questions about your participation in this research, do not hesitate to contact the researcher(s) named above or the NC State IRB office. The IRB office’s contact information is listed in the What if you have questions about your rights as a research participant? section of this form.

What is the purpose of this study?
The purpose of the study is to investigate supply chain transparency and traceability in the textile and apparel industry.

How many people will be in the study?
There will be approximately 20-25 participants in this study.

Am I eligible to be a participant in this study?
In order to be a participant in this study, you must agree to be in the study, are 18 years of age or older, live in the United States, and have hands-on experience in implementing transparency and traceability and strategic decision making in supply chain transparency, traceability, and strategic decision-making processes in the textile and apparel industry. You cannot participate in this study if you don’t meet the inclusion criteria, or you don’t agree that you can be recorded for research purposes.

What will happen if you take part in the study?
If you agree to participate in this study, you will be asked to do all of the following:
1. Read the consent form and agree electronically.
2. Let the researcher know when you would be available to do an interview.
3. Participate in a personal, recorded interview with the researcher asking open-ended questions about supply chain transparency, traceability, and strategic decision-making processes in the textile and apparel industry. The interview will be conversation, semi-formal, and will be recorded for research purposes. I expect that the interview will last 45 to 60 minutes. All interviews will be conducted over Zoom or in-person.

4. Follow-up for cross-checking or validation of information given (if needed) and refer someone else from your company or other company suitable for this study.

The total amount of time that you will be participating in this study is 45 to 60 minutes.

**Recording and images**

If you want to participate in this research, you must agree to be audio recorded. If you do not agree to be audio recorded, you cannot participate in this research.

**Risks and benefits**

There are minimal risks associated with participation in this research. The risks to you as a result of this research include you might be re-identified from the data but will be reported by using pseudo name (e.g., participant “X”), so there is no risks of job lose. There are no direct benefits to your participation in the research. The indirect benefits are helping industry practitioners and policymakers to take appropriate decisions for further steps for implementing transparency and traceability.

**Right to withdraw your participation**

You can stop participating in this study at any time for any reason. In order to stop your participation, please contact the student researcher Md Sadaqul Bari at mbari@ncsu.edu and 347-749-4713. You can also contact the faculty advisor for this research, Dr. Byoungho Ellie Jin, at bejin@ncsu.edu and 919 515 5977. If you choose to withdraw your consent and to stop participating in this research, you can expect that the researcher(s) will redact your data from their data set, securely destroy your data, and prevent future uses of your data for research purposes wherever possible. This is possible in some, but not all, cases.

**Confidentiality, personal privacy, and data management**

Trust is the foundation of the participant/researcher relationship. Much of that principle of trust is tied to keeping your information private and in the manner that we have described to you in this form. The information that you share with us will be held in confidence to the fullest extent allowed by law. Protecting your privacy as related to this research is of utmost importance to us. There are very rare circumstances related to confidentiality where we may have to share information about you. Your information collected in this research study could be reviewed by representatives of the University, research sponsors, or government agencies (for example, the FDA) for purposes such as quality control or safety. In other cases, we must report instances in which imminent harm could come to you or others. How we manage, protect, and share your data are the principal ways that we protect your personal privacy. Data that will be shared with others about you will be de-identified.

**De-identified.** De-identified data is information that at one time can directly identify you, but that we will record this data so that your identity will be separated from the data. We will have a
master list with your code and real name that we can use to link to your data. When the research concludes, there will be no way your real identity will be linked to the data we publish.

**Future use of your research data**
To help maximize the benefits of your participation in this project, by further contributing to science and our community, your de-identified information will be stored for future research and may be shared with other people without additional consent from you.

**Compensation**
There is no compensation for participating in this study.

**Sponsorship and funding**
This research is funded by Cotton Incorporated. This means that the sponsor is paying the research team for completing the research. The researchers do not, however, have a direct financial interest with the sponsor or in the final results of the study. If you would like more information, please ask the researcher(s) listed at the top of this form about the funding and sponsorship.

**What if you have questions about this study?**
If you have questions at any time about the study itself or the procedures implemented in this study, you may contact the student researcher, Md Sadaqul Bari, at mbari@ncsu.edu, and 347-749-4713. You can also contact the faculty advisor for this research, Dr. Byoungho Ellie Jin, at bejin@ncsu.edu and 919-515-5977.

**What if you have questions about your rights as a research participant?**
If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact the NC State IRB (Institutional Review Board) office. An IRB office helps participants if they have any issues regarding research activities. You can contact the NC State University IRB office at IRB-Director@ncsu.edu, 919-515-8754, or fill out a confidential form online at https://research.ncsu.edu/administration/participant-concern-and-complaint-form/

**Consent to participate**
By signing this consent form, I am affirming that I have read and understand the above information. All of the questions that I had about this research have been answered. I have chosen to participate in this study with the understanding that I may stop participating at any time without penalty or loss of benefits to which I am otherwise entitled. I am aware that I may revoke my consent at any time.

Please select one of the following:

☐ Yes, I want to participate.

Name and email___________________________

Today’s Date ____________________________

☐ No, I do not want to participate.

Thank you for your consideration.
Appendix D: Interview Questions and Protocol

**Introductory Scripts**
Hello, how are you? I am Bari and conducting this research as part of my Ph.D. dissertation at NC State University. This research will focus on the supply chain transparency and traceability in the textile and apparel industry. In particular, I am examining companies’ motivations for the adoption of policies and practices toward transparency and traceability. I want to record our conversation for the transcription and analysis. Are you ok with that? The information you will provide will use for dissertation and subsequent publication. But your and your company name will be not used anywhere in the report. Before we begin, I need your consent for the participation. I have sent you a link please consent it and do you have any questions regarding the interview or about me?

**Part 1**

4. Explain the importance of **sustainability** means to your organization, and how your stakeholders define it?
   a. Describe what activities your company does relating to **sustainability**.
   b. Tell me about the goals your company has for **sustainability** in the future.

5. Within the context of sustainability in your supply chain, what is the role of **transparency** and how is it operationalized?
   a. When discussing **transparency**, what other terms are used in those conversations? Can you tell me more about those terms?

6. Within the context of sustainability in your supply chain, what is the role of **traceability** and how is it operationalized?
   a. How would you differentiate between **sustainability, transparency, and traceability**?

**Part 2**

3. What motivated your company to adopt **transparency**?
   a. How has the growth of consumers’ sustainability consciousness affected your company's decision for **transparency**?
   b. How might this continued growth in consumer consciousness affect in the future?
   c. How do regulatory forces (government and/or NGOs) influence your company to adopt **transparency**? Tell me more about those regulatory forces.

