Utrecht University

Master's Thesis – Master Sustainable Business and Innovation

"Preparing in the Light of Uncertainty: How Textile Companies respond to New Regulations on the Digital Product Passport"

Master Thesis

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Abstract

European regulations are pushing for the implementation of a Digital Product Passport (DPP) to enhance transparency, circularity, and sustainability in different sectors, including the textile industry. This mandated information disclosure is a response to the textile industry's complex supply chains and should help mitigate its growing negative environmental and social impact. The DPP provides comprehensive data on products' origins, composition, and impact. This study aims to investigate how companies in the European textile sector perceive and respond to the upcoming DPP regulations characterised by regulatory uncertainty. The qualitative study of 16 semi-structured interviews with industry stakeholders revealed four different archetypes of companies, namely Enthusiastic Pioneers, Proactive Planners, Cautious Strategists, and Confident Procrastinators. Those types demonstrate different strategic responses and adoption strategies to the DPP. The findings illustrate that while some companies perceive the DPP as an opportunity to innovate and strengthen sustainability efforts, others remain hesitant, referring to challenges concerning data management and resource requirements. Some companies have started actively engaging with the DPP, either positioning themselves as pioneers in its implementation or taking precautionary steps to ensure they are fully prepared to comply with the upcoming regulations. In contrast, other companies apply a wait-and-see approach, confident in their ability to react when necessary. While the studied sample generally shows a positive and proactive attitude towards the DPP, the research indicates that many companies outside the sample investigated are rather sceptical and passive in their behaviour. Regulatory uncertainty builds a major challenge, affecting companies' strategies and planning. Policymakers are advised to provide clear guidelines while offering supporting resources and information. Companies are encouraged to engage proactively in industry collaborations and early compliance efforts. Future research should focus on broader cross-industry comparisons and longitudinal studies to analyse the adoption process and potential shifts in the four archetypes resulting from the final regulatory enforcement. This thesis contributes to the literature on regulatory uncertainty and innovation adoption, offering recommendations for companies and policymakers to navigate the transition to the DPP effectively.

Keywords: Digital Product Passport, DPP, Textile Industry, Regulatory Uncertainty, Strategic responses, Innovation adoption, Implementation Strategies

Contents

Abbreviations

AGEC	Anti-Waste for a Circular Economy
B2B	Business-to-Business
BCI	Better Cotton Initiative
BNW	Bundesverband Nachhaltig Wirtschaften
CIRPASS	Collaborative Initiative for a Standards-based Digital Product Passport for Stakeholder-Specific Sharing of Product Data for a Circular Economy
CO2	Carbon Dioxide
CSR	Corporate Social Responsibility
CSRD	Corporate Social Responsibility Disclosure
C	Company
DPP	Digital Product Passport
DOI	Diffusion of Innovators
E	Expert
EC	European Commission
EP	European Parliament
GHG	Greenhouse Gas Emissions
IEC	Electrotechnical Commission
ISO	International Organisation for Standardisation
LCA	Life Cycle Assessment
PwC	PricewaterhouseCoopers
SME	Small and Medium-sized Enterprises

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1. Introduction

In recent years, there has been increasing criticism directed at the textile and fashion industry concerning its environmental and social sustainability (Niinimäki, Peters, Dahlbo, Perry, Rissanen & Gwilt, 2020; Thorisdottir & Johannsdottir, 2020). This growing awareness of the industry's negative impacts can be found not only on the side of the consumers but also in the political sphere. Key environmental concerns include the industry's significant contribution to climate change, greenhouse gas (GHG) emissions and the loss of biodiversity (McKinsey & Firm & Global Fashion Agenda, 2020). Additionally, critics point out poor working conditions in the industry (Köksal & Strähle, 2021). The lack of transparency and traceability in supply chains and manufacturing practices additionally hinders efforts to address these issues effectively (Jordan & Rasmussen, 2018).

To facilitate the transition of industries such as the textile industry towards a more sustainable economy, the European Commission (EC) suggests the Digital Product Passport (DPP) as a functional solution (Götz, Adisorn, Berg, Chowdhury, Cembrero, Jansen, & Markkanen, 2022). After the EC proposed the legislation, the European Parliament (EP) engaged in extensive research to ensure that the regulations effectively support traceability, circularity, and transparency for all stakeholders in the European textile sector (EP, 2024).

The DPP serves as a digital policy tool, that is designed to offer comprehensive documentation on various aspects of a product. This includes information on its origin, supply chain, composition, potential for repair and disassembly, as well as recycling or disposal guidelines. The aim is to facilitate product-related information sharing among supply chain entities, regulatory bodies, and consumers (Ducuing & Reich, 2023; Götz et al., 2022). Beyond its informative role, the DPP's digital information system promotes the adoption of circular economy strategies and empowers consumers and businesses to make well-informed decisions through enhanced traceability and transparency across the entire product life cycle (Götz et al., 2022; Solita & Gaia Consulting, 2022). Experience with the DPP implementation in other industries, like the battery industry, shows that the DPP can support the goals of circularity and digitalisation (Berg, Bendix, Jansen, Le Blévennec, Bottermann, Magnus-Melgar, & Wahlström, 2021; Götz et al., 2022). Following the battery industry, the textile industry will be one of the next industries to introduce the DPP (EC, 2024).

The introduction of DPP legislation by the EC in the textile sector is expected to be completed by 2030. However, the details of its implementation in this industry are still unclear (Götz et al., 2022). The exact content of the DPP, its technical infrastructure, and its integration with other systems are

not fully defined yet (Berg, Guth-Orlowski, Kulinna, Porepp, Stöcker, & Thiermann, 2022; Jansen, Meisen, Plociennik, Berg, Pomp & Windholz, 2023). Furthermore, it is unclear whether different DPPs tailored for various stakeholder groups containing case-specific information are planned. Alongside these uncertainties, other concerns arise, regarding the implementation of DPP. The innovations' implementation comes with challenges such as data management and technological integration (Götz et al., 2022). Resulting from those challenges, the industry response towards implementing the DPP is unclear.

Given the dynamics surrounding DPP regulations, its implementation in the textile industry offers an interesting case for further investigation. While various studies have explored uprising regulations and developed response and implementation strategies for companies (Engau & Hoffmann, 2011; Rogers, 2003), there has been limited research on how companies perceive and react in the exact period between the first announcement of regulations and before its final enforcement. Although the attention on the DPP and its surrounding uncertainties is rising (Jansen et al., 2023), there is a lack of academic studies regarding this topic, given the complexity and emerging nature of the circumstances (Lehtisalo, 2023). The main aim of this research is to examine the experience, preparation, and planned implementation strategies of companies operating in the European textile industry in response to the upcoming DPP regulations. To fill the identified gap in the present literature and contribute to the ongoing discourse about the DPP, the following research question with two subquestions was formulated:

How do companies in the textile industry respond to the upcoming mandated change concerning the Digital Product Passport?

SQ1: How do companies in the textile industry experience the mandated change and its underlying uncertainties?
SQ2: What different response and implementation strategies can be identified among these companies?

By conducting semi-structured interviews, the companies' experience of the situation is investigated, and their preparation for the upcoming changes is analysed. Different archetypes of companies' responses are identified based on the introduced literature and the collected data. This classification supports companies in refining their strategies to be able to adapt to upcoming regulations and equips policymakers with valuable insights into companies' response strategies.

The study's insights can be transferred to future uprising environmental regulations. They provide a foundation to understand companies' behaviour within regulatory uncertainty and towards mandated change. This thesis contributes to practical applications. It highlights the necessity for clear regulatory guidelines and support to help companies navigate the evolving landscape of environmental regulations. Insights into how companies and policymakers can prepare for the DPP implementation are given, highlighting the necessity for clear regulatory guidelines and industry collaboration. Understanding companies' behaviour is an important part of a successful transition towards transparency and traceability and creates important insights for the textile industry but also implications for other sectors facing similar challenges. Overall, these insights support a successful integration of environmental regulations. The study aims to provide actionable recommendations to guide policymakers and businesses in navigating this regulatory change.

2. Theoretical Background

This chapter provides the theoretical background for this master thesis. It gives an overview of the current dynamics surrounding the planned DPP implementation in the textile industry and characterises the type of change the DPP imposes on firms. The theories of innovation adoption, regulatory uncertainty, and companies' strategic responses to those, are introduced. Those theories provide classifications of companies within different focus areas, supporting identifying and analysing various company responses towards the DPP. The chapter concludes with a conceptual framework summarising the relevant concepts used to answer the research question.

2.1 The Digital Product Passport

The Digital Product Passport aims to electronically register, process, and share information related to products. It encompasses details on product components, origin, environmental and social impact, as well as repair and disassembly possibilities (Götz et al., 2022; Jansen et al., 2022). The European Parliament (2024) gives the following definition of the DPP:

"DPP is the combination of an identifier, the granularity of which can vary throughout the lifecycle (from a batch to a single product), and data characterising the product, processes and stakeholders, collected and used by all the stakeholders involved in the circularity process."

The DPP is a product-specific data set, which can be accessed through scanning a data carrier (EC, 2024). The gathered information can be provided across the supply chain to enable repairs and recycling, inform consumers, and assist public authorities with checks and controls (EC, 2024; EP 2024). It gives the possibility to improve communication between all actors along the supply chain (Adisorn et al., 2021). The DPP aims to promote the adoption of circular economy strategies and increase transparency (Götz et al., 2022).

The DPP is part of the Ecodesign for Sustainable Products Regulation (ESPR), which entered into force on 18 July 2024 and guides as the foundation of the Commission's approach to more environmentally sustainable and circular products (European Union, 2024).

2.1.1 The Case of the Textile Industry

The textile industry is a crucial case for the implementation of a digital solution to enhance traceability and transparency (Ahmed & MacCarthy, 2021; Papú Carrone, 2020).

The industry encompasses a wide range of firms involved in the design, production, and distribution of clothing, accessories, and footwear. It faces significant challenges regarding sustainability caused by the negative environmental and social impacts of current fast fashion business models and overconsumption (Cura, Sheenam & Niinimäki, 2022). Critics mainly point out wasteful and polluting practices such as the usage of non-renewable resources, the engagement with harmful chemicals, significant water and land usage, as well as their pollution (Ellen MacArthur Foundation, 2017). Due to the rapid growth of fast fashion, these challenges become even more significant (Cura et al., 2022). Consequently, there is an urgent need for the industry to find solutions and transform towards more sustainable practices to mitigate its environmental and social impacts. Part of this transition is to enhance traceability and transparency throughout textile supply chains (Adisorn et al., 2021). The introduction of the DPP in Europe provides the textile industry with a framework to support this and obliges companies to act (EP, 2024). It complements existing regulations, such as the Anti-Waste for a Circular Economy (AGEC) law in France, which aims to reduce waste and promote a circular economy through stricter regulations on product life cycles (EP, 2024). The AGEC law aligns with the DPP's objectives, it mandates environmental labelling and waste reduction targets for textiles and reinforces a comprehensive approach to achieving sustainability in the textile industry (European Union, 2020).

2.1.2 DPP in the Textile Industry - What is Known

Publications of the EC (2024) and the EP (2024) and related projects such as CIRPASS (Collaborative Initiative for a Standards-based Digital Product Passport for Stakeholder-Specific Sharing of Product Data for a Circular Economy) provide a first foundation for the proposed implementation steps and strategies for a DPP in the textile industry. The CIRPASS project was initiated by the EC to support the implementation and create a clear concept and understanding of the DPP (CIRPASS, 2024). The project was finalised in March 2024 and set a base for the deployment of the DPP. It included roadmaps for prototypes in the electronic, battery and textile sectors. The follow-up project CIRPASS-2 was introduced to demonstrate DPP functioning in real settings and use cases. CIRPASS-2 will be finalised in April 2027 (CIRPASS-2, 2024).

The **deployment** of the DPP is planned in three phases. Phase 1 involves implementing a "minimal & simplified DPP" for textiles by 2027. This DPP primarily focuses on required information and additional details supporting lifecycle analysis (EP, 2024). Phase 2 extends to additional stakeholders and information resulting in an advanced DPP by 2030. Lastly, Phase 3 aims to deploy a full circular DPP by 2033 (EP, 2024).

The overall **aim** of the DPP in the textile industry is to facilitate data sharing among stakeholders, including supply chain firms, retailers, authorities, and consumers to promote circularity and sustainability. The EC identifies eleven categories of possible aims and contributions such as informing consumers and firms, managing resource flows, promoting circularity and product end-of-life management (EC, 2024).

Regarding its **content**, the DPP intends to contain information on product description, composition, supply chain details, environmental and social impact and more, divided into both private and open-access data (EC, 2024).

On the **technical** side, a decentralised system is intended. Each product will receive a unique identifier, and have a durable, scannable data carrier such as a QR code or digital watermark. A link will connect the physical product to its digital information. The information technology will build on standardised protocols and formats for the exchange of data (CIRPASS, 2024). The European Commission defined a first version of a generic model of DPP, which is displayed in Figure 1.

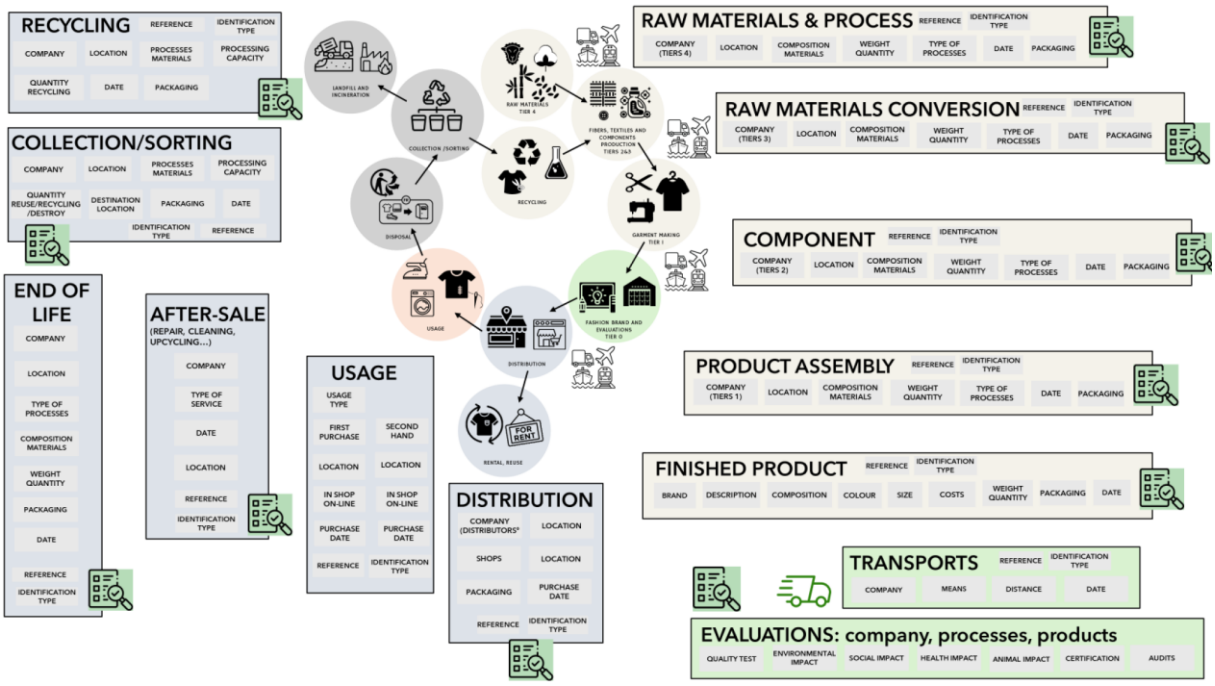

Figure 1 Generic Model of DPP (EC, 2024)

2.1.3 DPP in the Textile Industry- Remaining Unknowns

Despite this first version, there are still many unknown aspects surrounding the implementation. Uncertainty arises regarding the concrete **content** of the DPP. It is unclear if there will be different

types tailored for various stakeholder groups. This could be required, as those groups have different needs and levels of comprehension. On a customer level, the provided information could be more explanatory and consultative, while administrational information would need to be more comprehensive (Götz et al., 2022).

