UNIVERSIDADE CATÓLICA PORTUGUESA

Digital Transformation Supporting Sustainability

A Comparative Case Study in the Fashion Industry

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Católica Porto Business School
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Abstract

The fashion industry is in constant growth and evolution, standing out as one of the largest industries globally but also one of the most polluting. Sustainability therefore represents an increasingly important and relevant challenge, and digital transformation can be a strong ally in this evolution that seeks solutions for a better future.

Consumers are looking for new options when making purchases and tend to pay more attention to the impact their choices may have. Thus, for companies to remain competitive, they need to adapt and also consider the needs of the planet.

This qualitative study aims to explore how digital transformation is being used in support of sustainability in two of the largest companies in the fashion sector, Moncler and Inditex. Through the annual reports shared by these companies, it was possible to analyse the initiatives implemented that use technology to their advantage.

The results led to the creation of five dimensions for categorizing the initiatives, and it was therefore possible to conclude that digital transformation is used to support sustainability by optimizing processes, increasing supply chain transparency, enhancing the customer experience, supporting circular initiatives, developing innovation opportunities, and thus allowing organizations to remain competitive in a demanding and fast-evolving environment.

Keywords: Sustainability, Digital Transformation, Fashion, Innovation, Circular Economy

Word count: 9333

Resumo

O setor da moda está em constante crescimento e evolução, destacando-se como um dos maiores setores globalmente, mas também um dos mais poluentes. A sustentabilidade representa assim um desafio cada vez mais importante e relevante e a transformação digital pode ser um grande aliado nesta evolução que procura soluções para um futuro melhor.

Os consumidores procuram novas opções no momento da compra e tendem a ter mais atenção ao impacto que a mesma poderá ter. Desta forma, para as empresas se manterem competitivas precisam de se adaptar e ter em atenção também as necessidades do planeta.

O presente estudo qualitativo pretende explorar como a transformação digital é utilizada em prol da sustentabilidade em duas das maiores empresas do setor da moda, a Moncler e a Inditex. Através dos relatórios que as mesmas partilham anualmente foi possível analisar as iniciativas implementadas que utilizam a tecnologia a seu favor.

Os resultados permitiram a criação de cinco dimensões para categorização das iniciativas e foi assim possível concluir que a transformação digital é utilizada para apoiar a sustentabilidade, otimizando processos, aumentando a transparência na cadeia de abastecimento, fortalecendo a experiência do consumidor, apoiando iniciativas circulares, desenvolvendo novas oportunidades de inovação e dando assim oportunidade às organizações de permanecerem competitivas num ambiente exigente e em rápida evolução.

Palavras-chave: Sustentabilidade, Transformação Digital, Moda, Inovação, Economia Circular

Número de palavras: 9333

Contents

Table of Figures

Table of Tables

List of Abbreviations

AI - Artificial Intelligence

CE - Circular Economy

CSR - Corporate Social Responsibility

DT - Digital Transformation

GHG - Greenhouse Gas

IoT - Internet of Things

KPIs - Key Performance Indicators

NGOs - Non-Governmental Organizations

PLM - Product Lifecycle Management systems

R&D - Research and Development

RDBMS - Relational Database Management Systems

RFID - Radio Frequency Identification

SBTi - Science-Based Targets initiative

SDGs - Sustainable Development Goals

SINT - Integrated Stock Management System

TBL - The Triple Bottom Line

ZDHC - Zero Discharge of Hazardous Chemicals

Introduction

The fashion industry is considered as one of the most influential and fast-evolving sectors globally. However, with this rapid growth, a significant impact in environment and in society also emerges. Accordingly with the Ellen MacArthur Foundation (2017), the industry is responsible for the production of around 2.1 billion tonnes of greenhouse gas emissions annually, being considered as one of the top polluting industries.

The increasing pressure of all stakeholders, going from clients, suppliers, competitors or even the government, has made sustainability a necessity for fashion companies to remain competitive and it's now urgent to rethink their business models and ways of working. In response to this challenge, digital transformation can be a tool and a key enabler of more transparent, efficient, and circular business models (Pagoropoulos et al., 2017; Vial, 2019).

Both topics, digital transformation and sustainability, have been subject to several research and have seen an increase of relevance over time, but there's still a need to analyse the application of digital technologies in actual case studies and its impact, when related with sustainability (Pagoropoulos et al., 2017).

To contribute to the trending topic and to help fill the gap in the literature, which highlights the limited number of case studies, this study aims to contribute to the discussion of the impact of digital transformation in sustainability in the fashion industry, by answering the research question "How can digital

transformation impact sustainability?" and its subdivision into "How is it used in the fashion industry?" and "How do different fashion companies do it?".

Moncler and Inditex are ranked as the most sustainable companies in the fashion industry in 2024, and for that reason they were chosen to be compared to understand the application of digital technologies in actual case studies. A qualitative approach was used by choosing to follow a multiple case study with the main source of information being the public reports shared by the organizations.

This study is organized and structured into four main chapters: Chapter 1 contains the Literature Review, divided into the most relevant topics: Fashion Industry, Digital Transformation, Sustainability, and the relation between all concepts, finishing with the conclusion of the research gap that led into the research question. Chapter 2 starts by explaining the research question and objectives of the study, and contains the Methodology used for the Case study selection, the Data collection method, and finally the Data analysis procedure. To expose the data retrieved and selected, Chapter 3 Data Analysis presents the information of both companies to be discussed later in Chapter 4 Discussion, relating the data with the literature review already presented and compare the findings. To finalize, the Conclusion offers a final review of the study presented with its main findings, limitations and suggestions for future research.

Chapter 1
Literature Review

1.1. Fashion Industry

The fashion industry has doubled the production volumes over the past years and is now a USD 1.3 trillion global industry, employing more than 300 million people along the value chain (Ellen MacArthur Foundation, 2017). This rapid increase in production, also created an increase in Greenhouse Gas (GHG) emissions, and it is estimated that the industry produces around 2.1 billion tonnes, representing 4% of the global total emissions, with 70% of them coming from upstream activities (McKinsey & Company, 2020). With that said, the fashion industry ranks as the second largest polluting industry of the environment (Gomes de Oliveira et al., 2022), but at the same time, there's still potential to reduce these emissions by 50% by 2030 if companies adopt measures such as renewable energy, efficiency improvements, and circular business models (McKinsey & Company, 2020).

In this sense, and mostly because of their stakeholders' pressure and global needs for sustainability, the fashion industry is under transformation of its operating paradigm, and companies are now searching for solutions and strategies to include in their business (Colombi & D'Itria, 2023). These strategies take not only the planet's resources into consideration, but also the social and

economic dimensions, such as respect for people and the sustainability of their profits (Colombi & D'Itria, 2023).