4. What motivated your company to adopt **traceability**?
   a. How has the growth of consumers’ sustainability consciousness affected your company's decision for **traceability**?
   b. How might this continued growth in consumer consciousness affect in the future?
   c. How do regulatory forces (government and/or NGOs) influence your company to adopt **traceability**? Tell me more about those regulatory forces.

**Part 3**
8. What technologies and analytics are used for transparency efforts? How does your company evaluate the success of transparency efforts?
   a. Tell me in further detail about the methods and efforts used by your company for evaluating transparency.
   b. How were these evaluation methods developed?
   c. How does your company's method compare to other established standards (e.g., FTI)?
9. What KPI’s are used to assess transparency?
10. Do you think there should be a common evaluation system for transparency? Why or why not?
   a. What suggestions do you have for this common evaluation system?
11. What technologies and analytics are used for traceability efforts? How does your company evaluate the success of traceability efforts?
   a. Tell me more about your company's method for evaluation traceability efforts
   b. How were these traceability evaluation methods developed?
   c. How does your company's method compare to other established standards?
12. What KPI’s are used to assess traceability?
13. Do you think there should be a common evaluation system for traceability? Why or why not?
   a. What suggestions do you have for this common evaluation system?
14. How does your company communicate their transparency and traceability efforts?
   a. What information does your company track and trace?
   b. Describe the traceability information that is disclosed to consumers and stakeholders.

Part 4

4. How much impact do the transparency efforts have in relation to your company's supply chain strategies?
   a. How much of a priority would you say your company considers transparency?
   b. Describe any collaborative efforts being done by your company related to transparency.
   c. What does support from your company's higher management look like for transparency?
5. How much does traceability factor into your company's supply chain strategies?
   a. How much of a priority are the traceability efforts to your company?
   b. Do considerations about traceability affect the choice of products that you decide to source or the suppliers that you work with?
   c. How would you describe any collaborative efforts towards traceability by your company?
   d. What does support from your company's higher management look like for traceability?
6. What are your company’s plans (short-term and long-term) for transparency and traceability?

Finishing Script
Thank you so much for participating in this research. The information you provided will be a valuable resource for the study to achieve accurate results. I will appreciate the opportunity to follow up with you for cross-checking the information you provided after the transcription of the data. If you think someone else from your company or another company would be able to help me, I would greatly appreciate the contact information or your assistance to reach them. If you have any more information for this study regarding the questions I asked you or the topic of this research, please email me at (mbari@ncsu.edu). Thank you again.
## Appendix E: Quotes from Interview