As regulations are going to be established at the European level, navigating **global partnerships** presents challenges, for instance, how the information requirements regarding partners from outside the EU will look (Götz et al., 2022). This is highly relevant in the textile industry, where parts of the supply chain are commonly located outside of Europe (Girneata & Dobrin, 2015).

Since the DPP expects firms to publish product-specific data, concerns about **intellectual property protection** arise. Regulations regarding data governance and protection, as well as anonymity measures, become necessary to retain competitive advantages. However, yet no clear instructions are present (Berg et al., 2022).

Regarding the **technical requirements,** the underlying software systems are still unclear (Jansen et al., 2023). Furthermore, the interconnection and seamless exchange of information across different systems, thus the DPPs interoperability poses challenges (Berg et al., 2022).

From a **regulatory organisational** perspective, the management of the DPP encompasses difficulties. Who is going to oversee the publicly mandated systems is not decided yet. The responsible parties and mechanisms on a European and national level must be determined (Götz et al., 2022). Additionally, to this point, no information is given on reactions regarding possible disregard.

Table 1 provides an overview of both the known aspects and remaining uncertainties surrounding the implementation of the DPP in the textile industry.

Table 1 Textile DPP- Known & Unknowns (Based on Paragraph 2.1.2; 2.1.3)

Category	Known	Unknown
Objective	**11 categories of aims:** Promote Traceability and Circularity, Transparency, Consumer Education, Information Exchange, Informing Consumers and Firms, Managing Resource Flows, Product End-of-Life Management	
Implementation	**Three phases of employment:** "Minimal & simplified DPP" by 2027 "Advanced DPP" by 2030 "Full circular DPP" by 2033.	Regulatory Organisational Management: Responsible Parties (on a European and National Level) Possible Penalties in Case of Disregard
Content & Stakeholder	**8 identified categories of stakeholders:** Supply chain firms, Brands, Retailers, Authorities, Certification and Assessment Firms, Circularity Operators, Media, Consumers **16 identified content categories:** Product Description, Composition, Supply Chain, Transportation, Documentation, Environmental Impact, Social Impact, Impact on Animals, Circularity, Health impact, Information on the Brand, Communication/Identification Media, Granularity, Quantity, Costs, Tracking and Tracing after Sales, Customer Feedback	Requirement of tailored DPP for various Stakeholder Groups Unclarities regarding Global Partnerships outside EU Borders Concerns regarding Intellectual Property Rights Protection
Technical Aspects	Unique Identifier per Product Durable, Scannable Data Carrier Standardised Protocols and Formats for the Exchange of Data	Concrete underlying Software System to process, store and analyse, report the Data Interconnection and seamless Exchange of Information across different Systems

2.2 Characterising the type of Change the DPP represents for Companies

In the literature, various types of organisational change are discussed (Armenakis & Bedeian, 1999). Integrating the DPP will cause firms to change by implementing new and altering existing systems. Analysing this change for the textile industry is important since the response strategies of companies can differ depending on the type of change (Öner, Benson, Göl Beşer, 2014). The following section analyses the DPP's type of change as mandated information disclosure.

2.2.1 Mandated Change

Mandated or regulatory change describes a change required by law, legally constructed by local, national, and supranational authorities. Mandated change holds businesses accountable, for instance, for their environmental impact and imposes sanctions for non-compliance (Aragón-Correa, Marcus, Vogel, 2020). Such regulations can influence corporate environments, prices, and costs, as well as industry competitiveness, and foster research and innovation (Marcus, Aragón-Correa & Pinkse, 2011).

The concept of mandated change evolves as a response to market externalities, particularly negative ones, and aims to mitigate them (Field, 1997). It is highly relevant in the regulation of the sustainability performance of companies and found to have a significant impact on related efforts (Darnall, Henriques & Sadorsky, 2010; Kock, Diestre & Santalo, 2012; Testa, Iraldo & Daddi, 2018). This can be seen in the implementation of European regulations on sustainable reporting, which were found to have a critical influence (Simoni, Bini & Bellucci, 2020).

2.2.2 Information Disclosure

Information disclosure requires organisations to reveal information and guides as a response to asymmetric information (Fraas & Lutter, 2016). It also creates institutional pressure for performance improvement within the disclosed dimension (Doshi, Dowell & Toffel, 2013). Revealing relevant information regarding the company's sustainability performance can enhance stakeholder trust and credibility but presents challenges such as possible negative publicity (Chatterji & Toffel, 2010).

Studies indicate that regulated information disclosure motivates firms to improve their sustainability performance (Blackman, Afsah & Ratunanda, 2004; Li & Jia, 2022). To ensure accurate reporting, companies must monitor their supply chain operations, which requires specific strategic and

operational adjustments. It might raise barriers like data availability issues and the setup of reporting systems (Lehtisalo, 2023).

The DPP serves organisations as a system to reveal data about products' environmental and social impacts throughout their supply chain to stakeholders (Götz et al., 2022). It represents a novel approach to the tracking and sharing of detailed product information and emerges as a technology that is capable of bridging information gaps (Berger, Schöggl & Baumgartner, 2022). This involves adapting to new requirements and disclosures laid out by authorities and thus aligns with the concept of information disclosure.

This adaptation carries various challenges and barriers, such as resource provision for data availability and additional investments amongst supply chain partners to collect, store, transform and report required data. This might also result in an increased workload and financial challenges (Solita & Gaia Consulting, 2022).

2.3 Implementation Timing

As seen in the previous paragraphs, the DPP is still an emerging concept, hence a digital innovation, in the early stages of its market introduction (Koppelaar et al., 2023; Zhang & Seruing, 2024). To address the research question and examine companies' responses to the DPP, their implementation timing becomes a key aspect. The following chapter introduces classifications of companies' implementation timing.

2.3.1 Diffusion Innovation Theory

The Diffusion of innovation (DOI) theory by Rogers (2003) provides insights into how innovations spread within a social system and its adoption process within, for instance, companies. It gives a broad framework for understanding innovation by encompassing various elements, including the innovation-decision process, categories of adopters, perceived attributes of innovations, and factors like social systems, communication channels, and time.

One key factor of the DOI theory is **Time**, referring to different factors such as the rate of adoption, and individual innovativeness. As part of the innovation-decision process, five stages are identified, namely knowledge, persuasion, decision, implementation, and confirmation. For instance, within the persuasion stage, the innovation is evaluated to form an attitude toward adopting or rejecting it (Rogers, 2003). For this research the **adoption process** of the companies, thus the categories of

adopters are in the focus of interest. Concerning this adoption process, the theory describes five groups with different tendencies to adopt an innovation: the **Innovators**, **Early Adopters**, **Early Majority**, **Late Majority** and **Laggards** (Rogers, 2003). Those groups are categorised based on when they adopt an innovation and represent different levels of risk tolerance and timing in the adoption process. As Figure 2 shows, the distribution of adopters is very similar to the proportions of a normal bell curve (Rogers, 2003).

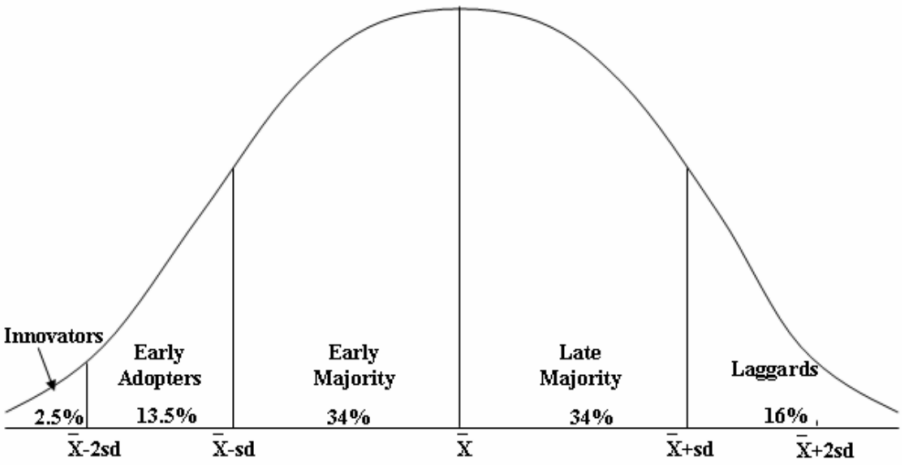

Figure 2 Adopter Categorisation Based on Innovativeness (Rogers, 2003)

The **Innovators** comprise the smallest proportion of adopters. They are technology enthusiasts with complex technical knowledge. Innovators are willing to experience new ideas and are described as visionaries and opinion leaders within the social system. They play a crucial role in initiating innovation projects. This type of adopter is characterised by its ability to manage uncertainty during the adoption process and to cope with unprofitable innovations (Roger, 2003).

Rogers (2003) describes **Early Adopters** as more limited by the boundaries of the social system compared to innovators. However, they still act as visionaries and opinion leaders and advise others about innovation. Early adopters' leadership in implementing the innovation reduces uncertainty within the diffusion process, as they effectively support the new idea through their adoption.

The **Early Majority** make up 34% of the distribution. They are pragmatic adopters who deliberate longer than the Innovators and the Early Adopters. Rogers (2003) states that they are neither the first nor the last to adopt an innovation. Their innovation decision takes more time, also including interaction with other members of the social system.

The **Late Majority**, representing 34% of the distribution, are more sceptical about innovations. They adopt only after the majority has already implemented the innovation, using the other adopters as reassurance of the innovation. Despite their scepsis, they are influenced by peer pressure and economic necessity, which may lead them to adopt the innovation. Interpersonal networks of trusted peers encourage the late majority to act (Rogers, 2003).

Laggards are the final category of adopters, typically comprising about 16% of the distribution. They are the most traditional group, highly sceptical about innovations. This group tends to be more cautious, often requiring significant social proof and reassurance before considering the integration of new ideas. Due to their limited resources and lack of awareness about innovations, they prefer to ensure that an innovation is effective before deciding to adopt it. Innovations are only adapted after their success among other members is ensured. This is explained by a lack of resources and awareness-knowledge of innovations. They are characterised by their resistance to change and to embrace innovations, which results in a relatively long innovation-decision period. Thus, they do not play a leadership role in the adoption process (Rogers, 2003).

2.3.4 Adoption Timing of the Innovation

Adoption timing plays a critical role in how firms position themselves, especially in contexts of systemic innovation and regulatory shifts (Huisman & Kort, 1998). This research zooms in on the early phase of innovation implementation, where the entire industry will need to comply with the new regulations but companies are still in the preliminary stages. In this phase, even the first trials by the **first movers** will likely be revisited and need to be reworked. Most initial DPP designs are still at different development stages (Zhang & Seuring, 2024). In this focused timeframe, the research examines the adoption timing of textile companies as they navigate the evolving regulatory landscape.

Companies facing the need to innovate still aim for a competitive advantage and need to navigate between competition, innovation and ongoing transition dynamics (Gerguri, Rexhepi & Ramadani, 2013). Thereby, different adoption timing can lead to various advantages and disadvantages (Lieberman & Montgomery, 1988).

First movers, such as the Innovators and Early Adopters, gain competitive benefits, like positive economic profits. They enter a market or introduce a product ahead of their competitors to obtain a first-mover advantage (Kerin, Varadarajan & Peterson, 1992). They can secure key resources, develop

proprietary learning, or create buyer switching costs, and thereby solidify their leadership (Lieberman & Montgomery, 1988).

Other companies decide for the approach to follow the first movers (Hockerts & Wüstenhagen, 2010), preferring to adopt a **wait-and-see** approach, avoiding the high costs and risks associated with early adoption (Endenich, Hahn, Reimsbach & Wickert, 2023; Querbes & Frenken, 2017). Those **late-movers** can benefit from reduced costs and risks by free-riding on first-mover investments and experience. Late-movers profit from reduced uncertainty as technology and market conditions become clearer, and they can take advantage of shifts in technology or changes in customer needs to better position themselves in the market (Lieberman & Montgomery, 1988; Querbes & Frenken, 2017). These late-mover advantages often present challenges for first movers, such as reduced flexibility in adapting to evolving market conditions. In the case of the DPP, this may occur when new regulations are introduced. Deciding for a wait-and-see approach carries the risk of intensified external pressure, and little time to act. This can lead to a necessary fast organisational change, that requires a high resource effort.

The adoption timing of innovation is shaped by firm-specific factors such as available resources, market perceptions, as well as past experiences and responses towards institutional pressure. It can vary depending on companies' incentives and innovation opportunities (Lee & Klassen, 2016; Wesseling, Niesten, Faber & Hekkert, 2015). The innovation adoption timing stands out as an interesting aspect to explore (Bohnsack, Kolk, Pinkse & Bidmon, 2020). For this research, it forms a key part of the analysis of textile companies' strategic responses to the DPP.

2.4 Strategic Responses towards Regulatory Uncertainty

This section examines companies' strategic responses to navigate uncertainty caused by regulatory changes. Hereby, the upcoming regulations are seen as an innovation, while uncertainty is one of the upcoming challenges within this innovation implementation. While the prior frameworks look at adoption timing in general, the following section introduces literature specific to regulatory uncertainty and the strategies companies employ in response to these perceived uncertainties. Regulatory uncertainty is a special type of change that can significantly impact strategic decision-making. Therefore the next section introduces a framework for understanding and classifying companies' strategic responses towards uncertainty in mandated change.

2.4.1 Uncertainty in Mandated Change

The DPP regulations are set to be effective between 2027 and 2033 (Götz et al., 2022), creating a **near future** transition period in which firms anticipate impending changes. However, as described in 2.1.2, many uncertainties arise regarding the regulations. **Regulatory uncertainty** refers to the perceived inability to foresee the upcoming regulatory circumstances (Hoffmann, Trautmann & Hamprecht, 2009). It has a great influence on organisational behaviour, as managers must start preparing to comply with regulations regardless of their realisation.

Environmental regulations are challenging to predict and coincide with uncertainty, involving long-term considerations and combining science and policymaking (Birnbaum, 1984; Van den Hove, 2000). This uncertainty poses challenges for firms (Bourgeois, 1985). Resources are needed to prepare for and adjust to uncertain regulations continuously. Additionally, decisions need to be made on how to respond and how those resources are going to be used. This influences the innovativeness and productiveness of firms and, thereby, their competitive advantage (Levy, 1997).

Similar to the DPP implementation, uncertainties have been observed in other mandated regulatory changes, such as the introduction of guidelines for Corporate Social Responsibility Disclosure (CSRD) and during the post-Kyoto Protocol time when firms had no clear information on the future developments of the regulatory outline regarding GHG emissions (Engau & Hoffmann, 2011).

2.4.2 Firms Response Strategies for Regulatory Uncertainty

In the literature, different contributions to analyse firms' response strategies towards regulatory uncertainty and mandated change can be found (Doshi et al, 2013; Hoffmann, Trautmann, & Hamprecht, 2009, Marcus et al., 2011). One specific research analysing those response strategies is the work of Engau and Hoffmann (2011). This study provides a suitable theoretical lens to analyse companies' behaviour in similar situations. Engau and Hoffmann examined firms' responses in the post-Kyoto circumstances, marked by high uncertainty after the end of Kyoto regulations in 2012 (Anger, 2008).

By developing a framework to analyse the response strategies of impacted companies, the study derives recommendations and support for managers making informed decisions in comparable situations. The central finding of the study consists of four strategic postures describing companies' responses, namely **Daredevils, Coordinators, Hedgers, and Gamblers**. Those four postures result from the connection of three overall strategies, namely offensive, defensive or passive, employed by

the specifically investigated companies in the airline industry (Engau & Hoffmann, 2011). Engau and Hoffmann connected the strategies with 13 approaches like for instance, investigation, stabilisation or integration, that are applied in response to regulatory uncertainty. They are further elaborated in Table 2. An overview of the framework can be found in Figure 3.