Over the last years, the fashion industry has transformed itself with significant changes in the competitiveness between companies, reflecting the need to reshape the business model (Gazzola et al., 2020). This transformation led to a fast growth in the industry, and despite the last decade's financial crisis, global brands keep working in a highly competitive environment (Gazzola et al., 2020) and the concern with sustainability in the sector has become a strategic issue, since companies want to obtain competitive advantage by adopting sustainable practices and decreasing their negative environmental impact (Gomes de Oliveira et al., 2022).

Colombi & D'Itria (2023) also highlights the current economic and climate crisis as the responsible for the industry radical change, to maintain competitiveness by developing alternative business models, since fashion companies are sensitive to new challenges related with sustainability scandals (Moretto et al., 2018).

It is also relevant to address the subject from a supply chain perspective, since the fashion industry business model "has been predominantly built on the use of fragmented suppliers, often located in low labour cost countries that lack stringent environmental and social regulations, and on resource and pollution-intensive production processes" (Ramos et al., 2020).

Several Non-Governmental Organizations (NGOs) have started initiatives to inform the public and bring attention to this issue by sharing the unpleasant aspects behind the industry, like the relation between the production and the critical environmental and social issues (Moretto et al., 2018).

Both fast fashion companies and luxury groups have explored new paths towards sustainability (Moretto et al., 2018), even though fast fashion is aiming

at an immediate consumption, considering the speed of both production and subsequent disposal of clothing (Gomes de Oliveira et al., 2022).

Recently, a new movement, representing the total opposite, was created in the fashion industry called Slow fashion (Gomes de Oliveira et al., 2022). It uses sustainable aspects as a priority, slowing the production, diminishing the exploitation of natural resources, and avoiding overproduction, intending for a more conscious consumption, considering the quality and the long-term duration of the garments (Gomes de Oliveira et al., 2022).

Despite all that, both fast and slow fashion segments are trying to attract the consumer attention using different approaches on communicating their sustainability practices (Gomes de Oliveira et al., 2022), and business model innovation towards circularity is considered by Colombi & D'Itria (2023) as a crucial capability for fashion companies, as the primary business model for the fashion industry to address their issues related with sustainability.

1.2. Digital Transformation

Digital Transformation (DT) has been studied and defined by several researchers and experts over the years due to its evolution to identify its impacts, both its benefits and consequences (Zaoui & Souissi, 2020).

It was only in 2017 that DT started to be an important academic term (Plekhanov et al., 2023) and ever since 2019, the number of articles on this subject has significantly increased (Tavana et al., 2022), by becoming a worldwide topic issue of great importance for all companies in all sectors, as it changes customer relationships, internal processes, and value creation (Zaoui & Souissi, 2020). The topic's increasing relevance is proved by the acceleration in the number of articles published in the last years (Plekhanov et al., 2023).

Vial (2019) did an extensive literature review on a selection of articles to combine what is already known about Digital Transformation and how the concept has been defined over time and Zaoui & Souissi (2020) completed by saying that definitions can vary depending on perspectives and perceptions.

One of the first definitions of Digital Transformation is found in the work of Westerman et al. (2014), who considered it as the use of technology to improve performance or reach of enterprises.

Vial (2019) reviewed and compared 23 unique definitions and gathered three observations: that DT was primarily defined as being related to organizations, there was a difference across definitions when it came to the types of technology and the nature of the transformation taking place, and finally, there was a common similarity between definitions when using terms as "digital technologies".

Based in these observations, Vial (2019) developed a conceptual definition of DT as "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies". In this way, the definition came to be more inclusive and consistent, because it is not organization-centric, it acknowledges improvement without guaranteeing the realization and does not focus only on digital technologies (Vial, 2019).

More recently, in 2024, Tangwaragorn et al. (2024) defined DT as representing "a strategic initiative where organizations adapt to the changing digital environment, utilizing technologies such as mobile computing, Artificial Intelligence (AI), cloud computing, Block-chain, and the Internet of Things (IoT) to revolutionize their processes of creating value".

For the purpose of this study, Vial (2019) definition of DT will be used since it's considered to be more general and inclusive on a company's transformation.

There are a lot of benefits for organizations in implementing Digital Transformation by empowering collaboration among internal and external organizations and systems (Tavana et al., 2022). Accordingly with Daugherty et al. (2015), DT enables companies to be more effective managing external challenges, and in a competitive and unpredictable environment, turns those challenges into opportunities.

Many authors considered the influences of Digital Transformation on firm performance concerning productivity, organizational restructuring, profitability, environmental innovation, and supply chain performance, highlighting the positive consequences of Digital Transformation (Tian et al., 2023).

Henfridsson & Liu (2017) mentions that digital technologies in organizations can be used to optimize the production process, accelerating the integration of research and development, production, sales, as well as services, and finally reshaping the value chain, and, similarly Vial (2019) considered technology to be important for an organization to remain competitive in a digital world and went further by describing DT as a source of disruption at social and industrial levels, such as consumer behaviour and expectations, competitive landscape, and availability of data.

Confirming the above, Verhoef et al. (2021) considered that "Digital Transformation and resultant business model innovation have fundamentally altered consumers' expectations and behaviours, pressured traditional firms, and disrupted numerous markets.".

Tian et al. (2023) findings also indicate that Digital Transformation has a positive effect on a firm's operational efficiency, since it can improve the firm's operations, and practices centred on data resources and digital technologies might be crucial for increasing it.

And, finally, Tangwaragorn et al. (2024) considers technology as a primary catalyst for transformation, making it necessary for organizations to remain competitive by making significant shifts.

However, for the Digital Transformation process to have positive results, there are several factors to consider (Vial, 2019). Strategy, structure, processes, and culture are considered as required for a company when it comes to its capability to generate value creation, and organizations must implement structural changes and overcome barriers while using digital technologies to that end (Vial, 2019).

Building on these, Zaoui & Souissi (2020) developed and proposed a roadmap for digital transformation, considering the process to have three indispensable phases:

1- Evaluation of Digital Transformation.
2- Definition of the strategy and setting of strategic goals.
3- Implementation of Digital Transformation.

In a separate way, Verhoef et al. (2021) identified three stages of Digital Transformation to be:

1- Digitization, by mainly digitalizing internal and external documentation processes, and not changing activities of value creation.
2- Digitalization that also includes process improvements, by not only focusing on cost savings, but also enhancing customer experiences.
3- Lastly, Digital Transformation affects the whole company, and firms search for and implement business model innovation.