Table E1. Illustrative Quotes from Interviews of RQ#1

<table>
<thead>
<tr>
<th>RQs</th>
<th>Topics</th>
<th>Themes</th>
<th>Sub-themes</th>
<th>Illustrative quotes from interviews</th>
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<tbody>
<tr>
<td>RQ#1</td>
<td>Sustainability</td>
<td>Core corporate initiative</td>
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<td>“Sustainability has become a core competency, I would even say, within our company, and we use sustainability through the lens of performance. We believe that sustainability is not in competition with material performance; rather, we can actually get benefits from sustainability. The whole company has put sustainability as a top priority corporate initiative, and it’s built in everything we do, from our products through our people and the planet” (Company A Participant 1).</td>
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<td>“I mean sustainability and responsibility is kind of the like core of Company D, […], so we believe we are living in it, even before the sustainability has been coined in the industry in the late 90’s and in the academic world, but recently I think back in 2018 late 2018 we come with a purpose of statement and the purpose of statement we have embedded the sustainability of the betterment of people on the planet” (Company D Participant 5).</td>
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<td>“Sustainability is central to kind of the work that we do. Sustainability has a lot of different aspects with a big bucket” (Company C Participant 4).</td>
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<td>Important but not a top corporate initiative</td>
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<td>“For our organization, sustainability has really come out of our company values. We are family owned and operated, […] it has been really important to us to be a good corporate citizen. As the world has changed and the industry has evolved, that has grown to include sustainability. I think it has grown in importance as it has grown importance across the industry. Because we’ve also understood that it's important to our customers, […] Increasingly it's becoming important from a regulatory standpoint as well, […]. Hence, we've obviously paying attention to that, but the kind of the real drive is from our family values to do the right thing for our community and the world at large” (Company H, Participant 11).</td>
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<td>Dimension</td>
<td>Product, people, and planet</td>
<td>Product, people, and the planet</td>
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<td>Product, people and the planet are three pillars that we focus on. And each from a very high level obviously wants to ensure people are treated fairly. We stand for quality within the organization, then product that we are building products in a way that is the least impact on the environment. […]. But also, we minimize our impact on the environment at all of our production facilities for every item and the site we use that are using minimum water and minimum power and working towards a goal of net zero emissions impact within the company. So, […], but people, product, and the planet is the lens we look at and build that” (Company A Participant 1).</td>
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<td>RQs</td>
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<tr>
<td>RQ#1</td>
<td>Sustainability</td>
<td>Dimension</td>
<td>Product, people, and planet</td>
<td>&quot;We define sustainability, we kind of have a few different banners for it, but we use the three P, but a little bit tweaked so instead of people planet profit, we use people planet product because we really recognize that our product there's so much in how we make and distribute the product.” (Company H Participant 11).</td>
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<td>Only environmental aspects</td>
<td>“We are committed to a full circularity story in the long term here. We are actually putting a goal for 2030 for product circularity” (Company A Participant 1).</td>
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<td>“I think I would say because we used to say we were in the business to build the best product and cause the least amount of unnecessary harm, and that's still important, but we look at it from several ways; one is our own footprint as a company, so the headquarters and our shops our distribution centers trying to make those places be the least impactful in a number of ways, so energy usage water usage etc.” (Company G Participant 10).</td>
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<td>“Of course, we're more and more involved in resale. We have our repair team in our distribution center in Y (Y is the pseudonym of the city), the biggest repair center in North America for garments, and it's a very important part of the company” (Company G Participant 10).</td>
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<td>“Then the product is a very important part. So, in the design, how do we design? Quality that's the number one thing, so if it's high quality, it will last longer, and the least amount of garments that you purchase is the most sustainable decision that you can make, so that’s key is quality, durability, also repair ability” (Company G Participant 9).</td>
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<td>Only products aspects</td>
<td>We source 100% organic cotton. Almost all of our synthetics are recycled. By 2025 our goal is for 100% of our materials to be either recycled or renewable. By renewable, we mean organic cotton or hemp or responsible wool or responsible down, so we're finding the best material possible the least impactful, and it's now extending towards trims and packaging” (Company B Participant 2).</td>
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<td>Environmental and social aspects</td>
<td>&quot;The metrics we are looking for are in regularly evaluating our water usage, greenhouse gas emission, and waste reduction targets. And then also there is a social side of it. Which is making sure that our manufacturing environments are a safe place to work and that we are meeting all of the local and global international labor in our organization guidelines for good social practices” (Company F Participant 7).</td>
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<td>Sustainable practices</td>
<td>Environmental</td>
<td>&quot;Restricted substance list (RSL)” (Participant 7), “circularity” (Participant 1)</td>
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<td>RQ#1</td>
<td>Sustainability</td>
<td>Sustainable practices</td>
<td>Social</td>
<td>We treat our employees to the efforts we're putting forth with diversity and inclusion and how we run our factory monitoring program” (Company H, Participant 11).</td>
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<td>Products</td>
<td>Sustainable fibers certifications of Organic Content Standard (OCS)” (Participant 10).</td>
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<td>Definition</td>
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<td>“For us, sustainability means measuring our environmental impact and then setting targets around climate and other things to kind of” (Company A Participant 1).</td>
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<td></td>
<td>Transparency and traceability</td>
<td>Distinction in definition</td>
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<td>“Stakeholders that are our investors and then our employees and manufacturing groups and our definition of sustainability is meeting the needs of the present without sacrificing the needs of the future” (Company G Participant 8).</td>
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<td>“I think those are almost completely different concepts. Traceability is your ability to identify back into your supply chain, and transparency is what you choose to disclose about those traceability efforts. I think that those are two almost completely distinct concepts. Often, work together, but they’re very distinct, they would be almost very different concepts” (Company B Participant 2).</td>
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<td>“I think transparency is about your supply chain, understanding the tiers and who you are doing business with. Traceability is your ability to show the chain of custody between tiers and the supply chain. Traceability, to me, at least means your ability to understand the chain of custody in specific product types or material types, so that’s how we differentiate the two; there are a lot of interlocking themes. But those are the two differences in my mind. […], and traceability and transparency for me mean your ability to kind of talk about your supply chain and how you disclose that” (Company C Participant 4).</td>
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<td>“I think they do get used interchangeably is not necessarily the correct way. We talked about transparency, like what we are sharing, what we are communicating, and how much information we are sharing with our stakeholders. Whereas traceability is what we know about our supply chain. […]. I think there’s a definite difference. Traceability, as I said, is what we know. It’s the information we’re collecting from our supply chain and how far back we will map our products and all the inputs, whereas transparency is kind of what and how much we are sharing” (Company H Participant 11).</td>
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<td>“I would say traceability is more what I mentioned like being able to show our customers where our products are coming from and how we are tracking those through the system. If we are using a sustainable fiber, we are saying that we are using a sustainable fiber to prove that at the end of the line. […]. And then, for transparency, it is more of an effort to make not hide our practices. So we are using the Higg facility environmental module and ecotex testing and ZDHC […] to demonstrate to our customers that we are not trying to hide anything” (Company F Participant 7).</td>
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<tr>
<td>Transparency and traceability</td>
<td>Importance of transparency and traceability</td>
<td>Equal importance</td>
<td>“For us, transparency means publicly disclosing where our products are made, and we do that already. [...]. So we firmly believe that transparency is critical as part of this overall sustainability and corporate responsibility mission. I would say traceability is critical if you are making a product, especially for making product claims. So you are saying something is organic, or something is recycled, or it is responsible like responsible down responsible wool. You have got to be transparent, your supply chain as well, you have to be good at to be able to trace your supply chain or the backup that claim” (Company C Participant 4).</td>
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<td>Emphasized on traceability</td>
<td>“To our company, traceability is more like capability. So one is how capable you are in tracing your supply chain and is knowing your supply chain to me that it’s traceability and in terms of company C and we are doing a fantastic job in tier 1. We are doing quite a good job in tier 2, but in tiers 3, 4, and 5, we do not always know who they are. When you are done with this traceability thing, here comes the transparency, which is more like your disclosure because you might be able to trace your entire supply chain, but then your board might decide that while we are not going to disclose it as of now” (Company D Participant 5). “We have really put a task force in place, not only for sustainability but for traceability, to advance our traceability policy. I can tell you that we are a very traceable company within the industry. And we have transparency all the way through to our material and chemical inputs into our product. An example would be cotton; we have the most traceable cotton. [...]. So, just an example of how deeply and how important we believe traceability is. Now, really, the question is, how much of that do we unlock to the consumer lands? And that's an area we're working on and building a foundation within our organization” (Company A Participant 1). “We have really put a task force in place, not only for sustainability but for traceability, to advance our traceability policy. I can tell you that we are a very traceable company within the industry. And we have transparency all the way through to our material and chemical inputs into our product. An example would be cotton; we have the most traceable cotton. [...]. So, just an example of how deeply and how important we believe traceability is. Now, really, the question is, how much of that do we unlock to the consumer lands? And that's an area we're working on and building a foundation within our organization” (Company A Participant 1). “You can have traceability and not have transparency. So we can have visibility and understand that our cotton came from a particular region; we just choose not to disclose that” (Company B Participant 2).</td>
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<td>Transparency depends on companies' decisions</td>
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<td>“Because of whatever reason, competitive. […] found something in your supply chain which is not very promising, and you don’t want to disclose it. […] a lot of your peers are not disclosing […] the demographic you are serving does not have the appetite for transparency. […]. And also, many times, it has to come with your annual sustainability report, […], and others to deliver that information in a digestible format. Because if I disclose all our supply chain […], our consumers will not even understand what it means. […]. Well, once you know your traceability, how much transparency do you want to be” (Company D Participant 5). “The role of transparency in our company is definitely evolving. We have recognized that the expectations for transparency have shifted in the last five years. […]. It depends on the company's decision in so much as the right information at the right time. We're not hiding anything, but we also recognize there's not always a value in putting everything out there. Like our customers care about the tier one garment factory of where we're producing product […] is it going to result in a positive outcome for people or planet” (Company H Participant 11).</td>
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<tr>
<td>Transparency and</td>
<td>Relation between sustainability, transparency, and traceability</td>
<td>Relation between transparency and traceability</td>
<td>“If you don’t mind, I think probably you can start by traceability and go to transparency because, to be honest to me in mind and in the traceability comes first. And then it goes to transparency” (Company D Participant 5).</td>
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<td>traceability</td>
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<td>“I would say, generally speaking, that traceability is the work you have to do first. You must map your supply chain. You cannot be transparent if you have no idea what is there, so, first of all, you have to map your supply chain in order to achieve traceability. Then you sort of the transparency, which is part of being how much information you’re going to yield and for what purposes” (Company G Participant 10).</td>
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<td>“I think sustainability we're publishing a sustainability report tell you is focused on the activities of people product and planet. In some instances, we see traceability as a part of sustainability to ensure that we're truly traceable from start to finish with our products and processes. And then transparency to us is showing. All that good or bad, and that is the whole point of us publishing our sustainability report this year, and it looks some of that's not going to be great, some of its going to be outstanding, but to be transparent to you have to show everything and show there is that we're going to get better, so that's our plan this year.” (Company A Participant 1).</td>
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<td>“Sustainability is a big umbrella. But I would say it’s important again, any claims you are making or anything you are saying to be able to back those up. So, traceability and transparency allow us to validate anything that we are saying about the work that we are doing. Transparency shows who you partner with and make your products […] within your supply chain. Traceability kind of really shows kind of connections between those entities in order to prove various product claims. so, I think that all relates to our overall sustainability efforts. Don’t think you’d be a sustainable brand without those two components” (Company C Participant 4).</td>
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<td>“The recognition that traceability is like a prerequisite to sustainability. Because if you don’t know who is making your product. Or where raw materials are coming from, how people are being treated and what the environmental impacts are. We see it as a very important component of sustainability, and the role it’s taking is incremental effort to be able to trace our product and engage the suppliers involved further upstream, step by step, as much as we can. As far back as we can understand, covering who are involved in our supply chain and then engaging them in a relevant way, whether it's social or environmental” (Company H Participant 11).</td>
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| RQ#2 | Reasons for adoption transparency | Consumers    | Direct pressure from end consumers | “I think we feel like, one of the things consumers want to know about where the product is made” (Company C Participant 4).  
“Transparency, on the other hand, I think become at the customer's request, so working with our website development has been a good approach. Where we're continuously improving the website, it's delicate in that you try to craft the appropriate message for the consumer. But I think we've exhibited and demonstrated performance and an improvement over website development and continually update that” (Company B Participant 3).  
“Externally, of course, there is pressure from the shareholder, from the stakeholder, the pressure from consumer and our demographic. Because they also want to know where the cloth is made, all the big campaigns such as whomademycloth, fashion revolution, fashion transparency index, and better buying everything. So fundamental for them to know where their cloth is made. Do we know our risk, and what have we done to manage that risk tomorrow if there is a fire in the factories in Bangladesh, India, or Sri Lanka. Our consumers want to know if we know that the factory is making our product and what we have done to ensure we can avoid that kind of situation” (Company D Participant 5). |
|     |                                    |              | Indirect pressure from end consumers | “I think primarily the influence has been through our customers. One of our bigger customers, Levi’s, got a lot of pressure from Greenpeace to address the detox issues with Zero Discharge Hazardous Chemicals (ZDHC), so we are kind of feeling that from them. Being in the middle of the supply chain, more of our pressure comes from customers and government and NGOs, I guess is what I am saying” (Company F Participant 7).  
“We have always focused on doing business the right way; our original episode sustainability efforts came from back in the early 2000s. It’s, now we have customers who are demanding to see all of these reports. But when we began our sustainability program, we wanted our customers and stakeholder to hold us accountable and be able to hold us responsible” (Company F Participant 7). |
<p>|     |                                    |              | Educate consumers                  | “I think probably really, it was to provide this information to our customers that’s the main driver, and that is because some customers were requesting the information, but the other was to help educate customers in what supply chains look like, but also to be fully open. We do not own factories, and we do not own mills. We work with these partners, but we may not be perfect, and they may not be perfect, but we're trying. And so, if you want to learn more about how your product was made, you can learn about the materials and provide you with that information, or you can look at who the finished goods factories are. And the mills as well and, you can dig in further there as well, so that’s it really was the impetus was, for that was for, first of all, the customers” (Company G Participant 10). |</p>
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| RQ#2      | Reasons for adoption transparency   | NGOs and associations                       | Membership of organizations/associations | “We are part of the Fair Labor Association; they expect us to list our supply chain. There is the Transparency Pledge, an NGO pushing brands to be transparent. There are people at Open Apparel Registry who will also publicly list. So many groups are doing this kind of work, and we are supporting their work by disclosing our supply chain information” (Company D Participant 4).  
“As a privately held company (Company G) doesn't have disclosure requirements. Still, we do a lot of ESG-type reporting, mainly because we are members of certain initiatives such as the Fair Labor Organization. We’re a B Corp company, so those have requirements for participating members to provide reports” (Company G Participant 10).  
“As well as like B Corp, those are all going to have a much bigger impact in our transparency programs and what we have seen so far” (Company F Participant 7). |
|           |                                     | Influence of NGOs                           |                                     | “Greenpeace was an NGO, and they started the whole they worked with zero discharge of hazardous chemical (ZDHC) to create the manufacturers’ restricted substance list (MRSL). All of the tools that have come out of there, so I would say there was some NGO influence there” (Company F Participant 7).  
“We will be legally required to be that much more transparent. So I see this in the next few years, going from non-governmental stakeholder pressure, consumers, customers, investors, and NGOs to government requiring it and making it a legally required expectation of companies like ours. So, legally required to trace back further legally required to be more transparent about what find I think that’s what's really going to drive this space in the next two to four years” (Company B Participant 3). |
|           |                                     | Afraid of being rated                       |                                     | “We also have regular requests from non-government organizations or civil society, asking us to explain our sustainability job. Very often, they will rate a company based on publicly available information, so it's an important engagement with NGOs and civil society” (Company G Participant 10). |
|           |                                     | Government rules and regulations            | Withhold release order (WRO)         | “In certain countries, especially in the last couple of years, it's become very important to do this for legislative reasons, because in the United States, the farm on cotton from Xinjiang is one that's very important” (Company G Participant 10). |
|           |                                     | New laws are emerging                       |                                     | “As far as government requirement, I think we are just starting to see how that is affecting us. We adopted ecotex testing several years ago, which can also help with proposition 65 requirements, so I guess you could say that is an influence. But ultimately, like the bills that are coming out now, the European Green Acts and New York fashion bill, I think those are the new bills emerging. (Company F Participant 7).  
“We're starting to see draft legislation in New York, called the New York fashion act. Yeah, its proposed legislation in New York similar legislation has been dropped on the table in the state of Washington. We don’t know yet; it's just pending legislation that hasn't passed; it's not a law yet, and we don't know exactly where it's going to go, but our view is some sort of legislation over time like that is very likely” (Company B Participant 3). |
Table E2. Illustrative Quotes from Interviews of RQ#2