Table 2 Approaches Uncertainty adapted after Engau and Hoffmann (2011)

Approach	Strategy	Explanation
Investigation	**Offensive**	Systematically searching for additional information
Influencing	**Offensive**	Engaging in the policy-making process to contribute to the decision-making
Flexibility	**Offensive**	Preparing for more than one potential outcome of the policy-making process
Cooperation	**Offensive**	Joining forces with others, e.g., suppliers, customers, or competitors
Substitution	**Defensive**	Agreeing on the regulation scenario considered most likely and focusing on preparing for this scenario
Stabilisation	**Defensive**	Creating predictability, e.g., by negotiating contracts or long-term rules with other companies or the government
Imitation	**Defensive**	Observing the activities of other companies and following them if appropriate
Simplification	**Defensive**	Selecting specific issues in the business environment to focus on to simplify decision-making
Internal Design	**Passive**	Changing the organisational structure, e.g., by increasing decentralisation or lowering the degree of formalisation, to better deal with uncertainty
Withdrawal	**Passive**	Shifting business to markets probably not affected by a regulation
Integration	**Passive**	Rearranging the portfolio through mergers, acquisitions, or divestitures to be less exposed to regulatory uncertainty
Postponement	**Passive**	Postponing strategic decisions until there is more certainty
No-regret moves	**Passive**	Making only investments that have a guaranteed positive return regardless of the outcome of a possible future regulation

Companies employing an **offensive strategy** actively influence the sources of uncertainty and gather additional information to counter them without reducing their exposure to them. The offensive strategy involves flexible strategic options, possible adjustments, and the option to adapt to various scenarios resulting from the policymaking process (Engau & Hoffmann, 2011).

Within a **defensive strategy,** the focus is set on the execution of detailed analyses, the participation in long-term contracts to gain stability and the avoidance of direct confrontation with uncertainty. Companies frequently need to adapt their approach according to novel information or external circumstances (Engau & Hoffmann, 2011).

This becomes less relevant in the **passive strategy**, where the focus is set on enduring uncertainty with resilience. Companies adjust in such a significant way that they can operate independently of uncertainty and thereby aim to minimise its negative effects. These approaches involve postponing uncertain decisions, reorganising internal design, integrating business portfolios, or withdrawing from uncertain environments entirely (Engau & Hoffmann, 2011).

These three strategies are applied and combined by companies differently resulting in the four identified postures:

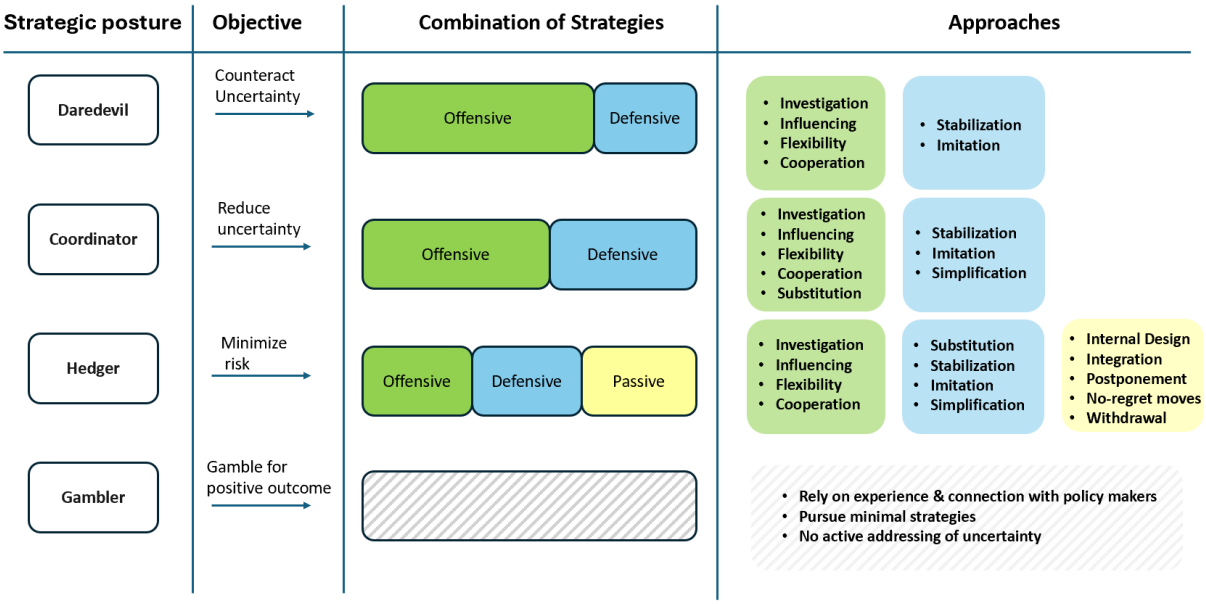

Figure 3 Strategic Responses to Uncertainty by Engau and Hoffmann, 2011 (Own Illustration)

Daredevils employ mainly offensive strategy approaches by primarily aiming to directly counteract regulatory uncertainty. Therefore, they make use of the approach investigation, also by forming

partnerships to develop a joined knowledge of the ongoing process and interact with policymakers to gather further information. The aim is to shape or influence the regulatory circumstances without reducing the exposure to uncertainty (Engau & Hoffmann, 2011).

The second type, the **Coordinators**, focus primarily on an offensive strategy but complement those with defensive elements to a greater extent than Daredevils. Those firms actively try to reduce uncertainty, by cooperating with other firms to collect information and influence policymakers. Defensive approaches can be found in safeguarding moves, such as imitating actions of competitors, and a focus on key aspects to increase efficiency and allocate resources more effectively (Engau & Hoffmann, 2011).

Firms adopting a **Hedger** posture combine all three strategies, creating a diversified approach. They identify regulatory uncertainty as unpreventable and aim to minimise the risks. Hedgers intend to increase their resilience by integrating new business areas or changing their internal design while simultaneously reducing uncertainty by hedging against potential negative effects of unexpected political developments. Therefore, upcoming regulations are analysed to prepare for various scenarios (Engau & Hoffmann, 2011).

The final strategic posture, the **Gambler**, was found to apply none of the defined strategies to cope with regulatory uncertainty. Engau and Hoffmann found companies within this category to rely on their experience and connection to policymakers or to pursue minimal strategies and not actively address the uncertainty. Those firms are “gambling” for a positive outcome of the upcoming regulations in their specific case. This mainly arises from their set strategic orientation, which in some cases already aligns with the upcoming regulations. In the example of the post-Kyoto circumstances, companies with low CO2 emissions were found to overtake the strategic posture of Gamblers (Engau & Hoffmann, 2011).

2.5 Conceptual Framework

The literature described in this chapter builds the foundation for the conceptual framework. The **DOI theory** was applied, offering a comprehensive framework to analyse the innovation adoption process of textile companies and categorise them based on their adoption timing. As seen in previous research, such as the study by Berger et al. (2023), the DOI theory appears suitable for analysing the adoption process of the DPP. It provides a comprehensive understanding of diverse reactions, showing why some companies are more proactive in adopting the DPP than others. Additionally, the

theory enables exploring possible consequences of the different adoption types. The emphasis on the role of time in the diffusion process aligns with the research focus on the critical early implementation phase of the DPP.

In addition, literature on **mandated change** and **regulatory uncertainty** was used. Companies' responses to uncertain regulations vary and need to be further investigated (Engau, Hoffmann & Busch, 2011; Marcus et al., 2011). Within this research, the responses of textile companies to the DPP are analysed through the lens of the four introduced postures. Engau and Hoffmann's (2011) findings are based on the post-Kyoto context, which featured different characteristics and expected responses. Post-Kyoto regulations focused on broad climate change mitigation, while DPP implementation targets specific product and supply chain levels. Additionally, less clarity was given within the post-Kyoto situation resulting in a high level of uncertainty. The present situation surrounding the DPP can be characterised by a smaller uncertainty, as demonstrated in Table 1.

Since Rogers', and Engau and Hoffmann's theories alone do not fully capture the complexity of companies' responses in these multifaceted circumstances, a **novel typology** combining the two theories offers a more tailored perspective. The combination enabled the creation of new organisational typologies that reflect the observed responses (Doty & Glick, 1994), depicted as four new archetypes (see Findings 4.2 Responses to Mandated Change). The theory-building approach contributes to expanding and refining the introduced theories, integrating insights specific to the DPP's implementation in the textile industry (Shepherd & Suddaby, 2017). Figure 4 summarises the research context, case study, and the key theories that shape the conceptual framework.

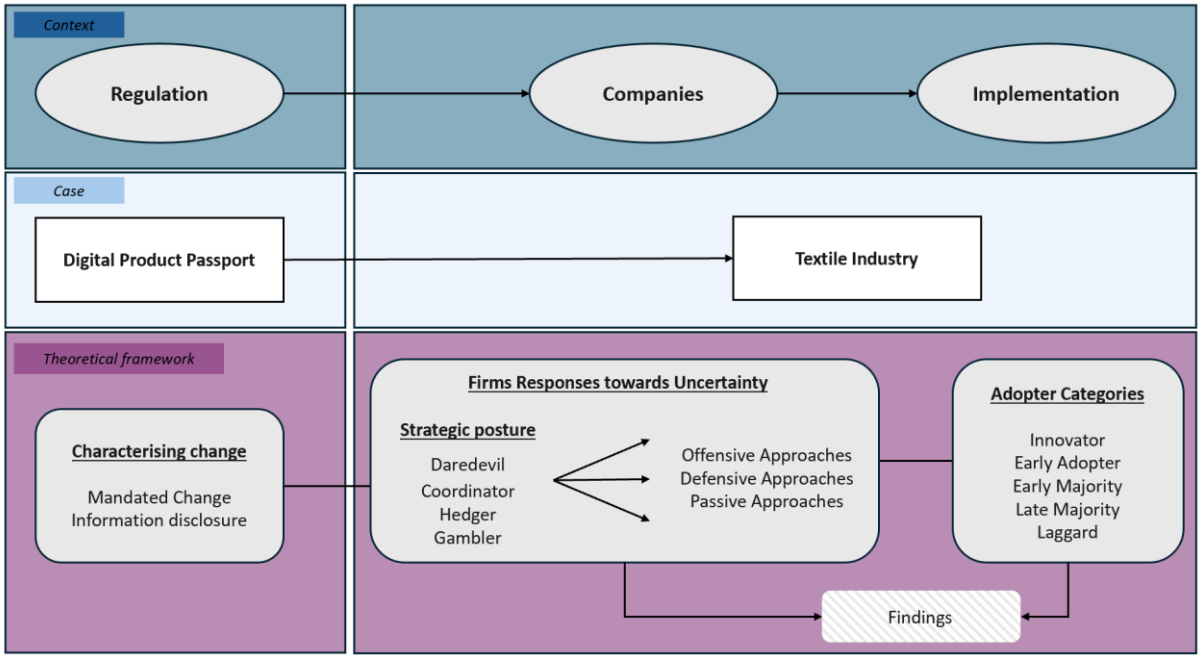

Figure 4 Conceptual Framework (Own Illustration)

3. Methodology

This chapter presents the methodological choices, describing the research design, data collection, and data analysis. Research quality indicators are addressed within those subchapters.

3.1 Research Design

While regulatory uncertainty and companies' reactions towards innovation have been previously studied, this thesis complements the literature by further developing and expanding the introduced theoretical frameworks. Therefore, actors like textile companies contributed valuable responses with their insights specific to the underlying situation.

An **abductive approach** to the **qualitative research question** was applied. Qualitative data is valuable for studying strategic behaviour and decision-making, as it allows for detailed insight into evolving processes (Langley & Abdallah, 2011). As described in chapter 2.4 the theory introduced was used as a framework to analyse the present situation. In addition to this **deductive element**, there were also **inductive elements** within the data collection, which allowed discovering complementary insights on companies' responses adding to the theory of Engau and Hoffmann and the DOI theory. During the research process, there was ongoing back-and-forth between the data and theory, mixing established models with insights drawn from the observed cases. This abductive logic aimed to refine and combine the existing theory allowing for new insights during the research process (Dubois & Gadde, 2002; Fisher & Aguinis, 2017).

The research design was based on a **multiple case study** approach in the textile industry, aiming to understand the dynamics present within single settings (Eisenhardt, 1989). Those settings were represented by different textile firms, enabling a comparison of several reaction types (Hunziker & Blankenagel, 2021). The case of the textile industry provided a relevant case for studying companies' response towards regulatory uncertainty as the industry must navigate complex sustainability challenges and adapt to constantly evolving regulations (Adisorn et al., 2021). A multiple case study was particularly valuable for a comparison of diverse strategic behaviours and decision-making processes by examining these different organisational settings and circumstances (Steward, 2012). Since different reactions from textile companies were expected, a multiple case study offered richer insights on diverse companies than a single case. Examining several cases allows the identification of patterns, and thereby supports the refining and expanding of the introduced theories (Yin, 2009).

The study employed a **cross-sectional design**, meaning that data was collected at a single point in time (Bryman, 2016). This approach captured companies' postures at a specific point in time, where change is imminent and unavoidable yet still surrounded by uncertainties. This particular moment can be viewed as a zoom-in on the period shortly before the introduction of the regulation, capturing a spectrum that ranges from the very initial steps of implementation to a complete lack of engagement with the topic.

3.2 Data Collection

Qualitative research was conducted through 16 semi-structured interviews. A qualitative approach was preferred over a quantitative approach, allowing for an effective collection of complex case-specific data on temporally evolving phenomena (Langley & Abdallah, 2011).

The **semi-structured interviews** enabled the exploration of respondents' perceptions regarding the complex issue of the DPP and resulted in detailed as well as rich answers (Bryman, 2016; Rowley, 2012). The interviews took an average of 45 minutes, were primarily conducted in Microsoft Teams and recorded to ensure accurate data transcription. The interviewees were approached via Email or LinkedIn with an interview invitation (Appendix A.1 Interview Invitation & Attachment). To enhance the **accessibility** of interviewees, respondents were additionally identified through contacts provided by previous participants, following a **snowball sampling** method (Parker, Scott & Geddes, 2019). An interview guide (Appendix A.3 Interview Guide) was used to guide and structure the interviews, connected to the introduced research question. The questions were generally based on the concepts from the theoretical framework, creating an overall structure while allowing a detailed format to develop during the interview (Drever, 1995). Respondents were encouraged to provide examples, and follow-up questions were asked. This approach ensured consistency in analysis by asking all participants comparable questions while simultaneously enhancing the interviewer's reflexivity in the analysis.

Ethical issues were carefully considered to prioritise participants' comfort during the interviews. The ethical guidelines were aligned with those set by Utrecht University (Utrecht University, n.d.) and were strictly followed throughout the study. Appendix A.2 Ethics and Informed Consent provides further details regarding ethical considerations and informed consent. Interviewees were informed of those upfront.

This research employed **purposive sampling**, which involved the strategic selection of information-rich participants based on their relevance to the research questions (Bryman, 2016). The **sample** of

16 Interviews consisted of 12 companies and four experts, as displayed in Table 3 and Table 4. The combination of expert and company interviews enhanced the robustness of the findings by integrating diverse perspectives. While the company interviews provided detailed, context-specific insights, the expert interviews offered a broader, industry-wide viewpoint, which supported a comprehensive understanding of the research question.

The **sample** included a variety of European companies regarding sizes and types operating in the textile industry to maintain sample representativity and provide a comprehensive understanding of their responses (Appendix A.4 List of Interviewed Companies). This approach was preferred over the selection of for instance solely dominant large textile firms since the legislation on the DPP will affect all firms operating within Europe. While larger firms have a strong influence in Europe's textile industry, yet 99,5% of the firms operating in this sector are small and medium-sized enterprises (EC, 2021). Hence, to get an overview of the industry dynamics, it was relevant to analyse a broad variety of firms to identify possible differences.

The interviews targeted relevant **employees**, like Corporate Social Responsibility (CSR) managers, who spoke about the strategic positioning of their organisations. Thereby, **credibility** was ensured by selecting interviewees who were capable of articulating their companies' strategic position. Credibility in research refers to the confidence in the truth of the findings and assesses whether the results represent the participants' original perspectives accurately (Lincoln & Guba, 1985). Relying on a single employee for representation may cause limitations, as it might introduce bias based on individual perspectives. To mitigate this, the interviewer guided participants to focus on presenting their company's perspective rather than personal opinions. Additionally, the interview invitation ensured that the participant had prior expertise or awareness of the DPP and enhanced their understanding of the research topic.