For this process to be successful and have a positive outcome, there are factors that can impact and determine its results, such as leadership commitment and a clear strategic view, in which digital initiatives must be well aligned with the business strategy (Hess et al., 2016; Kane et al., 2015). Employees roles and skills also change (Vial, 2019), and people must be trained to achieve the right skills

and tools (Tavana et al., 2022), in this way, creating a culture of innovation within the organizations, as well as agility and continuous learning that can mitigate the inertia and resistance that could occur (Vial, 2019). As mentioned before, external forces can also have an impact, such as customer behaviour, and market competitiveness (Verhoef et al., 2021), playing a significant role in the effectiveness of Digital Transformation.

Tangwaragorn et al. (2024) systematic review identified five primary elements that integrate and impact the Digital Transformation, being them the culture, human capital, governance, research and development (R&D) and organizational strategy.

When it comes to the fashion industry, Digital Transformation has been studied by several authors to understand how it is used in the evolution of the industry. Colombi & D'Itria (2023) recognizes Digital Transformation as an asset when it comes to transforming the fashion industry into a more sustainable one, using technological devices to generate transparent and sustainable supply chains, but also to avoid inefficiency. With digitization, monitor a greater amount of data is now possible, which helps to identify waste and production processes with errors in real time, which can facilitate actions to solve problems much faster (Colombi & D'Itria, 2023). DT has also "revolutionized product organization and design, streamlined purchasing and production processes, enhanced product distribution strategies, facilitated real-time sales feedback, and facilitated prompt consumer response" (Li et al., 2024).

1.3. Sustainability

The Brundtland Report first affirmed in 1987 that "Sustainable development is development that meets the needs of the present without compromising the

ability of future generations to meet their own needs" (World Commission on Environment and Development (WCED), 1987). The concept ever since then has evolved to also include environmental, social, and economic dimensions, and more recently to also include governance.

Kuhlman & Farrington (2010) considered a looser definition of Sustainability as "a state of affairs where the sum of natural and man-made resources remains at least constant for the foreseeable future, in order that the well-being of future generations does not decline".

Among researchers, there is still progress to be made when defining Sustainability because there's no universally agreed definition of it, due to its complexity and by being contested, since it's a concept under continuous discussion and research (Ramos et al., 2020).

The concern about aspects of work related to sustainability is increasing in society and leads to organizations to reflect and act on the economic, environmental, and social problems affecting the current and future generations, by identifying problems and responding to them, transitioning towards sustainability (Esbeih et al., 2021). But the sustainability tripod, that includes economic, social, and environmental issues, continues to be a challenge for companies to work on, primarily the environmental issue (Gomes de Oliveira et al., 2022).

The Triple Bottom Line (TBL) was first described in 1997 as a term focusing on economic prosperity, environmental quality, and social justice (Elkington, 1997) and, accordingly with Moretto et al. (2018) the pillars of the Triple Bottom Line dimensions lead many companies that are trying to use sustainable initiatives to transform their business to fail, by making only task-oriented decisions. On the other side, the TBL could also support creatively developing, visualizing, and communicating sustainable business model innovation in organizations, generating multiple types of value (Joyce & Paquin, 2016).

In the European Union, recent policies of the European Commission reflect the concern for sustainability that has been shared by its politically and ecologically motivated discourse (Eckert & Kovalevska, 2021). Furthermore, in 2015, all member states of United Nations adopted *The 2030 Agenda for Sustainable Development* that was created to share a blueprint for peace and prosperity for people and the planet (United Nations, n.d.). 17 Sustainable Development Goals (SDGs) were developed, and governments have committed to the sustainability transition by adopting and including them in their day to day. They are now described in the table 1.

Goal	Resume	Description
1	No Poverty.	End poverty in all its forms everywhere.
2	Zero Hunger.	End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
3	Good Health and Well-Being.	Ensure healthy lives and promote well-being for all at all ages.
4	Quality Education.	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5	Gender Equality.	Achieve gender equality and empower all women and girls.
6	Clean Water and Sanitation.	Ensure availability and sustainable management of water and sanitation for all.
7	Affordable and Clean Energy.	Ensure access to affordable, reliable, sustainable and modern energy for all.
8	Decent Work and Economic Growth.	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
9	Industry, Innovation, and Infrastructure.	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
10	Reduced Inequalities.	Reduce inequality within and among countries.
11	Sustainable Cities and Communities.	Make cities and human settlements inclusive, safe, resilient and sustainable.

Goal	Resume	Description
12	Responsible Consumption and Production.	Ensure sustainable consumption and production patterns.
13	Climate Action.	Take urgent action to combat climate change and its impacts.
14	Life Below Water.	Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
15	Life on Land.	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16	Peace, Justice, and Strong Institutions.	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
17	Partnerships for the Goals.	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

Table 1: 17 Sustainable Development Goals

Sustainability is used by companies to remain competitive in this economic context, and there's an increase in the search for alternatives to maintain sustainable growth and enhanced resource efficiency (Pagoropoulos et al., 2017), but Moretto et al. (2018) affirms that sustainability should be address by organizations not only within their internal processes, but also by extending this need along the supply chain.

Colombi & D'Itria (2023) concluded that many companies use sustainability dimension to innovate their business model and consequently increase their competitive advantage, but the path to achieve it is not always linear, since it has several complex and dynamic levels of deployment in each step (Moretto et al., 2018).

Gazzola et al. (2020) had previously affirmed that sustainability and circular economy (CE) are the most important phenomena influencing the fashion market

and its competitiveness. This sustainability issue that the fashion industry represents, creates the desire to transform into a more sustainable economic system, and circular economy is defined as a primary model to address it and achieve it (Colombi & D'Itria, 2023).

Circular Economy definition was originated in environmental, ecological, and industrial economic areas, where the intention is to replace the current linear economic model to one where products and services can be reused, recovered and recycled, taking the most out of their useful life and in this way reducing the production chain (Esbeih et al., 2021). In this way, it appears as a system to replace "end of life" with "restoration" (Esbeih et al., 2021).

Pagoropoulos et al. (2017) had also already mentioned that circular economy was attracting attention from researchers and policy makers due to being a restorative and regenerative economy, where companies concentrate on rethinking products and services from the bottom up to "future proof" their operations and even considering the customer value proposition.

1.4. Digital transformation and sustainability in fashion

The integration of digital transformation and sustainability has increased in the fashion industry with researchers analysing new business models and digital technologies to improve efficiency and circularity.

In the fashion industry, sustainable business models can serve to coordinate technological innovations with circularity to reach sustainability (Colombi & D'Itria, 2023). Digital-driven application nurture innovation and reduce adverse environmental effects, by changing the organization work with the available resources, and this could include digital lean manufacturing, additive

manufacturing, and de-materialization through digital services (Colombi & D'Itria, 2023).