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<tr>
<th>RQs</th>
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<tr>
<td>RQ#2</td>
<td>Reasons for adoption transparency (External)</td>
<td>Government rules and regulations</td>
<td>Different laws across the worlds</td>
<td>“We are a global company. We saw it with the world and regulations around that vary from country to country, so I would say the change in an organization of change in our industry takes place a couple of different ways one is regulatory, one is the consumer. But I think it is a complex landscape that is good because it is not as if we have one regulation globally, one outside the US, one for Canada. I mean it is pretty complicated. So I think regulation plays a part and it is gaining momentum right from a regulatory perspective around disclosing chemicals disclosing you talk about your emissions how did you get that number how you validated the creation, so regulation is gaining momentum globally” (Company C Participant 4). “I would say yes, but it also specific region because we are talking about regulation in North America, but there is also regulation in Europe, and there is the different regulation in Asia, and they state pretty different. For example, suppose you talk about the regulations in the European side. In that case, I think that is much higher than the North American regulation related to sustainability and making the business more responsible. If you do your due diligence, you see there is the UK modern slavery act, a German supply chain due diligence, and an Australian modern slavery act to do right drafting and working. They are kind of holding then the California transparency. Hence, in the US, it also depends on the federal vs. the state government to put that mandate on the company to say you have to disclose your supply chain at a certain level. You have to explain if there is a modern slavery practice in their supply chain now how do we know if there is a modern slavery how they know my supply chain is not connected in China” (Company D Participant 5).</td>
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<td>RQ#2</td>
<td>Reasons for adoption transparency (internal)</td>
<td>Self-motivated</td>
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<td>“We have a social responsibility auditing program, so there is no reason for us not to disclose that. We have confidence in the supply chain that we work with. When I think we have taken traceability and transparency to another level, in a sense, you can track where your product is made. And a lot of brands do not do that, so I think we have been pretty clear on our commitment to transparency” (Company C Participant 4). “I think it's kind of just in our DNA. I mean, I think there are market conditions and the consumers, I think, need and desire more transparency and traceability. I just think it's kind of become part of almost consumer expectation. But even before that, it's just kind of a core value built into Company A” (Company A Participant 1) “Years ago, we created something pretty pioneering at a time. It was called with footprint protocols, so basically, what we did was provide this of our suppliers' finished goods and also our mills and as far back as we possibly could, including some farms where cotton was being grown, and we posted this on our website. We would also link that to the product. So we would on a product landing page on our website, you can dig deep into it, and it would reveal to you finished good factory and fabric mill, and so that was at the time were pioneering is now adopted by many other companies” (Company G Participant 10).</td>
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<td>RQ#2</td>
<td></td>
<td>Create competitive edge</td>
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<td>“The reason for transparency is probably one added thing: oftentimes, we can utilize transparency to create our competitive edge in the marketplace. We can go to the market on it, […] we can go to consumers, our stakeholder, NGO, and watchdog saying look, we are much better than the rest of our peers, in terms of traceability and here is our disclosure, here we are opening it to the public. Not everyone is doing that public disclosure. We see it as a competitive advantage for us” (Company D Participant 5).</td>
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Table E2. Illustrative Quotes from Interviews of RQ#2