The additionally interviewed **experts** shared their expertise, which stemmed from, for instance, involvement in the CIRPASS project, a position as a sustainability consultant or employment with a global standardisation organisation. The experts gave an overall view of the developments in the industry, providing a diverse perspective and a well-rounded validation of the findings. In addition, this participant selection created a diverse sample representing various segments of the industry, which was critical given the study's relatively smaller sample size (Yin, 2009). The experts' insights enhanced the study's **transferability** and addressed potential **response biases**. These biases included socially desirable answers from employees that might be aligned with internal communication norms or that the interviewees do not fully reflect their companies' actual practices (Bryman, 2016; Chung &

Monroe, 2003). Additional data collection through expert interviews facilitated cross-checking and validating the data gathered during company interviews (Bryman, 2016).

During the data collection process, the companies that accepted the interview request began to provide repetitive responses. Consequently, the data collection was concluded after 12 company interviews, as additional responses were unlikely to yield new insights. However, new and alternative views could be collected in the four expert interviews. This approach ensured a diverse and representative sample for the study's scope (Baker & Edwards, 2012). The deviation in the number of expert and company interviews can be explained by the study's primary focus on insights from the company interviews.

Table 3 List of Companies

Company	Industry	Respondent Position
Company 1	Clothing/ Jeans	CSR Manager
Company 2	Clothing/ Underwear	Sustainable Packaging & Product Life Cycle Technologist
Company 3	Clothing / Backpacks	CSR Manager
Company 4	Clothing / Jeans	Sourcing and Sustainability Coordinator
Company 5	Clothing/ Wholesale	Product and Sustainability Manager
Company 6	Backpacks/ Bags/ Shoes	CSR Manager
Company 7	Clothing/ Footwear	Product and Sustainability Manager
Company 8	Clothing	Sustainability Manager
Company 9	Clothing	Sustainability Specialist
Company 10	Clothing/ Accessories/ Luxury	Circularity Coordinator
Company 11	Clothing, Medium Luxury	Sustainability Advisor
Company 12	Clothing	Sustainability Specialist

Table 4 List of Experts

Expert	Company	Respondent Position
Expert 1	Standardisation Company	Sector Lead Textile and Apparel
Expert 2	Consultancy and Sustainability Solution Provider	Sustainability Advisory- Head of Textile Services
Expert 3	IT Consultancy Textile	Founder of Textile Initiative + Contribution to CIRPASS project
Expert 4	Consulting Company (Circular Economy)	Project Manager + Contribution to CIRPASS project

3.3 Data Analysis

The interviews were transcribed and analysed by coding, resulting in a structured and language-based analysis (Saldaña, 2021). As some interviews were conducted in German, the quotes were translated into English. The software NVivo was used for the coding of the data. NVivo is a program that assists the researcher in efficiently organising, managing, and coding qualitative data (Zhang & Wildemuth, 2009). Patterns and themes related to companies' responses were identified and coded onto the underlying conceptual framework. The approach used is summarised in Figure 5.

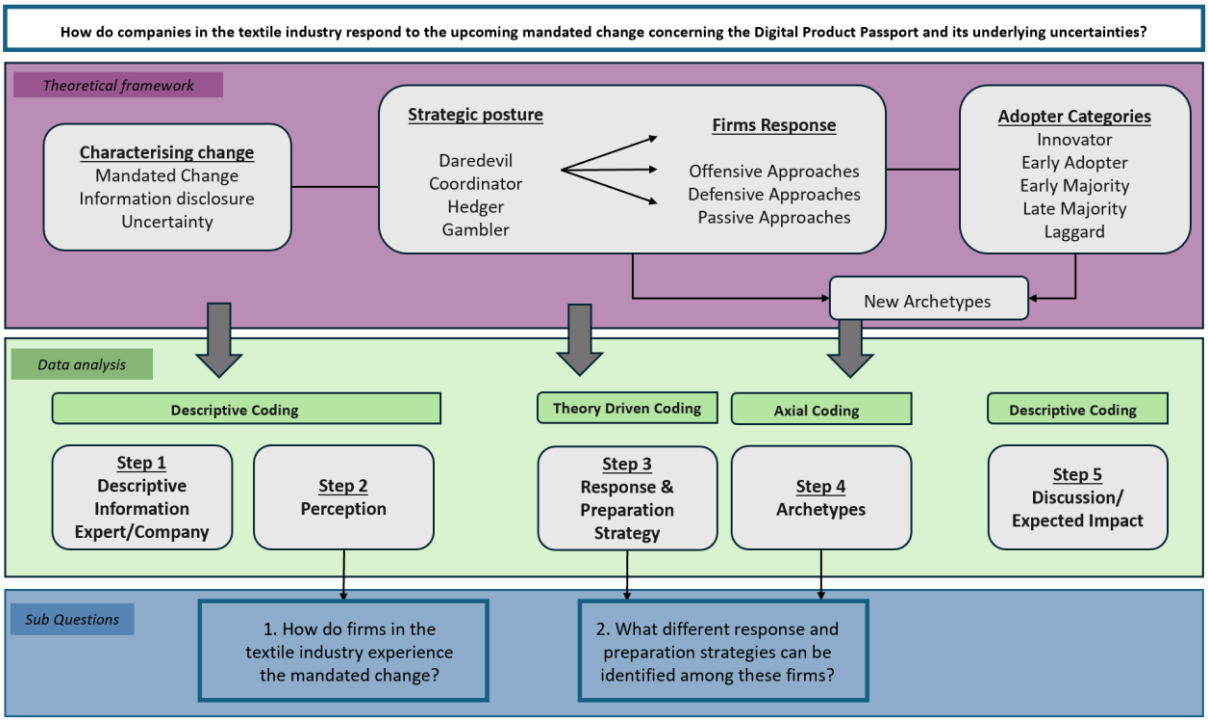

Figure 5 Coding Process (Own Illustration)

In the first step, **descriptive coding** was used to gather information and extract characteristics of the interviewed companies and experts.

In the second step, the companies' perceptions of the upcoming regulatory situation were coded, addressing the first sub-question. Experienced challenges and opportunities, as well as the companies' perceptions of uncertainty, were coded.

Third, aligning with the second sub-question, the companies' response and preparation strategies were coded using **theory-driven coding**. The data was analysed following a cross-case comparison to summarise the main contents and to find patterns, similarities, and differences (Borman, Clarke, Cotner & Lee, 2012). In this step, the theories of Engau and Hoffman, as well as Rogers, were

connected to the found data. Regarding the DOI theory, the coding focused mainly on the companies' planning of the DPP implementation, their readiness for adoption and their coherent proactive or rather reactive approach. Additionally, the motivation for adoption and perception of opportunities and challenges were coded. This combination allowed categorising the companies according to the five adopter categories (Innovator, Early Adopter, Early Majority, Late Majority, Laggard). To analyse the strategic responses, the coding book was based on the 13 approaches applied to counteract uncertainty introduced in Figure 3, allowing to categorise firms into the identified strategic postures (Gamblers, Hedgers, Coordinators, and Daredevils).

In the fourth step, with constant comparison of those findings, relationships between the theories emerged (Corbin & Strauss, 2015). From this combination through **axial coding**, overarching themes in the data emerged, building four new archetypes. Axial coding organises codes into broader themes and connects them to the underlying framework (Corbin & Strauss, 2015). This step was complemented by expert interviews to confirm and further elaborate on the found archetypes. The experts' external perspectives contributed additional insights to the archetypes identified in the company interviews. They gave deeper insights into companies' behaviour and provided an overall understanding of the findings.

In the final step, **descriptive coding** was used to categorise the expected impact of the DPP on the industry and to set a base for discussing the study's findings. Thereby, mainly, the expert interviews were analysed, providing a structured insight into anticipated industry-wide changes. Insights into the analysis schemes can be found in Appendix B Data Analysis.

4. Findings

This chapter presents the findings on how the investigated companies perceive and react in the current situation surrounding the DPP. It begins by illustrating the companies' perceptions and highlights both the opportunities and challenges they face, especially focussing on the perceived uncertainties. The chapter then identifies the different response strategies and implementation stages of the companies by applying Engau and Hoffmann's theory and the Innovation of Diffusion theory. The observed responses are analysed through the lens of the introduced theories. Appendix B Data Analysis gives a detailed look into the data analysis conducted. Stemming from this analysis four archetypes of companies are identified and described. In the following, companies are referred to as C and experts as E.

4.1 Perception of the Mandated Change

The introduction of the Digital Product Passport created significant discussion and various responses among companies in the textile industry. In the sample, most companies have already started preparing for the DPP, with some actively implementing changes, while others do not see sufficient reason for change. Companies' responses reflect different perceptions of the current situation and the mandated change. Some companies emphasise the present uncertainties and classify the DPP mainly as a regulatory requirement that must be met (E3). Others perceive the DPP as rather irrelevant and too vague to explore the topic more deeply at this moment (C5, E3, 4). Most companies describe the upcoming regulations as highly relevant and beneficial, highlighting the positive impact on transparency, consumer awareness and digitalisation. They acknowledge that the DPP aligns with their sustainability goals, as it provides detailed information about products' life cycles and environmental impacts (C3, 4, 7, 8, 9, 10, 11, 12). This chapter presents the perceived opportunities and challenges described in the interviews.

4.1.1 Opportunities

"The DPP is highly relevant for us as it aligns with our commitments to sustainability and transparency." (C4)

There is a recognition of the value the DPP brings to consumers by providing detailed information about the environmental impact and life cycle of products (E1). Various companies highlight transparency as essential for meeting consumer demands for more sustainable and ethically

produced goods (C2, 7, 11, 12). It allows better tracking of products and improves the understanding of supply chains by raising awareness among companies and consumers about the product's origin and production processes. In this sense, companies can gain a competitive advantage by presenting their sustainability efforts to customers (C3, 10). The DPP furthermore enables easier comparison of products within the textile industry (E4).

Most companies identify improved communication with their customers as a key opportunity. The DPP is seen as a chance to improve customer trust and engagement by clearly communicating their sustainability efforts (E1, 2, 4). At the same time, respondents describe additional opportunities for after-sales engagement, such as offering services like repair, recycling, authentication and resale, thereby fostering a longer-term relationship with the customer and providing an additional opportunity to collect customer data (C10, E4).

"I hope it will build some consumer trust. So enhancing transparency can build stronger consumer trust and brand loyalty." (C4)

On the regulatory side, interviewees perceive an opportunity in the alignment of various regulations, such as the AGEC law, emphasising that this could enable them to comply more effectively with upcoming regulations (C10, 11).

The DPP's innovative and digital nature is seen as a motivation for technological upgrades and enhanced digital strategies that are perceived as useful beyond the DPP (E3, C12).

Additionally, increased transparency helps companies take ownership of their sourcing processes and pushes the industry towards greater accountability (E4). By understanding their supply chain, companies can identify room for improvement and adjust inefficient processes. Thereby, they can enhance the efficiency of the supply chain (C7).

"Once you have your full supply chain traceable, you are also able to see where your biggest impact is actually and how you can improve that." (C11)

Generally, a positive impact on the sustainability of the industry is expected, supporting Circular Economy, as well as an enhanced motivation to act sustainable.

"This is an opportunity for the whole industry to finally find out how we're doing as an industry and to make everything transparent. " (C2)

Table 5 summarises the opportunities experienced and described.

Table 5 Opportunities Identified through the Interviews

Category	Opportunities
Industry & Market	Comparison, Competitive advantage, Equal Playing Field
Customer Communication	Brand Loyalty, Consumer Trust, Consumer Engagement, Informed Choices of Customers
Legal & Regulatory	Compliance with Other Laws, Regulatory Compliance, Support for Upcoming Regulations
Technology & Systems	Technological Upgrades, Software Solutions, Digital Integration
Operational Efficiency	Sustainable Operations, Integration, Supply Chain Efficiency
Transparency & Traceability	Counteracting Greenwashing, Supplier Pressure, Information for Recyclers, Data Clarity
Sustainability & Impact	Circular Economy, Sustainability Motivation

4.1.2 Challenges

The companies interviewed describe challenges in several areas related to the DPP, including concerns about data management, resource allocation, technology integration and communication with suppliers. The interviewees describe issues with a thorough understanding of the requirements resulting from high regulatory complexity (C2, 4). Additional difficulties in coordinating with suppliers to gather the necessary information are highlighted (C8, 11, 12). For all the mentioned points, the required resources in terms of time, human resources and also financial investments cause

challenges for the majority of the interviewed companies. This results in concerns regarding the competitiveness of the companies in the market (C2).

“There is a certain amount of time and energy, and money probably invested in tracing and checking what we are disclosing so it remains a delicate point. “ (C10)

Financial investments are expected in different areas, such as operational costs, costs for digital solutions as well as solution providers, that support the DPP implementation.

Concerns have been raised about how customers will react to the DPP. Companies already experimenting with initial DPP versions observed low engagement, primarily due to a lack of customer education and unclear incentives for interacting with the DPP (C4, 7, 10, 12). Additionally, challenges arise regarding label cutting, so cutting out of the DPP in case it will integrated as in the care label of the garments (E3).

Data operationalisation is a major challenge for several companies, with difficulties in collecting, storing and managing data efficiently (C4, 5, 6, 8, 9, 11). Ensuring the accuracy and completeness of data throughout the production chain and moving away from manual stand-alone systems such as Excel to more automatic digitally linked solutions are mentioned issues (E4).

"Ensuring accurate and comprehensive data collection across all stages of production can be really resource intensive." (C4)

Within the data collection, companies describe issues with supplier engagement and the challenges of controlling the preciseness of the provided data (C8). Companies also mention high pressure from business-to-business (B2B) customers to fulfil their requirements resulting from the upcoming regulations (C5).

Uncertainty about the new regulations was cited as a major challenge. This research especially focuses on companies’ responses towards this experienced uncertainty. Their perception of this challenge is described more deeply in the following subchapter. Table 6 summarises the challenges identified.

Table 6 Challenges identified through the interviews

Category	Challenges
Industry & Market	Competitiveness, Market position, External Pressures
Customer Communication	Customer Engagement
Legal & Regulatory	Legislative Complexity, Regulatory Compliance
Technology & Systems	Standardisation, Technology Integration, System Implementation
Resources	Financial Investment, Human Resources, Time Constraints
Data Management	Data Collection, Accuracy, Traceability, Operationalisation
Supplier & Partner	Supplier Engagement, B2B Collaboration
Uncertainty	Unclearities in specifics regarding internal Implementation of DPP, Unclear Timelines, Unclear Scope of Required Data

4.1.3 Uncertainty

Most companies experience a high level of uncertainty. More specifically, this uncertainty is related to the details of the DPP implementation, as the information currently available is perceived to be rather general (C7, 10, 11). Questions arise about which product groups will be affected, the level of detail required in the information and the types of indicators that will be needed (C3, C12).

"The companies have more questions than answers." (E1)

Some companies are unsure about the expected timeline, and how political developments such as the European elections could influence the regulatory situation (C5, C6, E1, E4). In addition to the unclarity resulting from pending regulations, companies describe emerging confusion due to inconsistent information communicated by various solution providers (C5, C12). Furthermore, uncertainties regarding the expected timeline were mentioned (C5).

"It is very problematic to get detailed requirements and data because there are so many different timelines floating around." (C5)

For some companies, the extent of uncertainty is so significant that they question whether the planned regulations will ultimately be implemented (C2, 7). The main concerns relate to the final form of the regulations and the specific data requirements (C1, 6, 7, 10, E2). These concerns include the depth and scope of the required information—such as whether the supply chain needs to be disclosed up to Tier 4—and whether product groups beyond clothing, such as shoes or backpacks, will be included in the regulations (C3, C6, C7).

Uncertainty was also expressed regarding the technological implementation of the Digital Product Passport. This includes concerns about the technological complexity (C3) and questions about the infrastructure needed for proper communication and integration, such as how to manage QR or RFID codes on products and the linkage of information to online platforms (C4, 7, E4).