Colombi & D'Itria (2023) presents an example on how a lean manufacturing software was able to increase safety, work quality, and consequently, worker' behaviour and productivity, while still reducing and optimizing costs and virtually eliminate waste.

Pagoropoulos et al. (2017) also had concluded that "digital technologies play an important role in the transition towards a Circular Economy by optimizing forward material flows and enabling reverse material flows", and that this importance is generally agreed.

Digital technologies can help close the material loop, when looking to the life cycle stages, taking the focus to end of life and link to production, and one example that can help is the use of Radio Frequency Identification (RFID) technology, that can contain, for example, information on how the product was utilized by the customer (Pagoropoulos et al., 2017).

In this sense, Pagoropoulos et al. (2017) did a literature review and identified key digital technologies connected with Circular Economy and grouped them in three architectural layers: Data collection, Data integration and Data analysis.

Data collection included Radio Frequency Identification (RFID) technology that uses electromagnetic fields to automatically identify, and track tags attached to the garments, helping, in the context of circular economy, track material flows, and Internet of Things (IoT) that can collect information generated by sensors to connect stakeholders across the value chain

Data integration considered Relational Database Management Systems (RDBMS) and database handling systems, and Product Lifecycle Management (PLM) systems, all supporting Circular economy by integrating information across multiple life cycles and several stakeholders in the value chain.

Finally, Data analysis contained Machine Learning and Artificial Intelligence (AI) technologies, which can identify patterns and optimize operations through data-driven predictions, and Big Data analytics that allows companies to extract insights from massive datasets.

It is not only in the fashion industry that the concepts of Digital Transformation and Sustainability are studied together, for example, Ingemarsdotter et al. (2019) developed a structured framework, based in 40 case studies from companies in different sectors, to analyse how Internet of Things (IoT) technologies support circular economy strategies by categorizing them. One of the main conclusions is that the implementation of IoT-enabled circular strategies supports two strategies: efficiency in use and product lifetime extension.

Although the increase in explore and research about digital transformation and sustainability in the fashion industry, it remains a relevant and emerging research area.

Pagoropoulos et al. (2017) affirmed that there's still limited knowledge about how new digital technologies, such as Internet of Things and Big Data can be used to support the transition to Circular economy, and there's a limited amount of case studies that evaluate the application of digital technologies in this context.

There are many efforts around rethinking sustainability research and its practices, but there is still also many challenges and opportunities for research on this topic (Ramos et al., 2020). In this sense, it was suggested by Pagoropoulos et al. (2017) that future research could analyse the application of digital technologies in actual case studies to share a technological perspective, but one of the challenges identified in this area is the lack of communication by the companies, due to how they communicate their sustainability commitment to all (Moretto et al., 2018).

One of the main gaps is the small number of publications about actual implementations in practice to understand the opportunities to support circular strategies in businesses, and it is suggested that more studies are needed to help companies map their current implementation and improve their strategy (Ingemarsdotter et al., 2019).

Even though Esbeih et al. (2021) study already focus on a case study on Inditex to analyse its transition to circular economy through sustainability indicators and the digital transformation use, it also reveals that despite advances, the transition is still ongoing and there's still a need for more studies to explore the integration of digital technologies and sustainability practices in the fashion industry. The combination of Sustainability and Digital transformation is rapidly growing but it is still a small research area with a lack in concrete case studies.

Chapter 2
Methodology

2.1. Research question

To fill the research gap on the lack of case studies about digital transformation and sustainability in the fashion industry, the research question defined for this study was "**How can digital transformation impact sustainability?**" with its subdivision into **"How is it used in the fashion industry?"** and **"How do different fashion companies do it?".** The objectives are understanding and comparing the organizations realities and their initiatives in the area, to gather different approaches to the subject, in order to comprehend the relation between digital transformation and sustainability in the fashion industry, and its application in practice.

In this sense, the type of method most appropriate is a qualitative research, more specifically an explanatory research study, using public information from fashion companies to create a multiple case study. The way the questions were structured could also be an indicator of the most relevant research method to be used, in this case "how", confirming that case study research would most likely be the appropriate method (Yin, 2018).

Explanatory research is used when instead of just describing, the study also seeks to explain the causal links in real-life (Yin, 2018), going beyond observation.

To do so, publicly available reports were collected, providing first-hand data on the companies' initiatives and its impact (Saunders et al., 2019).

The first step as an initial methodology was conducting a literature review to get knowledge on key topics that were going to be studied and needed to be identified, such as "Digital Transformation", "Sustainability", "Fashion", "Innovation" and "Circular Economy". The databases used to get this kind of information were mostly Scopus, Mendeley and EBSCO. Literature review was used since it can create a firm foundation for advancing knowledge and it facilitates theory development (Webster & Watson, 2002), in this way it was possible to get knowledge on the concepts and find gaps to conduct the study and identify the relevant initiatives to categorize and compare.

2.2. Case study selection

To select the companies that were going to be analysed and compared in this case study, the Time Magazine ranking of the *World's most sustainable companies of 2024* was used, which was created in collaboration with Statista.

They collaborated for the first time to create a ranking for the *World's Most Sustainable Companies of 2024* (Time & Statista, 2024), but their selection first included over 5,000 of the world's biggest and influential companies from several industries. They followed a 4-step methodology to recognize the top five hundred, which started with an exclusion of Non-Sustainable Businesses, and then an analysis on external sustainability ratings, an evaluation of the reporting and transparency reports and its quality, and lastly, an analysis of the Key Performance Indicators (KPIs) presented in the company's Corporate Social Responsibility (CSR) reports and its relations with environmental and social metric.

Based on these steps, Time and Statista were able to calculate an overall sustainability score, with a maximum of 100 points, but the analysed companies belonged to 21 different industries, and for the relevance of this study, since the goal is to study the fashion industry, it was only considered the industry of "Retail, Wholesale & Consumer Goods" that held 31 companies out of the 500 selected. The information of the specific sector was then added in Table 2 by the author in the analysis to finally select the first two companies relevant for this case study: Moncler and Inditex.

To select the cases for case study research, it is essential to have sufficient access to the data (Yin, 2018), so it was also confirmed in a first instance if the companies chosen opted to share sufficient information for this study.