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<tr>
<td>RQ#2</td>
<td>Reasons for adoption traceability (External)</td>
<td>Consumers and stakeholders</td>
<td>-</td>
<td>“I think there is general consumer sentiment that they want more information about where their products are made” (Company C Participant 4). “Traceability is also with our customers in mind because we want to stand behind our claims. We have to do our internal due diligence. First, we want to ensure that if we're not doing Greenwashing, and so, if we're making a claim that this is recycled, we need to go with a set. We need to go to provide this information we don't really get asked by customers normally sometimes. We do have retail customers, though we sell through REI through dicks sports through different international company companies as well, and very often those customers will have questions regarding, so this product is supposed to be recycled nylon from a fishing net, can you provide us with some form of evidence, if we're making the claim on your behalf, then, can we do that so sometimes our customers our retail customers asked for it” (Company G Participant 10).</td>
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<td></td>
<td>Regulations</td>
<td>WRO</td>
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<td>“Traceability is, I think, a combination of the regulatory environment. But that is coming from a very grave human rights issue of what's happening in Xinjiang. I think the regulatory pressures because of this human rights issue kind of like ramped it up and made the efforts kind of moved more quickly than maybe they would have if we were just if we just had kind of the environmental peace and kind of the like doing good for the sake of doing good […], but I think it just like ramped the speed with which people were working on it really increased after WRO” (Company H Participant 11). “So, regulation around things like forced labor regulation has motivated a lot of brands to take a deeper look at their supply chain to make sure they comply with customs and border protection regulation. So clearly, regulation has had some impact in recently on traceability. I will say the legislation on forced labor has caused a lot of movement in our industry to do a deeper dive into your supply chain, not just ours, everyone’s.” (Company C Participant 4). “I know, definitely for other brands, it certainly did because that's something where the government is pushing the industry where they need to know where their cotton is coming from. I’d say that's much more influential than previous laws or things the government may have done for us. We were already pulling out of risk cotton, a region that had been shown to be at risk for quite some time before the government intervened. So, it didn't have a huge influence on us, because as social awareness came of what was going on, we pulled out and ensured that we were not getting cotton from that region, ahead of the government” (Company G Participant 9). “We are first and foremost really in tune with what's coming and where regulations are. We have a lot of meetings to ensure that we’re always doing the standard and above as far as any kind of regulations changes or there are NGOs that feel are movements kind of coming. Maybe a great example is even the cotton sourcing from Xinjiang province in China. […] a couple of years ago and long before the regulations even came out, we had built, we began building that traceability platform I mentioned. […] And our cotton was not sourced from the region. So, we were well ahead of regulation. That was almost no impact because we were already ahead of the curve” (Participant 1).</td>
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### Table E2. Illustrative Quotes from Interviews of RQ#2