These perceived unclarities result in concerns regarding the impact on internal discussions and investment decisions (C4, 11). Company 6 describes expected issues in the internal defence of required actions based on a rather unclear situation and due to the uncertainty of final requirements. The interviewee states to see issues in encouraging the decision makers in the company for actions, without having complete certainty on the requirements. Company 1 expresses concern regarding the impact of the uncertainty on its market position.

Opposing to this, other companies do not perceive the experienced uncertainty as a threat (C7, 8, 10). This rather unconcerned perception of uncertainty is mostly explained by the fact that all companies in the sector will be affected more or less similarly (E3). Furthermore, these companies expect that there will be enough time to prepare and react (C7, 8, 10).

4.2 Responses to Mandated Change

Building on the analysis of the companies' perception of the upcoming regulatory situation, the following chapters investigate companies' response and preparation strategies. Resulting from the interviews, four different archetypes were identified that analyse and categorise companies' responses to the upcoming mandated change. This novel typology offers a tailored perspective to answer the introduced research question. The following chapter introduces the four archetypes based on their implementation process, applied strategies regarding regulatory uncertainty, and overall motivation to implement the DPP. The distribution of the four archetypes within this sample can be found in Figure 6.

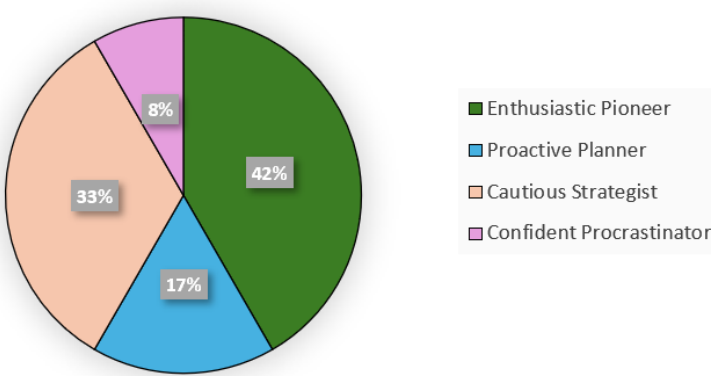

Figure 6 Distribution of Archetypes (Own Illustration)

The found archetypes are based on the strategic postures of Engau and Hoffman and the Implementation Stages of the Diffusion of Innovators curve by Rogers and display the identified approaches and preparation strategies of the companies interviewed. The companies analysed were classified within these categories, which were then combined into the four novel archetypes. Figure 7 gives an overview of the four archetypes and displays the companies found matching the archetypes. The right part of the figure shows and describes the new archetypes, and the left side displays the found categorisation based on the implemented theories. In the following, each archetype will be described in detail.

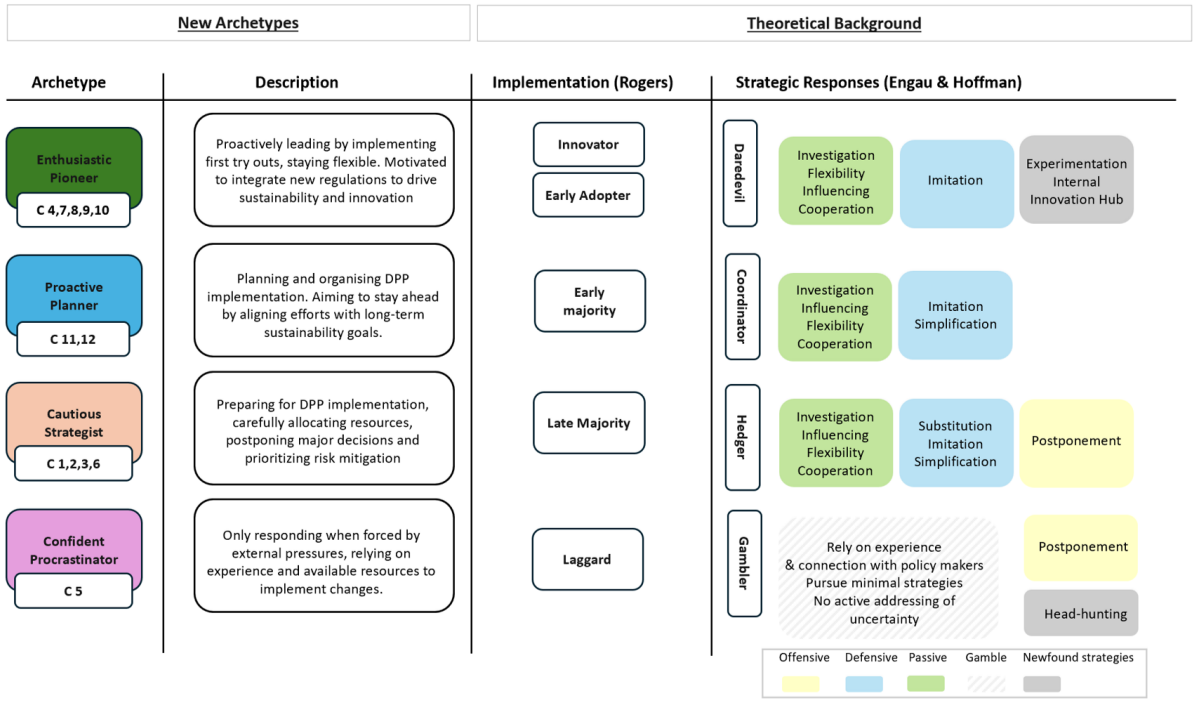

Figure 7 The four Archetypes (Own Illustration)

4.3 Enthusiastic Pioneers

The first identified archetype, the **Enthusiastic Pioneer**, aims to be a forerunner in the preparation for the DPP and does not perceive upcoming regulations as a threat but rather as a chance. The goal is to comply and go further by applying offensive and proactive preparation strategies. Those companies take the initiative to implement their own DPP systems and start working on the aspects, which they believe will be included in the regulation, aligning with the **Innovator** and **Early Adopter** stages.

4.3.1 Implementation Process

Company 10, for instance, was found to implement an initial DPP, which is planned to be extended to 100% of their products by 2025, regardless of the regulatory timelines. This company specifically addressed the innovative value of the DPP, using it for additional services like authentication of their products. By scanning a digital ID embedded in each product via an NFC tag or QR code, customers are directed to a website with details of the manufacturing process and instructions for product care and repair. This site includes a product certificate to authenticate the product or to directly resell it through the company's website (C10).

"We don't want to wait for the legislation to arrive to implement, but we want to do our own and hope it's as close as possible to the regulation to align it afterwards." (C10)

Similarly, other companies pioneer the DPP process by conducting first try-outs, while staying open for later adjustments once the regulations become clearer (C4, 7, 8, 9). The companies' goal is to implement the DPP earlier than the regulations. An early implementation ensures a smooth transition and product planning since most products are often planned and produced up to two years in advance (C7).

4.3.2 Strategic Posture

The found behaviour of the Enthusiastic Pioneer aligns with Engau and Hoffman's (2011) strategic posture **Daredevil**. The perceived uncertainty is counteracted in a mostly offensive way by, for instance, engaging proactively with other industry bodies and regulators, while meanwhile emphasising flexibility to be able to quickly adapt to new regulations.

The Enthusiastic Pioneers focus on **Investigation**, for instance, through scoping of service providers that might be possible cooperation partners for further implementation, as well as general external information to stay ahead (C4, 7, 8, 9, 10). Training and education about the importance and implementation of DPP and first pilot projects were mentioned as an element of the investigation, internally for their staff but also for their suppliers and partners (C4, 9).

Most companies of this archetype rely on **Experimentation** to counteract uncertainty. Experimentation was found to be a strategy that complemented the offensive approaches found by Engau and Hoffmann. Company 9 describes experimentation taking place in an internal Innovation Hub. One pilot project involves their organic cotton t-shirt line, for which a DPP is integrated that includes information on the cotton's origin and details about the sustainable farming practices used. By collaborating with the Better Cotton Initiative (BCI), the company ensures that the pilot project is aligned with industry standards for sustainability (C9). Company 8 has already started developing a DPP for their workwear line. Building on this initiative, the company plans to develop a 2.0 version in the future extending the DPP on further product lines.

The Enthusiastic Pioneers proactively engage with industry bodies and regulators to stay informed and influence the development of new regulations (E3). This allows them to adapt quickly and reduce the need for significant adjustments later. The interviewed companies state that **Influencing** mainly takes place through industry groups such as MODINTs Branch organisation, a Dutch trade association for manufacturers, importers, agents, and wholesalers. **Cooperation** plays a crucial role for these companies. Next to these working groups, they engage with solution providers or IT partners to implement new systems in advance. The solution providers offer technological systems, platforms, or

services to help companies in the DPP implementation. Services range from tools for tracking and managing product data to legal advice (E1).

By focusing on preparation while maintaining **Flexibility**, this archetype turns regulatory uncertainty into an opportunity for innovation and leadership in their respective industries. Simultaneously, **Substitution** is applied, hence agreeing and preparing for a scenario that is considered most likely to occur. For instance, companies already prepare for a QR code without having the information on the concrete data-carrying system that will be required in the regulations (C7, 10)

4.3.3 Motivation

The Enthusiastic Pioneer leads the way and actively pursues its vision and perspective on the DPP (E1, 3). The behaviour is driven by a strong commitment to sustainability and transparency, combined with underlying digitalisation strategies that aim to create a unified data language (E3, 4).

"The Digital Product Passport is becoming very important for us. It aligns perfectly with our goals of sustainability and transparency." (C9)

While these strategies may be separate from the DPP itself, they now serve as valuable support for its implementation. This archetype takes a bold, risk-embracing approach and is motivated by the potential for innovation and sustainability, positioning those companies as early adopters of the DPP.

4.4 Proactive Planners

The second response archetype found is the **Proactive Planner**. This type takes a balanced active engagement approach with the DPP while staying cautious. These companies plan their steps more hesitantly than the Enthusiastic Pioneers but are still part of the **Early Majority** within the Diffusion of Innovation theory. They are in the stage of experimenting and testing DPP systems. Proactive Planners stay open to refine their strategies before fully committing and rely on external expertise and support to navigate the complexities of the DPP adoption (E2).

4.4.1 Implementation Process

These companies plan the first pilot projects and engage in experimentation. To navigate the complexity of the implementation, the Proactive Planners rely on external help from solution providers and legal advice from law firms. A good example of a Proactive Planner is company 12. This year, the company introduced a first pilot project, where ten pairs of jeans were tagged with RFID and

QR codes. This enabled the tracking of product materials and origin for the sorting systems and linked a website informing on the product features, materials and care instructions, and second-hand options. This was done in collaboration with the software company Circular Fashion. The project is now evaluated, based on the feedback of customers and suppliers. Company 12 remains open to contacting other solution providers to meet future regulatory demands efficiently.

Company 11 was found to match the Proactive Planner archetype as well. The company had a first unsuccessful tryout. Company 11 tried to implement a traceability system, in which internal problems regarding the implementation of a QR code arose. Therefore, the company now plans a second approach to implement a DPP, partnering with the traceability platform Fairly Made. They expect to implement the first DPP by 2025.

4.4.2 Strategic Posture

Proactive planners build on the **Coordinator's** strategic posture, combining offensive and defensive elements to navigate regulatory uncertainty and to ensure a well-rounded approach. This is done by proactive gathering of information to prepare for the regulatory changes and the active participation in industry groups like MODINT, the nonprofit organisation Textile Exchange, and the German Bundesverband Nachhaltig Wirtschaften (BNW) to stay further prepared. Within those industry groups, they also partly take **Influence** on policy-making and regulatory developments. However, this is not pursued apart from those groups. Next to the engagement with other companies, **Cooperation** with solution providers and consultants is used to counteract the uncertainty.

The Proactive Planner is oriented towards the actions of other companies, often working together to develop effective strategies (E1). The offensive strategies are complemented with defensive elements like **Imitation**. By observing the approaches of other companies, like the Enthusiastic Pioneers, they can imitate successful strategies and thereby minimise risks before fully committing, allowing them to learn from the other companies' experiences (E2, E4). They observe how both larger and medium enterprises implement the DPP, for instance, through textile newsletters and solution providers, that present successful implementation cases (C12).

"We are looking over the in the garden of the other companies, to see how it works." (C11)

Additionally, **Simplification** is used to focus on specific aspects and allocate resources efficiently. Company 11 sets the focus on a system that can create a fully traceable supply chain as a basis for a

DPP implementation. At the same time, these companies adopt a **Flexible** approach that ensures, that they can implement changes at a pace that aligns with their operational capabilities (C11, 12).

4.4.3 Motivation

The two found companies matching the Proactive Planner describe an intrinsic motivation to act more sustainably and, therefore, see the DPP as a support system to do so and to showcase their efforts. The DPP is seen as a valuable tool to advance their sustainability goals.

"We try to utilise the added value that the DPP will ultimately have for the customer in such a way that it makes our products as sustainable as possible, and that all the work we put into it can also be reflected in this." (C11)

Company 12 even identifies a possible competitive advantage, resulting from its sustainable positioning in the market, that can be emphasized through the DPP. Company 11 states the additional motivation to comply with the AGEC law. The interviewee emphasises the importance of a unified system across the EU and standardisation of the processes to avoid the complications experienced with country-specific regulations. The Proactive Planner is motivated to integrate a DPP earlier, aiming for a holistic implementation.

4.5 Cautious Strategists

The **Cautious Strategist** emerged as the third archetype, combining the strategic posture **Hedger** and the **Late Majority** of the Innovation Diffusion. Companies matching this archetype were found to carefully navigate through the regulatory uncertainty by adopting a diversified approach. Risk mitigation and resource efficiency are prioritised to prepare systematically while postponing major actions until the regulations become clearer. They perceive the DPP as an additional part of the already overwhelming upcoming legislation.

"There's so much legislation. It's like a tsunami. And next year will be even a bigger tsunami of legislation." (C2)

4.5.1 Implementation Process

As a reaction, they start the first steps of preparation for a DPP implementation, such as data gathering and first contact with possible cooperation partners, while still postponing significant decisions. This is in line with Rogers' **Late Majority** (Rogers, 2003)**.** The Cautious Strategists observe

how other companies navigate the DPP implementation, before fully committing to any approach. Thus, most companies focus on gathering specific data, such as conducting Life Cycle Assessments (LCAs), and prepare to invest in elements like landing pages for QR codes (C1, 2, 3). Hence, in those early stages of preparation, this archetype ensures to have all necessary components in place, without fully committing to implement the DPP. Generally, they plan to act when they feel more certain about the outcomes and the requirements. At the same time, they do not ignore the upcoming regulations and most companies describe an open attitude towards the regulation. Companies with a strategic orientation towards sustainability even see advantages in the DPP (C1, 2, 3, 6).

4.5.2 Strategic Posture

Aligning with the strategic posture **Hedger,** these companies adopt a diversified strategy combining offensive, passive, and defensive elements to minimise the risk as much as possible. The Cautious Strategists attempt to prepare for compliance while delaying major actions until the regulatory landscape becomes clearer.

"We don't want to go full force into it and then have to do everything all over again." (C1)

To counteract the experienced uncertainty, they combine the strategies of **Postponement, Investigation** and **Cooperation** to minimise risks. Therefore, information on the upcoming regulations and their possible implementation is gathered in different ways. For instance, company 3 is consulting its legal department for support and has started a cooperation with a master's student working on a thesis about circular products. Part of this project serves as a prototype for designing a Digital Product Passport. Additionally, they attend webinars from the German textile label Grüner Knopf with information on ESPR and the Eco Design Directive. Company 2 describes the lack of an R&D team and explains that investigation mainly takes place within the CSR department. Company 1 additionally attends the webinars of the industry group of MODINT.

“We're all in the same situation and we're all having the same problem.” (C2)

Cooperation with other companies and industry groups, such as the global standardisation company GS1 and PricewaterhouseCoopers (PwC), play a key role, in staying updated and sharing experiences (C1, 2, 3, 6). In the working group of GS1 companies from different industries are connected, allowing for an overarching exchange and aiming for a standardised approach towards the DPP.

Next to participating in those groups that are partly in contact with regulatory bodies, direct influencing is not pursued by companies falling into this archetype.