Time Rank	Company name	Headquarters	Industry	Score	Brand Overview
3	Moncler	Italy	Retail, Wholesale & Consumer Goods	85.66	Italian luxury fashion brand specialized in ready-to-wear outwear
25	Inditex	Spain	Retail, Wholesale & Consumer Goods	76.81	Spanish multinational clothing company

Table 2: Companies' ranking

2.3. Data collection method

After deciding on the companies to be used in the case study, the data collection method used was public documentation, mostly non-financial reports from 2023 that were published in 2024 by each company, but also companies' websites, covering, in this way, the most recent information available at the time

of this study. Documentation is a typology of data collection technique used as a source of evidence in case study research, offering both strengths and weaknesses (Yin, 2018), being:

1- Strengths:
    a. It is a stable source since it can be reviewed repeatedly.
    b. Unobtrusive – set created as a result of the case study.
    c. Exact – contains exact names, references, and details of the event.
    d. Broad coverage – long spans of time, many events, and many settings.
2- Weaknesses:
    a. Retrievability – can be low.
    b. Biased selectivity if collection is incomplete.
    c. Reporting bias – reflects (unknown) bias of author.
    d. Access – may be deliberately blocked.

One of the most relevant limitations in this study is that the extraction of information is biased in the first instance by the companies that choose the information they want to publicly share, and then by the unique author judgement and collection. This is a relevant limitation because it can bound the results and conclusions.

On the other side, one of the most relevant strengths of this type of study is that information is exact and publicly available to be reviewed by several researchers at any time.

2.4. Data analysis procedure

By reading and reviewing the reports and public information, it was created an Excel file to organize the selected initiatives from each company that

combined digital transformation and sustainability in any way and enumerate them in a table.

The first approach was collecting the initiative itself while reading the report and try to fill the description and impact it has based on the information available. After re-reading and considering if the initiative was adequate and relevant for the study, five different dimensions were created to group them.

The dimensions were created by the author, based on a review that grouped the initiatives by its description and impact, identifying common strategic areas or themes that demonstrated how the fashion companies operationalize their sustainability goals with digital tools, whether by transforming internal processes, enhancing external relationships (suppliers or clients), developing new business model, or investing in innovation.

The dimensions were then named and the initiatives categorized:

1- **Innovation in operations:** anything related with the flow of operations that could be changed or impacted by the initiative.
2- **Relation with suppliers:** initiatives that impact the relation with suppliers and the supply chain, either when choosing them, or impacting their side of the relation.
3- **Relation with client and user experience:** if the initiative impacts the experience of the client when purchasing or connecting with the company, but also the users that could be employees or potential buyers.
4- **Circular economy:** initiatives that impact a circular economy, either by changing the longevity of products or creating and strengthening a new business model approach.
5- **Research for Innovation:** initiatives that bring new opportunities for innovation, supporting the development of new products, approaches, or processes.

Each initiative was categorized on a grid to identify to which dimension it related to, but it could be to more than one, so different possibilities where then created to combine the dimensions. The total grids of both companies are available in Appendix 1 and 2.

To represent the company's dimensions and its initiatives, a mind map was also created with the name of the initiatives attributed to each dimension using a colour scheme for easier visualization of the combinations, meaning the initiative would have a colour if categorized in more than one dimension. All mind maps are also available in Appendix 3 to 7.

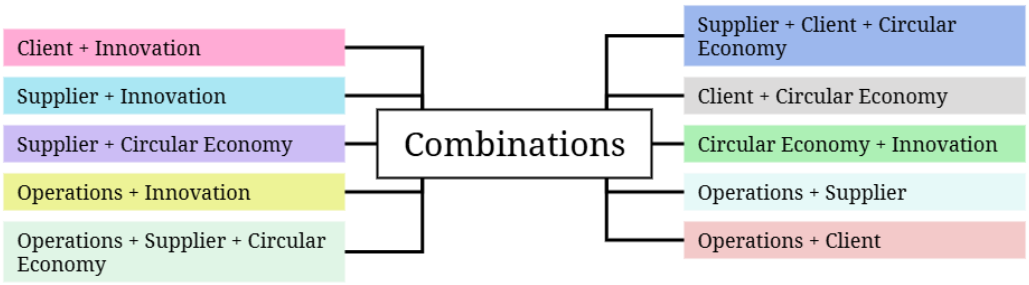

Figure 1: Combinations of Dimensions created

Each company has its own mind map to demonstrate all initiatives per dimension, but also, for each dimension was developed a mind map with both companies for easier understanding and comparison between them.

The grids for each company were created in Excel spreadsheet, which facilitated the process of generating descriptive statistics such as frequency counts of initiatives per dimension and graphs to visualize the data and compare the similarities and differences between both companies.

In conclusion, the data analysis procedure followed a thematic analysis that combined the steps of data preparation and familiarization with data by reading each report and extract relevant information, generation of codes to identify

themes and create the five dimensions, and final integration and review to interpret. This approach is aligned with the processed described by Braun & Clarke (2006), who highlights the thematic analysis as a flexible method for identifying, analysing, and gathering patterns or themes within qualitative data.

Chapter 3
Data analysis

3.1. Moncler

Moncler occupies the third position as the *World's most sustainable company of 2024*, according to (Time & Statista, 2024), taking the first place in the industry of "Retail, Wholesale & Consumer Goods", and as a result, was considered the most relevant for this study focused on the fashion industry.

3.1.1 Brief history of the company

Moncler got its name from an abbreviation of the village where it first originated in 1952; Monestier-de-Clermont, in France. The company sold garments made to protect workers, and it rapidly grew to be used in several expeditions and at the Olympics by the French ski team.

Only in 2003, Remo Ruffini, current Chairman and CEO of the Moncler Group, acquired the brand and gradually took it to a high fashion level. Later in 2020, Stone Island was also acquired and joined the Group.

The Group's Strategy is now based on four pillars:

1- Leadership in the new luxury segment.

2- Building a global group, able to fully enhance its brands' potential worldwide.

3- Developing of all distribution channels using an omnichannel approach, supported by a strong digital culture.
4- Following a sustainable growth path to create value for all stakeholders.

Both sustainability and digital transformation are in the base of the Group's strategy and were considered when developing the initiatives shared in this study.

In 2015, the first Sustainability Report and Sustainability Plan was prepared, and the Group now follows a plan for 2020-2025, which is reviewed and updated when necessary. It is now divided in five strategic priorities, each with its material topics (Moncler, 2024):

1- Act on climate & nature.
    a. Biodiversity.
    b. Climate change.
    c. Waste.
    d. Water.
2- Think circular & bold.
    a. Innovation, circular economy, and "preferred" materials.
    b. Packaging.
    c. Product quality and safety.
3- Be fair.
    a. Animal welfare.
    b. Responsible sourcing.
    c. Traceability.
4- Nurture uniqueness.
    a. Diversity, equity, and inclusion.
    b. Employee experience.
    c. Employee performance and development.
    d. Health, safety, and wellbeing.