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<tr>
<td>RQ#2</td>
<td>Reasons for adoption traceability (External)</td>
<td>Regulations</td>
<td>Other laws</td>
<td>“There is the UK modern slavery act. There is a German supply chain due diligence act there is an Australian modern slavery act to do right drafting and working. They are kind of holding, then the California transparency. Hence, in the US, it also depends on the state on the federal vs. the state government to put that mandate on the company to say you have to disclose your supply chain at a certain level. You have to explain if there is a modern slavery practice in their supply chain. Now how do we know if there is modern slavery? How do they know my supply chain is not connected to the Uyghur community in China if I'm not able even to trace my supply chain. So, of course, the regulatory has a big impact, […]” (Company D Participant 5).</td>
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<td>Various standards requirements</td>
<td>“And then there's another driver at as well, which depends on the claim we have if we're claiming that some item is certified to a certain standard and those standards have requirements as well. We are certified to the responsible down standard. And we've been certified in the past, responsible wool standards they have specific requirements around traceability and documentation that need to be collected, and that's where a claim” (Company G Participant 10).</td>
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<td>Internal reasons for traceability</td>
<td>Verification the claims</td>
<td>Sustainability claims</td>
<td>“We have with a sustainability program we have always said we are doing things the right way trust us. But transparency and traceability are becoming more important because now the whole feeling of the industry is everyone says that they are doing business the right way, but also need to prove that. So you need to show verified data that you are doing what you say. So that is the demand and wanting to have something ourselves to show look we are walking the walk; we are not just telling you that we are doing things correctly. We want to be able to show that to you” (Company G Participant 7). “But we've also wanted to improve our traceability program in order to back up our content claims around sustainability. So what that means for us is for each of the materials we source, especially the preferred materials, we want to ensure that we have evidence to back up the sustainability claim. So, for organic cotton, for example, we require all of our suppliers from the farm through to the finished product to be certified either to the organic content standards (OCS) or to the global organic textile standards (GOTS), […]” (Company G Participant 10). “Let me start with the traceability. I would say that we're motivated and working towards that because it fits into a total product lifecycle management approach, which is the desire of our customers and consumers. On scorecards and reports and dashboards and corporate level or and goals and things that an element of traceability is essential in order to be able to answer the appropriate scorecards” (Company B Participant 2).</td>
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<td>Paying premium for the right products</td>
<td>“I think to make sure that what we're paying for is happening, but then, also for the consumers if a consumer questions like, how do you know this is happening. We want to be able to have evidence to back it up and not be guilty of false claims and make sure that even just to ensure that the customer is getting what they're paying for and also what we're paying for is actually the truth and happening” (Company G Participant 9). “So, it's due diligence in a number of different ways, but that was the goal. The idea of, we need to provide this information to customers. We need to collect this information because it is required of us and it's the right thing to do. Also, it helps us to make sure that we're getting what we wanted to get, so if we are paying a premium for recycled material, we want to make sure that we're getting that material as well (Participant 10).“</td>
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<tr>
<td>RQ#2</td>
<td>Internal reasons for traceability</td>
<td>Identifying supply chain risks</td>
<td>-</td>
<td>“Internal forces are as a company, we want to raise I mean we want to increase our bottom line, and we want to get a better return to our shareholders. And to do that, we have to make sure that we are managing all the risk that is exposed to our business and supply chain, and we are mitigating those risks actively. […] And so clearly, traceability is one of those things, so we need to know where our supply chains alone get to and what kind of problems those areas face. […]we have more than 700 tier 1 factories and thousands tier 2 factories. To know where they are working, how they are working and what kind of risk they are exposed to and then how do we mitigate those, so that’s one of the key internal reasons why we do traceability” (Company D Participant 5).&lt;br&gt;“Our motivation is not a singular motivation; one is simply to know our supply chain more deeply is always a good practice. So I think a lot of brands have been fairly confident in their tier 1 tier 2 supply chain and less so in their tiers down” (Participant 4).</td>
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Table E3. Illustrative Quotes from Interviews of RQ#3