“You can scream, but it doesn't help if you know what I mean.” (C2)

They collaborate with solution providers to take the first step towards the DPP implementation, especially regarding technical requirements (E3). For instance, company 1 collaborates with an LCA solution provider, which also advises them on regulations, and a Corporate Responsibility Management Platform that offers a DPP establishment. Additionally, some companies observe and **imitate,** especially larger competitors, to learn from their strategies (C3, 6). The strategic approach **Postponement** is used to shift major decisions and resource allocation to a point where there is more clarity in the regulatory environment (C1, 2, 3, 6). **Simplification** is described to set focus points such as Tier 1 supplier data (C2).

"Piece by piece. They wait to see what happens before they start to change business operations too much." (E2)

Simultaneously, this archetype tries to stay **flexible** to adapt its strategies as more information on the regulations becomes available (C3, C6).

4.5.3 Motivation

The **Cautious Strategist** mainly aims to comply with the regulations while carefully managing risk and resource allocation. These companies wait for clearer guidelines before committing fully to DPP implementation (C1, 2, 3, 6). While they generally maintain a positive attitude toward sustainability regulations, they are still overwhelmed by the amount of upcoming regulations (C2). As a result, the DPP is seen as an additional requirement within an already complex regulatory landscape (C2). Although these companies recognise the necessity to act, the uncertainty surrounding the implementation details reduces their motivation to engage. The combination of complexity and uncertainty makes the Cautious Strategist hesitant to act (C3, 6).

To avoid unnecessary costs, these companies focus on gathering information and making incremental preparations, such as data collection and early planning, while postponing major investments and decisions until necessary (C1). They perceive the DPP rather as a challenge to manage than an opportunity to innovate (E4). The primary goal is to meet regulatory demands with minimal disruption to their operations and ensure that resources are not overcommitted before there is more clarity (C1, 2, 3, 6).

4.6 Confident Procrastinators

The final archetype, the **Confident Procrastinator**, waits until action is needed. These companies rely on experience and postpone decisions and actions until they become unavoidable. They match the **Laggard's** position within the Diffusion of Innovators. Uncertainty is not actively addressed, which is consistent with the **Gambler's** strategic posture. During the data collection, just one company matched this archetype. However, all experts interviewed described experiences with companies that align with the Confident Procrastinator archetype. A passive wait-and-see attitude is described, while some companies are completely unaware of the forthcoming regulations (E1, E4). Some companies operate with the mindset that anything that is not explicitly prohibited is allowed (E3). This type is prevalent in both large and small companies. Larger companies, in particular, rely on their connection with policymakers (E3).

4.6.1 Implementation Process

Expert 1 describes Confident Procrastinators as laid-back, observing the direction the regulations are taking and acting when necessary, classifying those companies as “The waiters”. This matches the **Laggards**, the most traditional group within the Diffusion of Innovators. These companies are highly sceptical and only open to adopting innovation after their success is ensured among other companies (Rogers, 2003). They may also search how to find their way out of the regulations. Some companies are not even aware that the regulations are coming up (E1, E4). Company 5 describes a wait-and-see approach in which external pressure is needed to cause action. The interviewee describes the company's data availability as comprehensive. However, the data quality is perceived to be inadequate, and the final communication of collected data is regarded as problematic (C5).

4.6.2 Strategic Position

Gamblers pursue only **Minimal Strategies**, such as limited **Investigation** combined with **Postponement** of decisions. Other strategies, such as **Cooperation,** are not pursued at all and are seen as a threat rather than a support (C5, E3).

"No, we're too large for Cooperation, we have the expertise within our company. We shouldn't forget that our competitors are also our rivals.” (C5)

Instead of Cooperation, Company 5 describes the procedure of recruiting employees from other companies to acquire the necessary knowledge. Thus, **Head-hunting** emerges as another additionally found strategy, adding to the framework of Engau and Hoffman (2011).

Actions are postponed, often waiting for external pressure, such as regulations. This archetype **relies on its experience** and ability to act quickly and effectively, when necessary, without preparing for potential uncertainties and hoping for a favourable outcome when regulations are implemented (C5). Some of those companies also **rely on their connection with policymakers** (E3).

Expert 2 gives an example of a business model that fits the Confident Procrastinator archetype. The "100 Euro T-Shirt Brand" represents companies with minimal traceability and limited awareness of their production processes. These brands often source garments from low-cost production sites, mainly in Asia, and resell them in Europe at a significantly higher price. They focus primarily on the final product and its marketing, and they provide little or no detailed information about the product's origin or manufacturing practices (E2).

4.6.3 Motivation

The motivation to act within the DPP implementation is not yet present. The information given on the DPP is perceived as rather vague and not clear enough to provoke action. However, company 5 sees the relevance of the DPP while being sceptical towards its implementation. Especially the timeline of the implementation is experienced as unclear and vague and therefore actions are postponed. Additionally, the connected costs and resources are tried to be avoided as long as possible. Action is expected to be driven by two main factors: customer demands and the requirements outlined in the regulatory framework. Thereby, this pressure is often also connected to financial aspects, such as decisions from the investor side or B2B customers. Company 5 cooperates with big companies, such as some of the major German supermarket chains, that have a great influence on their decision-making.

6. Discussion

This chapter discusses the insights presented in the previous chapter. First, the findings of this thesis are reviewed and discussed. An outlook on expected impacts is given. Next, the theoretical and managerial implications are discussed. In a last step, the chapter addresses the study's limitations and provides suggestions for future research.

6.1 Interpretations

Diverse responses towards the upcoming mandated change of the DPP and its underlying uncertainties were identified within this research. Some companies view the DPP as a significant opportunity for enhancing sustainability and transparency, while others express experienced uncertainty and challenges regarding the implementation. Consequently, some companies were found to be moving fast and leading by example, while others postpone the implementation. This variability in responses can be understood better through the lens of the four archetypes identified, namely Enthusiastic Pioneer, Proactive Planner, Cautious Strategist, and Confident Procrastinator. Those types explain and summarise the companies' perception of the upcoming regulations, the stage of the adoption process and the strategies applied to counteract the uncertainty experienced. Overall, the findings reveal a complex landscape of responses within the textile industry to the mandated regulatory change and associated uncertainties at this point in time.

6.1.1 Distribution of the Archetypes in the Industry

This paragraph discusses the distribution of the four archetypes within the textile industry. This builds a crucial aspect to answer the research question and analyse the different responses of companies. As displayed in Figure 6, the Enthusiastic Pioneer represents the largest portion of the sample followed by the Cautious Strategist and the Proactive Planner, while the Confident Procrastinators represent the minority. However, the findings from the expert interviews indicate a different distribution in the textile industry. The composition of the research sample suggests that certain biases may have influenced the results.

The prevalence of Enthusiastic Pioneers in the research sample demonstrates a generally positive attitude towards the DPP in the textile industry. However, it can be anticipated that companies fitting this archetype are more likely to engage in open discussions about the DPP and, as a result, respond positively to an interview request for a master's thesis. The expert interviews confirm that the

Confident Procrastinators archetype is expected to be strongly represented in the industry (E3, 4). Opposing the Enthusiastic Pioneers such companies may not have responded to interview requests due to their lack of interest in the DPP or cooperation with external studies like academic research.

This specific subset of companies in the sample influences the distribution of the archetypes since smaller or more proactive companies were more willing to participate, leaving out those less engaged in DPP-related activities. Generally, this would imply that fewer companies are already preparing for the DPP than the studied sample indicates.

This subset might additionally influence the identified strategies applied by the interviewed companies. Some strategic responses by Engau and Hoffman (2011) such as the strategic approach influencing may not be as present as they would be in a sample with a higher quantity of large companies. For example, Expert 3 describes the great extent to which he perceives bigger textile companies taking influence on policy making and regulations. The strategy of withdrawal was not mentioned at all by the interviewees. This can be explained since a company deciding to leave the market, would rather not be willing to give an interview.

6.1.2 Expected Impact

Interviewees gave their insights on the expected impact of the DPP on their organisation as well as expected changes in the textile landscape evolving through the DPP regulations. Since companies of different types and sizes were interviewed to get broad insights into the textile industry, distinctions regarding the impact of the regulatory change on the companies were found.

Smaller companies face significant challenges due to limited resources (C1, 12). In general, most respondents expect the impact of the DPP on smaller companies to be high. These companies struggle with the high cost and complexity of implementing and maintaining DPP requirements due to limited resources and budgets (E4). Therefore, within this research smaller companies, like company 1 or company 3 are more likely to match the Cautious Strategist Archetype.

The challenges described could potentially force smaller companies out of the market. Since none of the companies mentioned the strategic approach withdrawal, the perceived uncertainty has not caused the interviewed companies to exit the market until this moment in time. However, looking at the whole industry, a different research approach might support identifying and addressing those companies.

More variety in the responses was found within **bigger companies,** such as company 5 or company 2. Interestingly, in the largest company in the sample, company 9, the differences in resource availability became clear. While smaller companies see many challenges in this regard, company 9 uses an internal innovation hub to research and respond to upcoming regulations.

Companies adopting a **sustainability-focused** approach expressed a more positive attitude toward the DPP. For example, Enthusiastic Pioneers and Proactive Planners see the DPP as a valuable tool that enhances their present sustainability efforts, with the required transparency offering them an advantage over less sustainable competitors. Meanwhile, Cautious Strategists also recognise the potential of the DPP but take a more careful, step-by-step approach. While they share a commitment to sustainability, they prioritise a more measured adoption of new systems.

Within the data collection, **Ultra-Fast Fashion** brands such as Temu and Shein were contacted, but no response was given to the interview request. Therefore, the interviewees were asked about their perception regarding such Ultra-Fast Fashion brands and the expected impact of the DPP on those business models. Those brands are expected to face challenges with the DPP since they will need to adapt to extensive data requirements imposed by the upcoming regulations. The shift towards compliance could be difficult given their fast production cycles, and minimal physical inventory. To comply, significant adjustments in their operational strategies would be needed. This regulatory pressure might also drive broader changes in the fast-fashion landscape and possibly decrease the current fast-fashion trends (E1, 2, 3, C10). However, the interviewees partly expect those business models to find their way through or even avoid the regulations (E1). Overall, the DPP is anticipated to impact sustainability by reshaping the textile industry towards enhanced transparency and stricter data requirements. This could decrease the dominance of fast fashion and lead to better-informed consumer choices (C6, 7, 10, E1).

This study shows that, driven by environmental regulations, textile companies are moving towards greater transparency and traceability. Most interviewees contextualised the DPP within the broader regulatory landscape, including the ESPR, AGEC law, and CSRD. They confirm the importance of the DPP as part of a transition to a more sustainable textile industry and a valuable tool to enhance traceability and transparency. Despite uncertainties and related challenges, the DPP is seen as part of a regulatory-driven shift. The findings indicate a change in companies' mindsets, suggesting they are prepared to adapt to upcoming regulations. The imposed information disclosure is expected to motivate sustainability performance improvement (Blackman, Afsah & Ratunanda, 2004; Li & Jia, 2022, E4). However, clear guidelines and assistance will be needed to support this transition.

Additionally, for an all-encompassing shift, especially in the textile industry, an integration of customer behaviour and consumption patterns would be necessary (E2, E3).

6.2 Recommendations

This thesis offers implications that are relevant for companies and policymakers as well as solution providers offering services regarding the DPP.

6.2.1 Recommendations for Companies

This section presents key recommendations for companies at different stages of DPP adoption. Those recommendations are based on this research's findings regarding the four archetypes. Companies can draw practical insights from those identified archetypes. Depending on the company's approach to sustainability and regulatory change, the researcher recommends different strategies.

Companies that match the **Enthusiastic Pioneers** or **Proactive Planner** archetypes can benefit from engaging in collaborative projects. Initiatives such as CIRPASS focus on the development of a standardised DPP framework and thereby shape industry standards. A standardisation for the DPP is seen as highly relevant for a successful implementation, benefiting all involved parties (E1, C2, 4). With proactive involvement in those projects, these companies can influence the future shape of DPP standards and regulations, and secure an early-mover advantage. Therefore, they should actively share their insights within those projects, and with industry groups and policymakers to additionally establish themselves as industry benchmarks.

For the **Cautious Strategists,** the researcher encourages the companies to maintain their pursued approach while adopting a more confident mindset. This involves focusing on the development of a clear, actionable plan for the DPP implementation. They should continue allocating resources efficiently and seeking external expertise when necessary. Cooperation with solution providers and industry groups can support a better understanding and navigation of the regulatory requirements. Thereby, companies matching the Enthusiastic Pioneers or Strategic Planners can serve as valuable examples, offering guidance and inspiration. Their best practices and proactive approaches can provide useful frameworks for the Coutious Strategists. The interviewees described different organisations that enable this type of exchange, such as Modint, GS1, PwC or Deloitte. Generally, the careful approach helps especially companies with fewer resources to mitigate risks while still maintaining competitiveness, being open to changes and being prepared to comply with new regulations.

For the last archetype, the **Confident Procrastinator**, who tends to delay action until regulatory requirements are unavoidable, it is essential to carefully examine late-mover advantages and disadvantages. Postponing action can reduce costs and risks associated with early adoption since other companies create clearer market conditions, and regulatory uncertainty decreases over time (Endenich, Hahn, Reimsbach & Wickert, 2023; Querbes & Frenken, 2017). However, this brings the risk of intensified external pressure and little time to act, leading to the need for many resources and fast organisational change. Therefore, the researcher encourages these firms for a proactive shift. By gradually building internal capabilities, getting an understanding of the DPP requirements, and exploring early-stage compliance measures such as the “Minimal & simplified DPP” that is planned to be enforced by 2027. Another approach could involve companies conducting initial trials of the DPP within specific product groups to gain insights into possible implementations without significant resource investment. This strategy was described and successfully applied by companies matching the Proactive Planners archetype (C11, 12). Additionally, the Confident Procrastinator should open up for cooperation, rather than competition, which can provide valuable resources and knowledge-sharing opportunities. These first measures can mitigate potential disruptions caused by a last-minute need to comply and avoid regulatory penalties and market disadvantages.

The Cautious Strategists and Confident Procrastinators should take a closer look at the opportunities presented by the DPP. As demonstrated by the other two archetypes, particularly regarms of customer relationships, significant advantages can be gained from implementing a DPP. By shifting their focus from perceived challenges to these potential benefits, companies can find motivation and support throughout the DPP implementation process.

6.2.2 Recommendations for Policymakers

The studies' insights allow for **policy recommendations** in addition to their implications for companies. This study's findings suggest some key areas where support from regulators could improve the transition process and a successful DPP implementation in the industry.

From the interviews, a necessity for clear **guidelines and information** became evident. Establishing clear expectations, timelines, and specific requirements can reduce hesitation and uncertainty for companies. While initiatives like the CIRPASS project aim to support DPP adoption, there is a need for more clarity and accessibility of existing guidelines. Many companies frequently face difficulties in identifying the immediate advantages of compliance, which often results in hesitation and a tendency to focus on meeting only the minimum requirements (E2). In response, policymakers can provide the

necessary motivation and education to demonstrate the benefits and opportunities of DPP implementation.

Furthermore, **practical support** such as necessary resources to assist with navigating the DPP adoption process should be provided. This includes offering financial incentives or subsidies to reduce implementation costs, especially for small and medium-sized enterprises (SMEs). The provision of training programs, technical assistance, and digital platforms can additionally help businesses in the implementation process.

Lastly, policymakers should **foster collaboration** between companies. Encouraging best-practice sharing between the different archetypes will help bridge the gap between them. Thus, policymakers can support that the DPP transition benefits the industry and aligns with broader sustainability goals.