5- Give back.
    a. Client experience and community engagement.
    b. Give back for social development.
    c. Partnership for sustainable development.

In 2020, the Group shared a statement informing about their strengthening of their digital strategy based on the goal to accelerate its digital transformation with a "digital first" approach that required considerable evolution from the organization, its culture and technology. A new "Digital, Engagement and Transformation" function was created along with the Moncler Digital Hub department that has five strategic pillars (Moncler, n.d.):

1- D-Commerce.
2- D-Marketing.
3- D-Intelligence.
4- D-Operations.
5- Consumer Engagement.

In this sense, a significant commitment was made in terms of resources and investments to develop the Group in several digital areas, taking the best out of digital intelligence, digital performance, and consumer insights tools.

3.1.2 Key Digital Transformation & Sustainability Initiatives

Moncler shares the Consolidated Non-Financial Statement every year, presenting the initiatives and results of the year prior, as well as the objectives and perspectives for the future. Based on the 2023 Statement, shared in 2024, this study retrieved 73 initiatives that combined both digital transformation and sustainability. The initiatives were identified after the close reading of the document, with the author judgement to gather the ones relevant that combined both concepts. All initiatives are fully described in Appendix 1, but figure 2 summarizes and organizes them into the five dimensions created by the author.

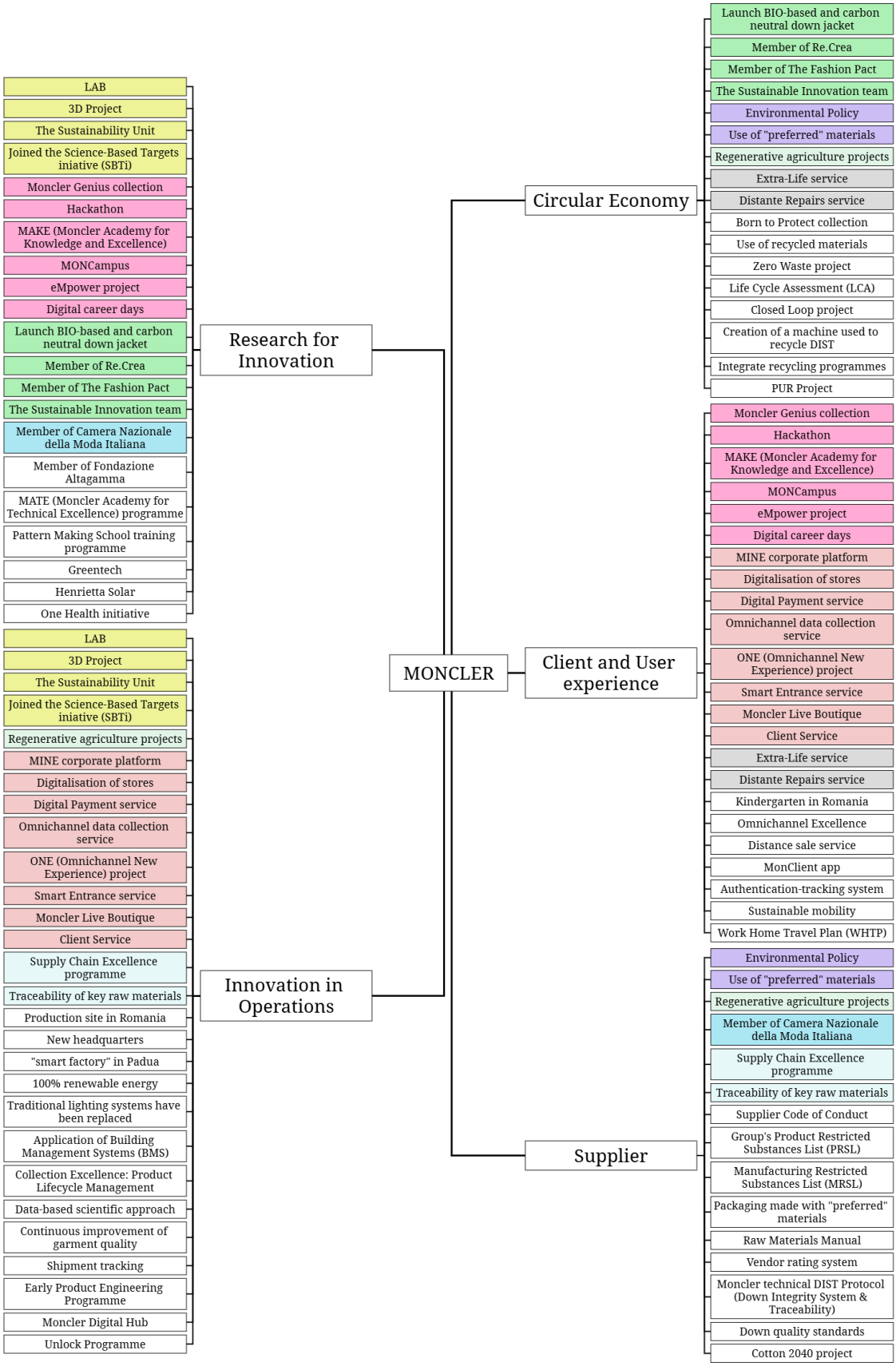

Figure 2: Moncler Initiatives by Dimension

After collecting all the initiatives, they were analysed to find patterns and similarities, to create the dimensions, taking into consideration the common characteristics identified in the description or impact of each. The dimensions created were then Innovation in operations, Relation with suppliers, Relation with client and user experience, Circular economy, and Research Innovation.

Each initiative was then coded into the most appropriate dimension, but in some cases, it was assigned to more than one dimension. Those are differentiated using different colours in figure 2, and the legend explains the difference to visually identify them.