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<td>RQ#3</td>
<td>Technology used for transparency</td>
<td>Technology used for transparency</td>
<td>-</td>
<td>“We have an interactive map on our website, [...]. I think, since 2013 publicly available on our website” (Participant 4), “And then that's the information that would go on to our website for providing transparency, so it doesn't require sophisticated technology in that sense it's fairly analog in a way” (Participant 10), and “I'll get back to AI that we are thinking of using the QR code and communicating that information” (Participant 5).</td>
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<td>“We're piloting this year a QR code, so a digital label on the back, the neck of some of our garment styles where it could if a consumer scanned it, tell you all the information about that product, so it could tell you the content of the products, etc. In addition, it could show you all the way through the supply chain where the origins of that garment and eventually could even link to a footprint regarding the sustainability metrics of that product” (Company A Participant 1).</td>
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<td>“We published our list of tier one factories on our website.” (Company H Participant 11).</td>
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<td>“We are working with the Higg Materials Sustainability Index (MSI) to create impact scores for our fabrics on requests from our customers” (Company F Participant 7).</td>
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<td></td>
<td>Technology used for traceability</td>
<td>Technology for tracing products</td>
<td>Oritain</td>
<td>“We conduct other verification of our material and including using novel technology such as Oritain which can test the origin of the farming of that cotton” (Company G Participant 10).</td>
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<td>“As I mentioned, we've also been using some novel tracing technology such as the Oritain tool, which isn't so much about tracing as it is just testing fingerprint of origin (Company G Participant 10)</td>
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<td>“We determined that Oritain made sense for us because it can test any product at any point, and it provides a certificate of origin whereas, as the digital traceability, it’s a whole different ballgame” (Company F Participant 8).</td>
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<td></td>
<td>Other technologies</td>
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<td>“I would say, and we are not alone, that the ability to systematically trace and record those tracing efforts is in its relative infancy. And we are actively and aggressively looking at how we can enhance our systems to be able to better manage these issues traceability. But it's very complex, and it, especially when you go down to a product level, gets very complex very quickly and so. The systematic way of managing this, I do believe is its relative infancy. [...] I would say we're aware of some of those technologies out there, so in my opinion, I think blockchain of some sort will have to be part of that technology scheme” (Company B Participant 3).</td>
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<td>“You know there is a lot of technology out there; more and more technology providers are offering up traceability systems and chain of custody systems, so we are exploring a bunch of different options. [...] there is some blockchain technology out there. I think that is gaining some momentum. So currently, I think along with many other brands we are exploring a technological platform or platforms to help with that effort” ( Company C Participant 4).</td>
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<td>We don't currently use it and blockchain; we are exploring other online platforms for collecting documentation, certification documentation, etc. The challenge for us, I think, is the blockchain hasn't yet been proven to be something that could be rolled out across many different fiber supply chains. [...] But for us very key part of the information would be the farm level. To my understanding, at least, the blockchain hasn’t yet been rolled out to an extent that it would be easy for a farm or a gin. Still, it's not something that I think it's not the silver bullet, that it is intended to be” (Company G Participant 10).</td>
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<tr>
<td>RQ#3 Technology used for traceability</td>
<td>Technology for tracing social aspects</td>
<td>Other technologies</td>
<td>“We have talked to a whole bunch of these system providers, and we are still deciding which would be our best partner. The other thing I would say is that we have yet to find one that sells both supply chain transparency system and a product traceability system. So, you have great providers, I can talk about source map and TextileGenesis those are really different providers in mind. One will provide you with traceability of the material, and the other will provide you with supply chain traceability; we have yet to find one, and so far that does both perfectly. Sadly, I think we may have to have two systems. We have not landed on a provider” (Participant 4).</td>
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<td>“There is some basically a big challenge and hiccup out. I would say that no matter how good you are in technology, whatever breakthrough you bring, or whatever AI or blockchain solution you are building here, it’s always going to be an uphill battle and challenging to trace information of a cotton farmer who sitting in Tamil Nadu. […] not of the tier 1. I am talking about tier 3, 4, 5. I am talking about small farmer who sitting in Nigeria. Does he have a computer, can you connect to my portal, can you provide all of his information, […]? That’s something like those technologies are coming very promising quite good in tier […] but it’s not exhausting” (Company D Participant 5).</td>
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<td>Fiber certifications standards</td>
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<td>“For Organic Cotton, for example, we require all of our suppliers, and which requires all the supply chain from the farm through to finished product to be certified either to the Organic Content Standards (OCS) or to the global organic textile standards (GOTS). Either of those two would work for us, and we also require tracing transaction certificates for every purchase that we make” (Company G Participant 10).</td>
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<td>Technology for tracking environmental aspects</td>
<td>-</td>
<td>“I think we use various standards regarding traceability, so we are not just saying, hey this is organic cotton, or this is responsible down. We generally align with a globally recognized standard, and I think to a large extent, we rely on that standard to be the benchmark that it would be. Company C saying this is responsible now we would say this is responsible down based on the responsible down standard which is run by textile exchange which is control union. So I think that’s really the key to it when it comes to traceability […] so that’s why I think we rely on those standards to be that part of it” (Company C Participant 4).</td>
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<td>“What we do as a company would acknowledge that a mass balance system around cotton does not check the box and satisfies traceability requirement. But we're also familiar, though, that you know the US cotton trust protocol is a tool out there that's going to enhance traceability (Company B, Participant 2).</td>
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<td>“We also try to obtain traceability for recycled material it's not to the same degree, because there aren't the same drivers, as there are for cotton. But it's an important material for us in terms of our portfolio it represents quite a lot, because a lot of our products are technical, alpine mountain climbing and skiing snowboarding etc. So, we do need to back up our content claims and we do that through third party certification mostly and those systems have traceability built in them” (Company G, Participant 10).</td>
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"I would have to point back to the tools we’re using through ZDHC like creating the in check reports for effort against the manufacturing restricted substances list (MRSL) and then Higg modules for environmental. […] Then the software we use to generate in check reports is called clean chain, and the clean chain has dashboards for us where we can see how many products out of our company are confirm it with the MRSL which facilities are generating and check reports where they stand in terms of their progress towards 100% conformance. We use all of that data on monthly basis and then Higg modules our annual, so the facilities enter their information once a year and then have it verified by a third party” (Participant 8).
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<td>Technology used for traceability</td>
<td>Technology for tracing social aspects</td>
<td>-</td>
<td>“For traceability, we are also in the last couple of years began requiring our suppliers to sign a vendor code of conduct which is also aligned with the ILO standards to make sure that we are sourcing from responsible companies” (Company F Participant 7).</td>
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<td>Technology for tracing overall SC</td>
<td>-</td>
<td>“I believe we met with FiberTrace when they started a year or two years ago and did not end up working them. We have not looked any more seriously into adopting one of those programs yet, because being in the middle of the supply chain we would need participation from raw material suppliers and our customers to make it sense. Because for us it relies on the raw material originator being part of the program too. So, anything that we adopted we would have to push down to our suppliers, and it adds an extra layer […]” (Company F Participant 8). “But in terms of technologies and analytics and effort, I would say that there is a lot of AI-based solution, a lot of blockchain-based solution that is emerging in the apparel industry, and we are trying all of them. But at the same time, we're also trying to see some of the low-tech solutions that we can work with until the big technology breakthrough is scalable and ready for the industry. So, in how we are trying, some low tech simple processes to trace and track and work with it, but also to match the industry speed, we are trying some blockchain and AI-based solutions to see if they can really bring the solution as the promise” (Company D Participant 5). “Our supply chain is fairly small enough that we don't really need to rely very much on online platforms to map our supply chain. Particularly for tier 1 and tier 2 we've already gotten that which is the information that we tend to provide anyway. We don't really mean to be using any kind of sophisticated platform for that we do. […] We also tend to use our invoicing system for collecting documents” (Company G Participant 10). “For traceability, that is something we're still doing pretty manually. So, we collect the information from our suppliers and manually manage it in excel. We do use a database called Salesforce to manage our traceability efforts, but we haven't landed on a solution just yet” (Company H Participant 11).</td>
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<td>Evaluation of transparency</td>
<td>Relied on external systems</td>
<td>“I would imagine that it is sometimes it's about NGO ranking. How are we scored according to different NGOs who use publicly available information? They base everything off publicly available information that's an important metric for us internally. Other than that, I don't know if there are other ways that we measure this or not.” (Company G Participant 10).</td>
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<td>No KPIs</td>
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<td>“So, evaluate the success of our transparency efforts here, I would say we're still developing that. We haven't completely defined success. […] So, I would say we're still developing that. But like more so from the lens of how we do kind of unlock that the I think internally or even building milestones to ensure that we deal with all the data we have”(Company A, Participant 1). “To be perfectly honest, we don't really have a KPI associated with it. At this point our factory list is all of our factories that we produce Company H proprietary products at, and that's really when we publish it quarterly. And that's kind of what we're that's it we don't really have a KPI for transparency at the moment” (Participant 11). “We do not have any KPIs specifically for transparency” (Company F Participant 7).</td>
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<td>RQ#3</td>
<td>Evaluation of traceability</td>
<td>KPIs</td>
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<td>“We do not have any KPIs specifically for traceability. The KPIs that we are tracking there are our emissions total, so we are trying to align those with our science-based targets goals. For greenhouse gas reductions, we are committed to a 25% water use reduction by 2025 with the 2016 baseline, so we are tracking reductions there as well and then with recycling just the KPI is improving the like waste reduction. So, […] the KPIs would be the ZDHC improvements […] And then for with Higg modules just achieving a better score each year is the KPI […]” (Company F Participant 8).</td>
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<td>“I would say if you are able to fully understand your supply chain back to a level 2 to a tier that you are confident in your inputs that I think you probably are being successful there is no external measurement of that in my mind that would say that you have successful not successful or any real metrics. […] if you got to withhold release order from customs and border protection you were not able to document your supply chain of custody in such a way that they released your product. I would assume that will be another measure of success” (Company C Participant 4).</td>
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<td>“Essentially, making sure that any claim we make, we can back it up and say that's, the most important thing. What is the percentage of our products that we have a document to back up our sustainability content claim for and how do we look at that, in terms of the fibers themselves because that's really how we would break it down, how many of our Organic Cotton. Products actually have a document backup how many recycled, how many down how many wool and then the goal is to ever increase that till you get” (Company G, Participant 10).</td>
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<td>“The percentage of your volume that you can actually trace that you have documentation to support. […] The KPI would be the percentage of tier 1 tier 2 tier 3 tier 4 take it all the way back suppliers, that you disclose” (Company B Participant 3).</td>
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<td>“Let's say our suppliers are able to adapt to it really fast, and it's not creating a lot of workload for them. I think that's what this one of the key KPIs that we look for” (Company D Participant 5).</td>
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<td>Communication</td>
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<td>“Maybe I have talked a little bit about our external facing transparency map and all that a lot of information we put in our corporate stones build the report we do an annual report every year. We also have a website which does with details a lot of this information” (Company C, Participant 4).</td>
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<td>“I would say that we provide a lot of information on our website on how we source on our standards. On our initiatives for improving either social or environmental performance, […] As I mentioned, the supply chain transparency around products and where materials are made, and finished goods are actually produced and then in any kind of our reporting that we do through our participation in different organizations or any kind of communication marketing that we do regularly we send out some information to our customers and you know is basically highlighting our initiatives and where we are now how we have done so far. (Company G, Participant 10).</td>
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<td>“We're disclosing kind of all of the required information, maybe a little extra that means country of origin, size, content, we're displaying that in 27 languages, I believe on our tags right now. That's what the consumer could easily and readily accessible. What we want to see is what else can we unlock for that consumer, especially through a digital unlock? So what else can we unlock instead of a printed hangtag or a printed label sewn in, given the fact we do it digitally? (Company A Participant 1).</td>
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<td>“We published our list of tier 1 factories on our website. So that's what is published publicly” (Company H, Participant 11).</td>
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<td>“Because we are a tier 2 manufacturer, we do not really have our products listed online because we are business to business, we are not business to the consumer we don’t have any digital e-commerce or anything like that. […] What end consumers could obtain from us through the initiatives we are undertaking? We are working with the Higg materials sustainability index to create impact scores for our fabrics on requests from our customers, brands and retailers. Then, they could build that data into their final product to give consumers the like emissions created from that product, the water used.” (Company F, Participant 8).</td>
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Table E4. Illustrative Quotes from Interviews of RQ#4