6.3 Theoretical Contributions

This study makes a valuable contribution to literature on regulatory uncertainty and innovation implementation by providing further evidence from another case. The **case of the Digital Product Passport** is especially valuable as its introduction stands out as a particular type of change. Its implementation is surrounded by critical regulatory uncertainty, yet not as imposing as in previously investigated cases such as the post-Kyoto regulations (Engau & Hoffmann, 2011). The upcoming regulations require companies to adopt new systems and technologies to enhance traceability and transparency in their supply chains (Ahmed & MacCarthy, 2021; Papú Carrone, 2020). The remaining ambiguities on the implementation create a unique form of uncertainty. Companies recognise that regulatory change is coming, but the specifics remain unclear in the phase between the first announcement and final enforcement. While other studies generally investigate companies' adoption of mandated change and innovation (Blackman et al., 2004; Li & Jia, 2022; Lieberman & Montgomery, 1988; Rogers, 2003), this research specifically analysed how companies perceive and react in the exact period between the first announcement of regulations and before its final enforcement. Thus, the new typology was needed to analyse the experience, preparation, and planned implementation strategies of companies operating in the European textile industry in response to the upcoming DPP regulations.

As discussed earlier, the textile industry is especially interesting for this analysis due to its high environmental and social impact (Adisorn et al., 2021). The CSR employees and experts are experienced in dealing with uncertainty and offer a unique insight into the underlying situation. This study provides a detailed analysis of their adaptive strategies and offers a broad understanding of

companies' behaviour during such transitional periods. Additionally, the insights from this case support the literature on how industries adjust to mandated changes in regulatory frameworks (Marcus, Aragón-Correa & Pinkse, 2011; Blackman, Afsah & Ratunanda, 2004). This gives practical insights for future regulatory developments, such as the planned DPP implementation in other industries.

Secondly, the study conducted by **Engau and Hoffman** (2011) is further supported by this research, stemming from an additional case example of regulatory uncertainty, the DPP. Generally, Engau and Hoffmann's findings were found to apply in the case of the DPP. This confirms the transferability of their findings on other case examples since the four introduced strategic postures were evident in the case researched. This research gives insights into companies' responses to regulatory uncertainty. Additional strategies, such as head-hunting and experimentation, were found to be applied by the companies to counteract uncertainty. Many of the companies investigated were found to employ experimentation through first tryouts of a DPP implementation with external partners, within internal projects, or even with an internal innovation hub. Additionally, this study highlights that some of Engau and Hoffmann's strategies, such as withdrawal, do not apply in the context of the DPP. This can be explained by the differing levels of uncertainty, given that the upcoming regulations are not characterised by such a high perception of uncertainty as the post-Kyoto situation. Overall, this research confirms the theory of Engau and Hoffmann to apply to other case examples while extending it by introducing minor modifications that reflect the specific circumstances of the DPP implementation.

Like Engau and Hoffmann's findings, **Rogers' Diffusion of Innovators theory** was also found to align with the behaviour of companies in the textile industry at the time of the DPP development and implementation. All innovation adopter types, namely Innovators, Early Adopters, Early Majority, Late Majority, and Laggards, were identified within the companies studied. While the overall DPP adoption is still in its early stages, notable differences in companies' responses are already observable. This highlights that even within the early stages of regulatory adoption, companies apply diverse approaches. The theory provided a useful tool for classifying the companies and analysing their approaches with the DPP implementation.

This study confirms that Engau and Hoffmann's theory and the DOI theory can be applied in other contexts and expands these frameworks by integrating new insights specific to the DPP implementation in the textile industry. By combining the two theories, this research identifies a novel approach to understanding and analysing companies' responses to regulatory uncertainty and

mandated change. The four novel archetypes provide a useful lens to understand how companies perceive and react to regulations and outline their strategies as well as early preparation steps. What is specifically valuable within those archetypes is the combination of adoption timing and the strategies to counteract uncertainty. This combination offers a refined understanding of companies' behaviour during regulatory transitions, their perception of regulatory uncertainty, their strategies to navigate it, and their initial steps in preparing for forthcoming regulations.

The developed archetypes were used to answer the research question and illustrate companies' responses to the upcoming DPP regulations, but can additionally support analysing similar scenarios. The EP (2024) plans to further extend the DPP regulations to other industries such as electronics. This master's thesis can be used as a valuable lens to analyse companies' behaviour independent from the textile industry. One factor contributing to the transferability of this study is similarity in supply chain structures. Like the textile industry, sectors such as electronics and batteries rely on global, multi-tired and complex supply chains that lack transparency (Barkhausen, Fick, Durand & Rohde, 2023; Cicerelli & Ravetti, 2024). The need for technology integration and data management forms a cross-sectoral challenge, making this study’s findings applicable to other industries.

Additionally, the new typology can be relevant for analysing the dynamics of other emerging regulations. Companies are likely to exhibit similar responses when facing upcoming regulations with characteristics comparable to the DPP, such as the experienced level of uncertainty and the described timeframe between the first announcement and final enforcement of the regulation. Consequently, the findings of this research provide a useful lens for analysing similar future regulations, for instance, related to information disclosure.

6.4 Limitations of Research

Despite the valuable insights this study offers, some limitations should be acknowledged.

Transferability is a key quality indicator (Bryman, 2016), and although the results are context-specific, the insights gained about corporate responses to new regulations provide a broader understanding of strategic behaviour under regulatory uncertainty. This makes the findings potentially applicable to industries beyond the textile sector, particularly those dealing with comparable regulatory shifts. The observed dynamics of this study are likely to appear in other contexts as well, while unique characteristics of other industries would need to be considered. Some specific challenges occurring in the textile sector may not be as present in other industries. Many interviewees mentioned for instance the challenge of label cutting, and related problems with using a QR- code as a data transfer. This challenge would not occur in, for example, the battery sector. The found strategies and dynamics are transferable to other cases, while specific factors might deviate from this study's findings.

The **cross-sectional character** of the qualitative study, meaning the data collection at a single point in time, limits the ability to observe longer-term trends or shifts in companies' behaviour. Such temporal dynamics and evolving strategies in response to regulatory uncertainty might be overlooked, impacting the study's ability to capture the full scope of how companies adapt over time. The found archetypes could change with adjustments in the regulations. Dynamic external factors, such as evolving regulations or changes in the top management of the firms during the research period, may result in outdated responses (Cummings, 2018). The stability of findings may also be affected if significant strategic shifts in the interviewed companies occur after data collection. For example, company 6 indicated that they had only recently begun detailed planning for the DPP just two weeks before the interview. However, this presents a natural limitation of the cross-sectional design (Cummings, 2018).

Accessibility posed a challenge during the data collection, as the response rate from contacted companies was rather low. As discussed earlier regarding the distribution of the archetypes, the companies that responded to the interview request may represent a specific subset of firms. Those companies already engaged with or are interested in the DPP implementation, or have taken initial steps toward compliance. Less companies that are not yet addressing the upcoming regulations have participated. This implies a possible **sample bias**, with smaller and more proactive companies more likely to respond, which limits the diversity of perspectives captured in the study. To counteract this

limitation, expert interviews were conducted to gain a broader understanding of the industry and maintain the sample's representativeness (Von Soest, 2023).

It is also possible that the **interviewees'** employment in the sustainability department of the companies may have introduced a certain degree of **bias**. Their perspective on topics relating to sustainability may be influenced by their specific focus and responsibilities, potentially leading to a biased view. While CSR managers might prioritise sustainability and view the DPP as a significant initiative, other decision-makers within the company, who may not emphasise sustainability as strongly, could perceive the DPP as less critical or even unimportant. This difference in focus can result in varying attitudes towards the DPP across different levels of the organisation. Therefore, the expert interviews played a key role in validating the findings and providing insights into the strategies of those more actively preparing for regulatory changes.

6.5 Recommendations for Future Research

Future research could address several limitations of this study and provide deeper insights into the studied research areas. Based on previously described limitations, the following section proposes three future research designs to address those limitations.

First, to enhance the transferability of the study, the **research scope** could be expanded to a **broader industry focus.** By analysing and comparing companies of different industries, insights on the general dynamics in companies' responses towards the DPP can be gained. This can then be analysed independently of industry specifics. Since the DPP is planned to be implemented in many different sectors, research in this direction could provide valuable insights for various stakeholders and especially regulators.

Second, to increase the robustness of the findings, a **quantitative approach** with a **larger sample size** could be valuable. For instance, a questionnaire could be sent to a large number of different textile companies. This would address accessibility problems since often companies stated that they do not have the time for an interview. Answering a questionnaire could mean less effort for the companies and thereby result in a higher response rate. This approach would help to generalise the results and provide a more comprehensive understanding of textile industry-wide responses.

Lastly, to capture the full scope of how companies adapt over time, a longitudinal study could provide valuable insights. This would enable tracking of how companies' strategies evolve within the regulatory developments surrounding the DPP. A multi-case study approach could be used by

selecting one or two representative companies for each of the four identified archetypes. Researchers can investigate how the companies identified as specific archetypes behave over time and whether their behaviour stays consistent with their archetype or if they deviate from the identified characteristics. By analysing and comparing variations within these archetypes over time, researchers can investigate the strategic changes and concrete implementation steps evolving through regulatory changes.

7. Conclusion

Companies in the textile industry are facing the implementation of a Digital Product Passport enforced by the European Union. The DPP builds an innovative solution to address the urgent need for enhanced transparency and traceability in the textile industry and aims to facilitate a transition towards a more sustainable economy. However, its final enforcement is characterised by regulatory uncertainty. This study investigated how companies in the European textile sector perceive and respond to the upcoming DPP regulations.

Although attention on this topic is increasing, there remains a lack of academic studies, given the complexity and emerging nature of the circumstances. While prior studies have researched companies' strategic behaviour in response to environmental regulations and their timing in adopting them, the specific responses of textile companies to the enforcement of the DPP and associated regulatory uncertainty have not been thoroughly explored in the existing literature. This study aimed to address this research gap by specifically analysing companies in the textile industry. It explored companies' perception, preparation and planned implementation of the upcoming DPP regulations. Therefore, 16 semi-structured interviews with companies and experts were conducted. The strategic behaviour of 12 textile companies, complemented by the insights of four experts, has been analysed qualitatively.

The findings demonstrate that while some companies view the DPP as an opportunity to strengthen sustainability initiatives and enhance customer relationships, others remain hesitant or passive. They describe needed resources and problems with data management as significant implementation challenges. The companies perceive the uncertainty of the situation to impact their decision-making and seek clearer guidelines.

Based on the strategic frameworks of Engau and Hoffmann concerning regulatory uncertainty and Rogers' Diffusion of Innovation Theory, addressing the adoption of innovation, the interviewed companies were analysed. The research identified four key archetypes—Enthusiastic Pioneers, Proactive Planners, Cautious Strategists, and Confident Procrastinators—each representing different response and preparation strategies. The Enthusiastic Pioneers view the DPP as an opportunity for innovation and sustainability, proactively implementing DPP systems ahead of regulations and engaging with industry bodies to secure a pioneering position. The Proactive Planners adopt a more balanced approach, relying on external expertise and refining their strategies through experimentation and observation before fully committing. While they actively engage in the DPP

process, they are hesitant to fully commit until they have refined their strategies. The Cautious Strategists prepare for the DPP by gathering data and collaborating with partners, delaying major decisions until the regulatory landscape is clearer. They aim to minimise risks while remaining flexible to adapt as more information emerges. Finally, the Confident Procrastinators take a passive wait-and-see approach, delaying action until external pressures make it necessary, relying on experience and hoping for favourable outcomes. The studied sample reflects a generally positive and proactive attitude toward the DPP. However, the proportion of companies that are sceptical and passive in their behaviour is expected to be higher within the textile industry. The findings contribute to the existing literature on regulatory change by demonstrating how companies in a complex, highly regulated industry respond to mandated information disclosure, building on the theoretical frameworks introduced. The comprehensive examination of how textile companies respond to the upcoming DPP regulations offers theoretical insights and practical recommendations. Policymakers are encouraged to provide clear and accessible guidelines, along with practical support such as financial incentives and training, to reduce uncertainty for companies. Meanwhile, companies are advised to take a proactive approach in preparing for regulatory changes to benefit from potential opportunities the DPP presents. They are encouraged to engage in industry collaborations and share best practices. Overall, the DPP aligns with the sustainability and circularity goals aimed for in the textile industry by building a valuable tool to enhance transparency along the entire value chain and lifecycle of the textiles.

While providing rich qualitative insights, the relatively small sample size limits the ability to generalise the findings to the entire textile industry and other sectors. Additionally, the evolving nature of the DPP regulations implies that some of the findings may shift as more details of the regulation become visible. Future research could focus on a broader cross-industry comparison and longitudinal studies that analyse the adoption process as the DPP becomes more fully implemented.

Overall, this study highlights the DPP as a valuable tool to address the present sustainability and transparency issues occurring in the textile industry. The insights analysed from the industry stakeholders emphasise the urgency of this transition and show a scenario in which the DPP plays a central part in driving and regulating this shift towards a more sustainable and circular economy.

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Appendix

Appendix A Data Collection

Appendix A.1 Interview Invitation & Attachment

Dear (…),

I hope this email finds you well. My name is Lea Quick, a student in Sustainable Business and Innovation at Utrecht University in the Netherlands.

I came aware of you through your expertise as (position and firm). Currently, I am conducting my Master's thesis on the Digital Product Passport (DPP) in the Textile industry. With the thesis, I will address the following question:

How do companies in the textile industry respond to the upcoming mandated change concerning the Digital Product Passport?

Thereby, the focus is set on the perspective of European textile firms like (firm name) and how you perceive and address the coming DPP. I am reaching out to invite you to participate in this study, since your expertise would be incredibly valuable for this research. All participants will have access to the results of my analysis which include various response strategies across the industry.

Would you be interested and available for an interview for approximately 45 minutes? Please feel free to forward this invitation to any colleague who might be more suitable for the interview.

Thank you in advance and best regards,

Lea Quick
Master Student at Utrecht University

LOOKING FOR INTERVIEWEES

Preparing in the light of Uncertainty: How Fashion Companies Respond to New Regulations on the Digital Product Passport

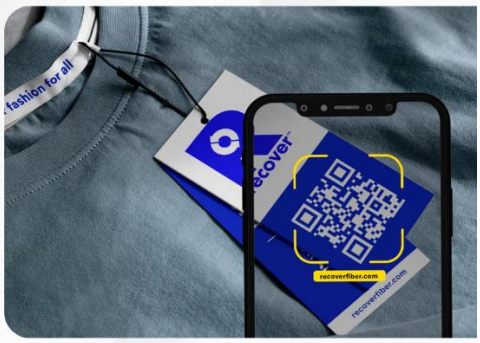
MY RESEARCH

Within my Master Thesis I am investigating the dynamics surrounding the Digital Product Passport implementation for the Textile industry.
The focus of my work is on how companies like yours respond to the realted upcoming regulatory uncertainties.
My underlying research question is:

HOW DO COMPANIES IN THE TEXTILE INDUSTRY RESPOND TO THE UPCOMING MANDATED CHANGE TO INTRODUCE THE DIGITAL PRODUCT PASSPORT?

THE INTERVIEW

I am conducting individual semi- structured interviews with important key stakeholders like you. Your expertise in the textile industry would be invaluable for this research and highly appreciated.
Your participation will involve a short confidential interview (about 45 minutes) conducted at a time convenient for you. The interview can be held online (for instance via Teams) or if suitable in person.



ARE YOU INTERESTED?

Do you want to contribute to gain critical insights on the implementation of the DPP in the textile industry?

Share your company's perspectives and get access to first hand insights!

Your input will contribute to a better understanding of industry strategies and responses to regulatory changes, ultimately benefiting the entire textile sector.

Ethical considerations

Your responses will be kept strictly confidential and anonymized in any reporting. The Data will be securely stored and only accessed by the research team.

Utrecht University

I would be greatly thankful to get to know your valuable insights and expertise. I appreciate your time and willingness to contribute to this study.
Warm greetings

LEA QUICK

Master Student
Sustainable Business and Innovation.

Contact:
l.quick@students.uu.nl
+49/ 15737220226

Appendix A.2 Ethics and Informed Consent

Before taking the interview, interviewees will be asked for permission to record the conversation. Additionally, it is important to inform the participants about the nature of the research and give the participants as much information as might be needed to make an informed decision regarding their participation in the research (Brinkmann & Kvale, 2005; Bryman, 2016). Furthermore, it is important to emphasise their right to withdraw at any point, how their data will be used and safeguarded to preserve confidentiality, and to possibility of contacting the university's Data Protection Officer if needed (Brinkmann & Kvale, 2005; Utrecht University, n.d.). The interviewees will always remain anonymous and will not be required to provide any personal information. The interview guide will also include these points. Informed consent will be obtained by presenting an oral statement of the abovementioned factors (Utrecht University, n.d.).