Table 3 and figure 3 show the number of initiatives included in each:

Dimension	Count of Initiatives
Innovation in operations	13
Relation with suppliers	9
Relation with client and user experience	7
Circular economy	8
Research innovation	6
Operations + Client	8
Operations + Innovations	4
Operations + Suppliers	2
Operations + Suppliers + Circular Economy	1
Supplier + Circular Economy	2
Supplier + Innovation	1
Client + Circular Economy	2
Client + Innovation	6
Circular Economy + Innovation	4
Total	73

Table 3: Count of Initiatives by Dimension - Moncler

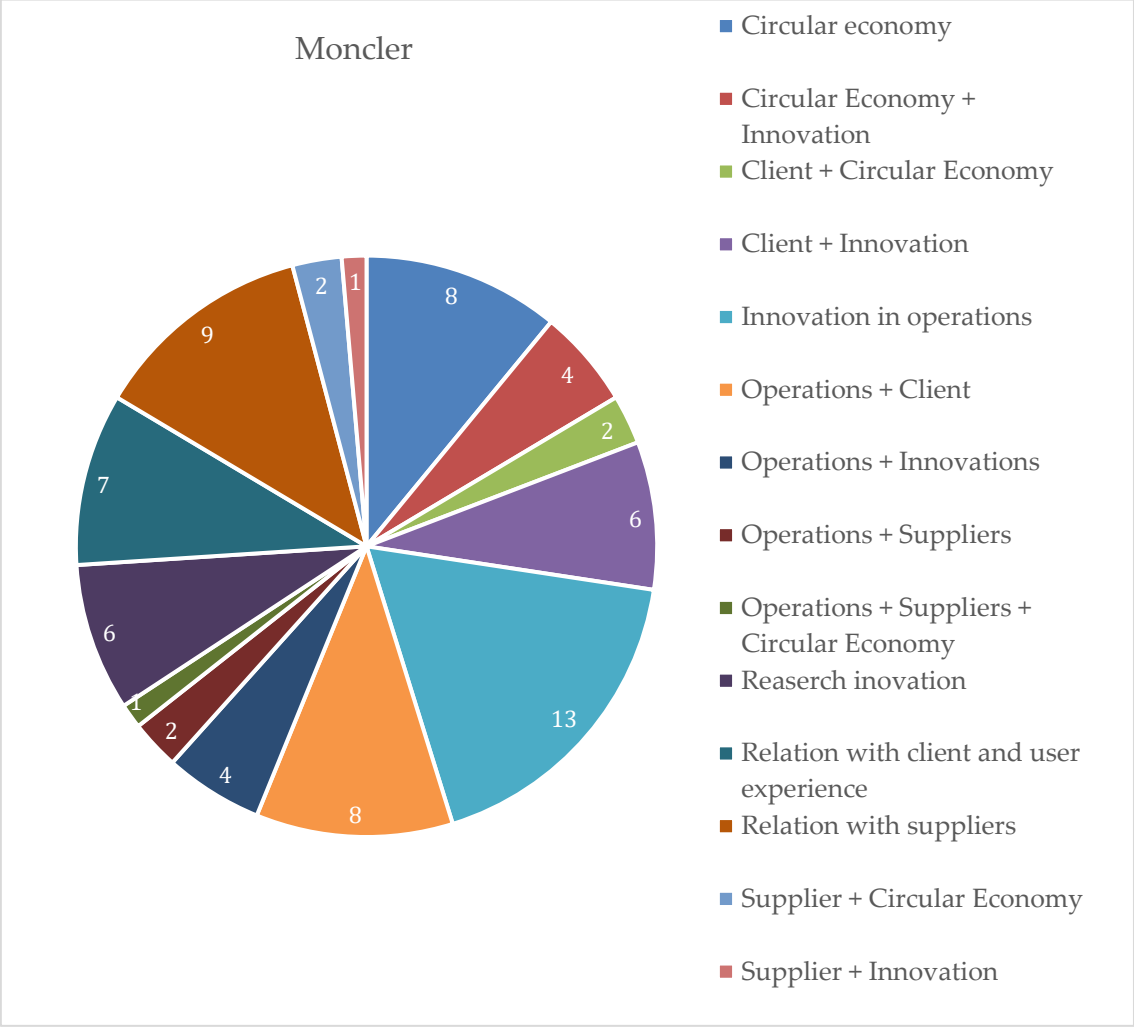

Figure 3: Moncler Count of Initiatives by Dimension

In the next subchapters, the study will describe some initiatives perceived as most relevant by the author for each dimension, taking in consideration that one initiative could be included as part of more than one dimension, and will not be repeated. All initiatives were gathered based on (Moncler, 2024).

The perception of relevance is based on the importance the statement gave to the initiative and the author consideration, based either by the number of times mentioned, the detail of the explanation, or the impact it has.

3.1.2.1 Innovation in operations

This dimension considered all initiatives that would impact the flow of operations, using digital transformation to improve or achieve more sustainable processes and operations.

As mentioned before, the **Moncler Digital Hub** department was created to guide digital transformation and to spread the digital culture in the entire Company, creating new roles and processes, and, as consequence, different initiatives also provoked an impact in the day-to-day operations. In the same sense, **The Sustainability Unit** was also created as the Group's response for the sustainability strategy. **LAB** is responsible for the continuous research into the transformation of materials and fibres and leads to discovery of new materials and production techniques, and **3D technology** was integrated into the Moncler products' development process to digitally adjust pieces requirements, reducing waste, development times and prototype production costs.

3.1.2.2 Relation with suppliers

There were initiatives identified that impacted the relationship with suppliers and the whole supply chain, either when choosing them or evaluating them.

Moncler implemented digital transformation and sustainability in the entire supply chain, developing codes, policies and lists to support and improve the relation with its suppliers. **Supplier Code of Conduct**, **Environmental Policy**, **Supply Chain Excellence programme**, **vendor rating system**, and **down quality standards** are some of the protocols they enforce when choosing to collaborate with a supplier that affects the whole supply chain, combining both digital transformation and sustainability in long term.

Regarding **the traceability of materials**, IT systems and tools were selected to trace key raw materials in all stages This approach enables Moncler to monitor

the origin and transformation of materials such as nylon, polyester, cotton, wool, and down, ensuring transparency and accountability.

3.1.2.3 Relation with client and user experience

Clients and users can also be impacted with the company's initiatives.

Improving the relation and experience with the client is also one of the Group's concerns, and the acceleration of the use of technology by consumers is not forgotten when developing digital transformation and sustainable initiatives, such as **Omnichannel Excellence**, and the **Digitalisation of stores**, creating **digital payment services**, **Moncler Live Boutique** and **MonClient app**.

3.1.2.4 Circular economy

Circular economy is one of the priorities of the Group, to follow a sustainable growth path and create value, by focusing on product longevity, "preferred" materials, recycling, and waste management.

Initiatives that comprise this are the **Zero Waste Project**, **Closed Loop projec**t and the creation of **a machine to recycle DIST,** all use innovative mechanical processes to recycle. Moncler also offers repair services to their customers, and this allows for greater product longevity, such as **Extra-Life** and **Distant Repairs service**.

3.1.2.5 Research for innovation

Innovation explores new opportunities to take the best out of digital transformation in sustainability, and Moncler partners with different organizations to invest in research, such as **Re.Crea consortium**, **Science-Based Targets initiative** (SBTi), **The Fashion Pact**, and **Camera Nazionale della Moda Italiana**. Meanwhile, another priority is to invest in projects that have a positive

impact on the planet, such as **Henrietta Solar**, which involves the installation of a photovoltaic energy system in Mauritius.