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<tr>
<th>RQs</th>
<th>Topics</th>
<th>Sub-themes</th>
<th>Illustrative quotes from interviews</th>
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| RQ#4      | Importance the transparency and traceability efforts | Priority for transparency efforts | “It is an important part. I mean, I don't know how to quantify that for you. But I know that it's been something we've done for a long time, and I think we were an early adopter of providing that information to customers” (Company G Participant 10).  
“I'll probably refer to the discussion that we start with, why transparency and traceability are possibly the core and fundamental of our cooperation. And this is something I mean; we're in the age that this is something you cannot ignore. […]. And, of course, you embed those information into your strategic decision making. If tomorrow will be working in Brazil or not, and tomorrow will be sourcing from Romania or not. Those decisions are definitely connected with transparency” (Company D Participant 5).  
“There's a clear recognition that we've got to be more transparent every day on what we're doing in this space. We've got a commitment to being far more transparent than we were 10 years or 20 years ago. And this is why we developed XXX (pseudonym of the website) sustainability website to begin with, with is to significantly enhance our overall transparency across a range of sustainability issues” (Company B Participant 2).  
“It fits in with our manufacturing and corporate responsibility strategies. I don’t know if it would be if you look at Company C’s overall strategy; I don’t think it’s probably one of the key strategies. But I think when you talk about manufacturing and talk about corporate responsibility, it’s definitely key strategies” (Company C, Participant 4).  
“Transparency is particularly like when we talk about how we engage with our suppliers and factories is a really important aspect. Because we feel that our relationships are really important part of our supply chain strategy. When you hear our kind of our supply chain talk and really anybody in our company that’s are we really view our supplier relationships like not as transactional it's kind of an important tenant of our business that business is personal. […] (Company H Participant 11).  
“I would say it absolutely affects the suppliers that we work with. The product that we source has less impact. I would say transparency is critical for all factory choice, raw material factory choice but not necessarily the product. I think transparency and our supply chain are critical, and we partner with factories that perform well in many areas, and one of them will be transparency. Transparency means a lot of things; it would be open access to their facilities, open this around a lot of different areas absolutely” (Company C Participant 4).  
“If they are not being transparent with us and show documentation, we will not work with them, so it's required that very high levels of transparency” (Company G Participant 10).  
“Definitely when we work with our supplier’s kind of going back to that transparency piece. Like if we're working with a supplier and we asked them for supply chain information, and they're unwilling to give it, that will have an impact on our relationship” (Company H Participant 11). |
Table E4. Illustrative Quotes from Interviews of RQ#4

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| RQ#4 | Importance the transparency and traceability efforts | Priority for traceability | Importance of traceability in product sourcing | “As we continue to implement traceability standards further and further back in our supply chain over time, it will be part of the requirements of doing business with us. So again, I would say, as a general rule, when we implement a requirement, our expectation is that requirement is satisfied, and if it’s not, we won’t do business with you” (Company B Participant 3). 

“It’s a very big deciding factor because we pretty much only use nominated inputs, so if they're not able to provide the traceability for it, then we won't do business with them. If we're going to work with the supplier and also for specific materials that we may be sourcing, it's demanded for whatever the claim is of the material that the traceability paperwork be right, or else we nor buy it” (Company G Participant 9). 

“I think where we are now is still highly driven by cost. But it’s all really based on what our customers, the brands and retailers are looking for and like their initiatives on it. Because if they say we need a higher volume of recycle content standard (RCS) certified polyester fabrics we are going to go out and look for as much of that RCS certified fabric is as they want. But it’s sort of like a push poll as far as the demand for it goes ultimately cost is still our highest driver. But the traceability pieces of it’s like if it does not have to be certified recycled, then we probably would not look for specifically certified recycled product” (Company F Participant 7). 

“I don’t know that it would have a huge impact on the products that we sell. I think we make products based on how we meet the needs of our customers and the needs of our market, and things like that, and obviously, things happening in the supply chain might impact our decisions. But I think that has less to do with traceability” (Company H Participant 11). |
| Plans (short or long term) | | | | “I think, in the short term, we're focusing more on tier two and the textile mills. Especially in the remaining 30% that we're contracting out and that that's probably the short-term concentration, the long term is a very detailed ability at a product level. To understand where all of the components of that product came from and be able to document it and potentially talk about it publicly” (Company B Participant 3). 

“I think finding a robust system provider would be a strategy in the short term. But I think secondarily would be to find a traceability provider. First of all, product of visibility into the country is probably a key because no one wants to get withheld from the US government, so that’s probably a first priority. And I would see a second priority would probably be a system that’s more on external traceability it’s I think the important but probably short term” (Company C Participant 4). 

“The short-term plan would be to continue to work with our vendors on tracing or complying with all the certifications. Like if it’s a recycled polyester, we need to have proof that it was a recycled polyester through GRS or RCS verification. In long-term transparency, we would like to be able to track every fiber down to its origins in our supply chain, like knowing where all of our polyesters are coming from, if it's recycled bottles, and where was the bottle collected. And what was the process for it if cotton ensures that, again it's where every field is?” (Company G Participant 9) 

“So, I would say most of our strategies would be classified as a near term within the next two to five years because the goals that we have for sustainable fibers are 2025. We are looking to meet those” (Company F Participant 7). |