Appendix A.3 Interview Guide

Introduction

Before the interview, informed consent from the participants is going to be obtained to be able to use the insights in a valid manner. This will be done by presenting an oral statement of the following factors:

- *Introduce research*
- *Purpose of the interview*
- *Give a short outline of the topic & research*
- *Explain the procedure of the interview*
- *Explain how the data will be used and safeguarded*
- *Right to withdraw at any point and to contact the university's Data Protection Officer*
- *Interviewees will always remain anonymous, no personal information is required*
- *Interviewees can always contact the researcher for any further information/ questions*
- *Asking for consent for the abovementioned points*

1) Background Information

1a) Could you tell me something about yourself and your position within the firm XY?

2) Understanding of Digital Product Passport:

2a) How familiar are you with the upcoming regulations on the DPP?

- How relevant is the topic of the DPP in your firm/ How frequently discussed?

2b) How do you perceive the potential impact of the DPP on your firm's operations within the textile industry?

2c) What challenges does your firm face regarding the upcoming requirements?

2d) What benefits or opportunities do you identify in this context?

2e) How do you perceive the uncertainties regarding the upcoming DPP implementation?

- To what extent do you perceive your firm to be affected by those uncertainties?

3) Response Strategies:

3a) How do those uncertainties impact your firm's strategies and operations?

- To what extent do you foresee changing your operations or business model?

3b) Which activities does your firm currently pursue to deal with the uncertainty-related to the upcoming regulations?

3b) What steps of preparation has your firm taken so far for the DPP implementation?

- What resources (financial, human, technological) have been allocated for DPP compliance?
- Are you participating any collaborations or communication efforts with regulatory bodies or industry partners?
- Are there any other specific initiatives or projects your firm is planning to implement in response to the DPP?

3c) How does your firm generally tend to react towards uncertain situations?

- How did your organisation prepare themselves for new developments in the past (e.g. CSRD)?

4) Industry analysis:

4a) How do you perceive other players in the industry reacting to the situation?

- Do you consider yourself a fast-mover or follower compared to others? (Can you give examples?)

4b) Do you see the situation affecting the landscape of the textile industry?

- Have you observed any changes in industry-wide behaviour due to the impending DPP implementation?

5) Closing and Final Thoughts

5a) Is there anything else you would like to add or share?

5b) Do you have any recommendations on who else I could speak to?

Thank you and Closing Remark

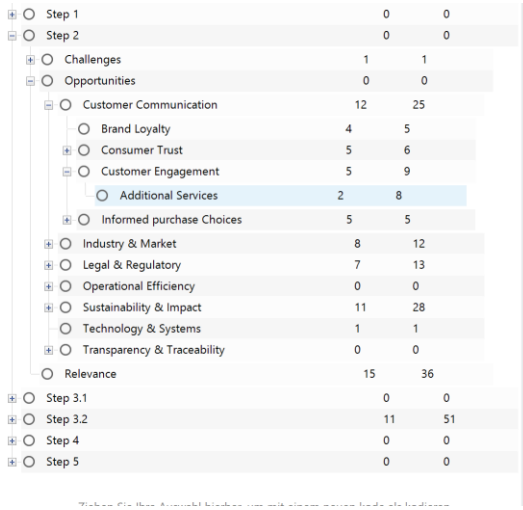
Appendix A.4 List of Interviewed Companies

Company	Industry	Country	Employees
Company 1	Clothing/ Jeans	Netherlands	~ 50
Company 2	Clothing/ Underwear	Netherlands	~ 7000
Company 3	Clothing / Backpacks	Germany	~ 50
Company 4	Clothing / Jeans	Netherlands	~ 1000
Company 5	Clothing/ Wholesale	Germany	~ 1000
Company 6	Backpacks/ Bags/ Shoes	Germany	~ 300
Company 7	Clothing/ Footwear	Spain	~3000
Company 8	Clothing	Netherlands	~100
Company 9	Clothing	Spain	~ 100.000
Company 10	Clothing/ Accessoires/ Luxery	France	~1000
Company 11	Clothing, Medium Luxery	Netherlands	~200
Company 12	Clothing	Germany	~350

Appendix B Data Analysis

This Appendix provides examples of the coding process, to get a better understanding of how the collected data was analysed and categorised.

Appendix B.1 Nvivo Coding Example Opportunities



It's not a new thing, it's just extending the warranty.
But it gives a good reason for the clients to register the product.
So that's an example.

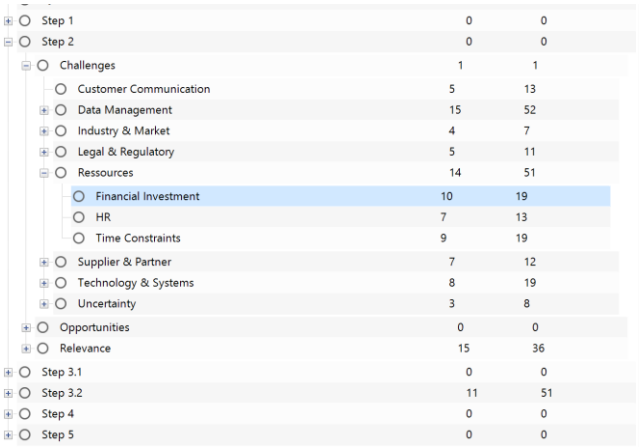
Referenz 5 - 0,67% Abdeckung

So I I feel that the brands that are saying that is not gonna be very useful is just because they're gonna look at, they're looking at it as the basic set of DPP, while if you added services to it or or create an ecosystem around it could be.
Could be something else

Referenz 6 - 1,35% Abdeckung

For example, there are third parties that are talking today about.
Digitalizing your wardrobe. Thanks to the digital ID. So you scan your product and you have pictures and you can do applications? I don't know AI. Everything is AI today -AI proposing you looks with the wardrobe you actually have, or even proposing you shopping things. New products to buy. Mixing what you have and your style. This kind of things and.
That's cool. That's services that a good reason for a client we to interact with the DPP or at least certain clients.

Appendix B.2 Nvivo Coding Example Challenges



implementing a data system in your company that takes first a lot of money

Referenz 2 - 0,37% Abdeckung

Only OK if you see it only for the company. Then it's way more work and way more cost.

Referenz 3 - 0,73% Abdeckung

. You're a company, and you're a commercial. You need to earn some some money.
And if you're only looking into things that won't.
Be necessary? Yeah. Why would you do it?

Referenz 4 - 1,29% Abdeckung

Yeah, if you need to do it on every products, yeah, that's one that, that's where they say, yeah. Then you need to implement the RFID. Yeah. If you need to implement it that that costs like 1,000,000. Yeah.
That's not done by tomorrow.
Yeah. And it's an investment like not every company can pay that.

Appendix B.3 Analysis Scheme Adopter Categories

Company	Integration in DOI	Status	Approach	Example
Company 1	**Late Majority**	Not implemented	Prepare as good as possible to comply, but also wait until regulation is clearer	*"We're preparing for it. There's still a lot uncertain. We don't want to like full force go into it and then have to do everything all over again because, with a lot of sustainability projects, that is the case."*
Company 2	**Late Majority**	Not implemented	Wait what is coming, in the meanwhile prepare as far as possible	*"You're a company. You need to earn some money. And if you're only looking into things that won't be necessary? Why would you do it?"*
Company 3	**Late Majority**	Not implemented	Prepare as good as possible to comply, to support sustainable strategy, open and positive mindset, aiming to surpass regulations	*"Those are all the things we do, with which we try to prepare ourselves, and which hopefully are enough to comply with the regulations."*
Company 4	**Early Majority**	Implementation planned and prepared	Be a pioneer, taking effort to make an extra step	*" I think the main goal is to pioneer in this, Communicate this information, but also in in a good way. That people understand it and want to read it."*
Company 5	**Laggard**	Not implemented	Wait until action is neccessasry	*"In the end we can only wait and see what is going to come"*
Company 6	**Late Majority**	Not implemented	DPP as competitive advantage as a sustainable company, still more of a wait and see mindset while steadily progressing and preparing in the direction of transparency	*"Of course, we also see this topic as a clear competitive advantage, because for us, the topic of responsibility and sustainability has always been a driving force that sets us apart from our competitors."*
Company 7	**Early Majority**	Implementation planned and prepared	Comply and go further, Prepare earlier	*The idea for now is to have everything almost ready as broadly as possible. There will be minimum requirements, but you can always communicate more and in a perfect case. Maybe I'm speaking really far out the window now, but we could already introduce it earlier to see.*
Company 8	**Early Adopter**	Implementation in progress	See themselve as a pioneer, pushing transparency and sustainability. Try out the way they think and adjust when the regulation is going to come	*"We are the type of company that is not going to sit and wait."*
Company 9	**Early Adopter**	Implementation in progress	Proactively take part in regulation process, prepare, try out	*"The DPP is becoming very important for us. While we are not fully using DPPs across our entire range yet, we are moving in that direction. It aligns perfectly with our goals of sustainability and transparency."*
Company 10	**Innovator**	Implementation advanced in progress	Enthusiastic and see internal value in DPP, therefore created own version, which is planned to be extended to all products by 2025	*"Our objective is to go to 100% of all our categories equipped with the digital ID by 2025. We don't want to wait for the legislation to arrive to implement, but we want to do our own and hope it's as close as possible to the regulation to align it after. "*
Company 11	**Early Majority**	Implementation planned and prepared	Implement the DPP regardless the regulations, DPP is seen as a tool to move forward in sustainability	*"Last year we started a first try out with a traceability system, just to see how that works and if we can implement such a system in our company. And actually, now we start a new pilot with a new system with the idea to really move forward with that and to create a fully traceable supply chain around next year."*
Company 12	**Early Majority**	Implementation planned and prepared	Aim to start earlier, aligning with sustainable strategy, seeing the worth in the DPP to educate and support sustainability	*"We try to utilize the added value that the DPP will ultimately have for the customer in such a way that it makes our products, and especially what makes our products so special, as sustainable as possible, and that all the work we put into it can also be reflected in this."*

Appendix B.4 Analysis Scheme Strategic Postures

Company	Approach	Strategic Posture	Strategies
Company 1	Offensive, Defensive, Passive	Hedger	Postponement, Investigation, Internal Design, Imitation, Cooperation
Company 2	Offensive, Defensive, Passive	Hedger	Postponement, Investigation, Imitation, Flexibility, Cooperation
Company 3	Offensive, Defensive, Passive	Hedger	Simplification, Postponement, Investigation, Imitation, Flexibility, Cooperation
Company 4	Offensive, Defensive	Daredevil	Cooperation, Imitation, Flexibility, Investigation, Influencing
Company 5	Gamble	Gambler	Rely on experience, Postponement, No active addressing of uncertainty, No Influencing, No Cooperation with other companies
Company 6	Offensive, Defensive, Passive	Hedger	Substitution, Postponement, Flexibility, Cooperation, Experimentation
Company 7	Offensive, Defensive	Daredevil	Substitution, External Information, Investigation, Influencing , Flexibility, Cooperation, Experimentation
Company 8	Offensive, Defensive	Daredevil	Substitution, Investigation , Influencing, Flexibility, Cooperation, Experimentation
Company 9	Offensive	Daredevil	Investigation, Influencing, Cooperation, Experimentation, Internal Innovation Hub
Company 10	Offensive	Daredevil	Investigation, No Influencing, Flexibility, Cooperation, Experimentation
Company 11	Offensive, Defensive	Coordinator	Experimentation, Investigation, Flexibility, Cooperation, Simplification, Imitation
Company 12	Offensive, Defensive	Coordinator	Substitution, Experimentation, External Information, Investigation, Influencing , Imitation, Flexibility, Cooperation

Appendix B.5 Analysis Scheme Example Hedger

Company	Strategy	Strategic Posture	Approach Example	
Company 1	Offensive, Defensive, **Passive**	Hedger	Imitate	*"It's nice to be a smaller brands because you can see also first see how the bigger ones are doing it and then take lessons from that as well and then put it in our own way of working"*
Company 2	Offensive, Defensive, **Passive**	Hedger	Postponent	*"We just leave it out for a bit now. Everyone is really busy."*
Company 3	**Offensive**, Defensive, Passive	Hedger	Investigation	*"We are observing the developments, that are happening"*
Company 6	Offensive, Defensive, Passive	Hedger	Cooperate	*"We are for example part of a working group with the topic of the DPP and this is our preparation to stay up to date"*

Appendix B.6 Analysis Scheme Example Daredevil

Company	Strategy	Strategic Posture	Approach Example	
Company 4	**Offensive,** Defensive	Daredevil	Influencing	*"These uncertainties impact our strategies. By prioritising flexible and adaptive approach. We are proactively engaging with industry bodies and also regulators to stay informed and be prepared for any changes."*
Company 7	**Offensive**, Defensive	Daredevil	Flexibility	*"For now, it's very much get prepared as broadly as possible and then you can fine tune it towards the end"*
Company 8	**Offensive**, Defensive	Daredevil	Cooperate	*"We do collaborate with a solution provider for the DPP. We have an IT partner who is providing us with a web-based app. In which we implemented the DPP"*
Company 9	Offensive	Daredevil	Influencing	*"We stay engaged with regulatory bodies and industry groups to stay informed and contribute to shaping the regulatory landscape."*
Company 10	Offensive	Daredevil	Investigation	*"We don't really know what's gonna be in the details so. We are talking with a different stakeholders, other brands."*
Company 11	Offensive	Daredevil	Cooperate	*"We ask for a lot of advice from our legal team, which is specialised in European laws on on all these kind of sustainability."*

Appendix B.7 Analysis Scheme Archetypes

Type	Description	Expert Description	DOI characteristics	Strategic Posture Characterstics
Enthusiastic Pioneers	Companies that proactively lead the way in DPP adoption by implementing first try outs, staying flexible and being motivated to integrate new regulations to drive sustainability and innovation	*"Some brands, mostly the bigger ones with more resources, are embracing the new legislation and seeing it as an opportunity. These companies are pioneers in the DPP implementation." (E2)*	**Innovator** First DPPs already implemented, and planned to be extended, independent from upcoming regulations recognised innovative value, enthusiastic mindset about DPP **Early Adopter** Aiming to pioneer in the DPP process, First try outs, stay open for later adjustments	**Daredevil:** Counteracting uncertainty through proactive engagement with industry bodies and regulators, flexibility, and in advance preparation to adapt quickly to new regulations
Proactive Planners	Companies that deliberately plan and organise their DPP implementation process. Aim to stay ahead by aligning efforts with long-term sustainability goals while maintaining a positive and open mindset.	*"Some companies are aware of the DPP and prepare by testing and learning from the market. They are already trying things out, while being still in the early stages of preparation." (E4)*	**Early Majority** Prepare as good as possible to comply and possibly even surpass, Perceive DPP as support of sustainability strategy, open and positive	**Coordinator** Reducing the uncertainty through investigation and flexibility combined with industry collaboration and more defensive elements like imitation
Cautious Strategists	Actively preparing for DPP implementation, carefully allocating resources only when necessary, and prioritizing risk mitigation through a diversified strategy.	*"For many brands, the approach is step by step: 'Piece piece by piece. Let's just wait to see what happens before we start to change business operations' It's likely smaller brands will wait to see how bigger brands implement changes before they start" (E2)*	**Late Majority** Prepare as good as possible to comply, but postpone action bit until regulation is clearer	**Hedger** Minimizing the risk by combining strategies like investigation, cooperation and postponing of major decisions
Confident Procrastinator	Companies that only respond when forced by external pressures, relying on experience and available resources to implement changes.	*I've spoken with many brands that aren't there yet—some didn't even realise how soon the changes were coming. There are companies taking a laid-back approach, saying, 'I'll just wait and see where this goes.' These are the waiters, and there will always be companies that find ways around the legislation. (E1)*	**Laggard** Wait until action is necessary	**Gambler** Gamble for a positive outcome and rely on experience