3.2. Inditex Group

Time ranked Inditex as the 25th *World's most sustainable company of 2024*, taking the 2nd place in the sector relevant for this study, the fashion industry.

3.2.1 Brief history of the company

Amancio Ortega started a small family-run dressmaking workshop, in 1963, known as "Confecciones GOA", that later grew to become Inditex Group, an international fashion retailer. Zara was created in 1975, and only in 1985 all companies joined to be Inditex.

Today, the Inditex Group has seven brands: Zara, Pull&Bear, Massimo Dutti, Bershka, Stradivarius, Oysho and Zara Home. Uterqüe was also one of their brands between 2008 and 2021, the year the Group announced its closure and merge with Massimo Dutti. Inditex operates in 214 markets all around the world and is considered as one of the most successful companies in Spain, where it was born, as well as the world.

Inditex's approach is based on promoting innovation, putting customers first, creating a truly elevated experience for all, with over 700 designers to respond quickly to the customer's desires, and creating smarter production processes and logistics. Innovation is the basis of their work.

In 2001, Inditex joined the United Nations Global Compact, and created a sustainability strategy that has been evolving ever since. In 2023, the new sustainability targets were developed when the Group presented the initiative to keep advancing towards an increasingly sustainable value chain as a priority.

Through partnerships and innovation, Inditex climate change pledges are designed to support the sector's transformation. The commitment Inditex has made to create a more efficient and circular fashion industry has led them to develop a new Climate Transition Plan divided in three lines of initiative:

1. Reduction.
2. Neutralisation.
3. Mitigation.

Keeping the focus on innovation and sustainability, Inditex is always involved in several projects and partnerships to make a positive difference for the future, and the digital transformation process "is gaining pace due to the birth and implementation of new technologies such as Artificial Intelligence and optimisation of existing processes, or its transformative application in other fields". In this sense, they consider digitalisation as a key to the development of their sustainability focused strategy.

3.2.2 Key Digital Transformation & Sustainability Initiatives

Inditex shares their Statement of Non-Financial Information combining all brands results in a consolidated report. This study identified and considered 64 initiatives that combined digital transformation and sustainability in 2023 results publicly shared by Inditex (2024).

Like made before, figure 4 now presents all Inditex's initiatives retrieved summarized and divided into dimensions accordingly with their nature. The description of each, as stated by the Group, can be found in Appendix 2, since this study only highlights the ones perceived as most relevant by the author, like mentioned previously.

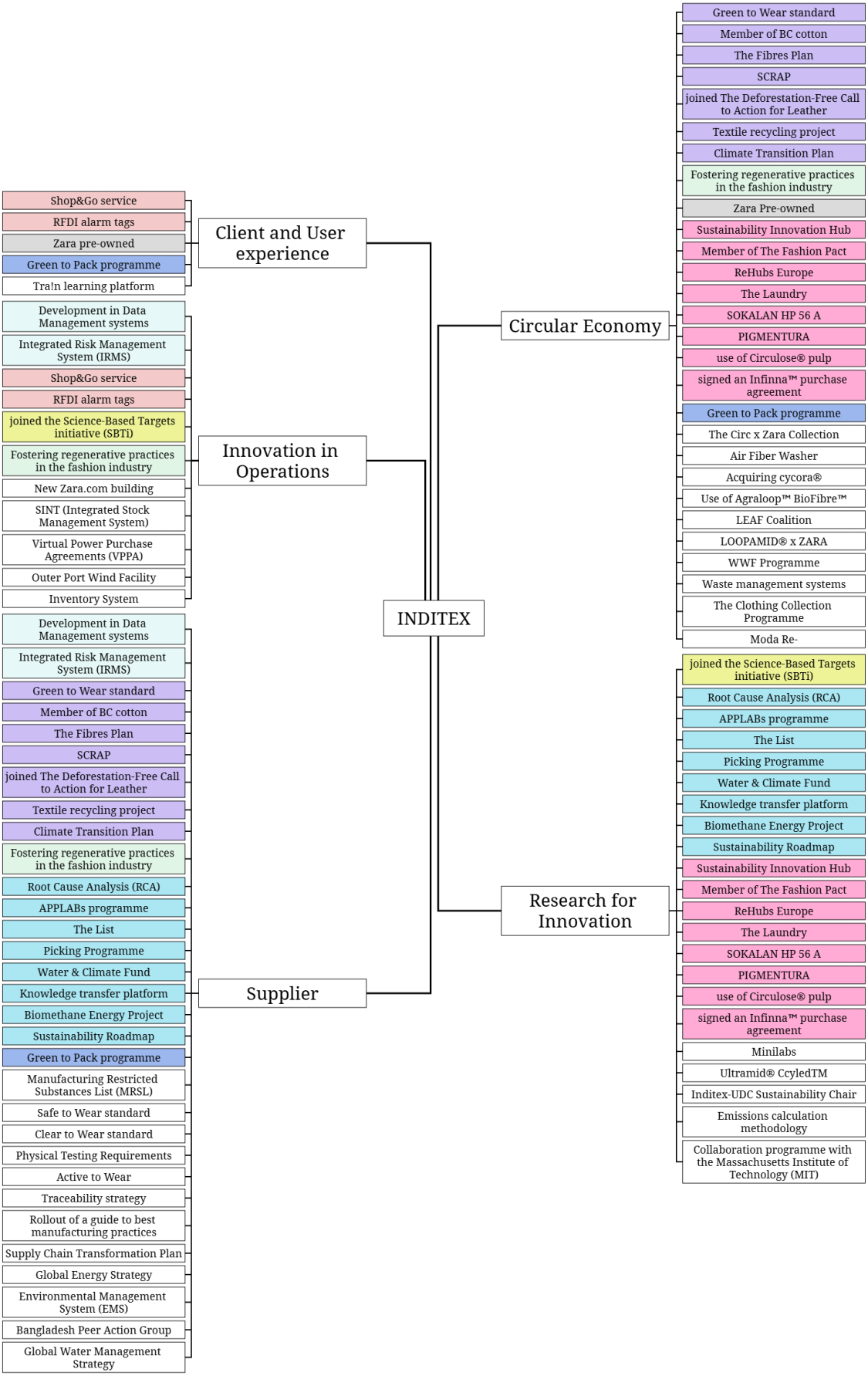

Figure 4: Inditex Initiatives by Dimension

These 64 initiatives were each divided into the appropriated dimension, but some of them into more than one, so the following image 5 and table 4 takes that division in consideration:

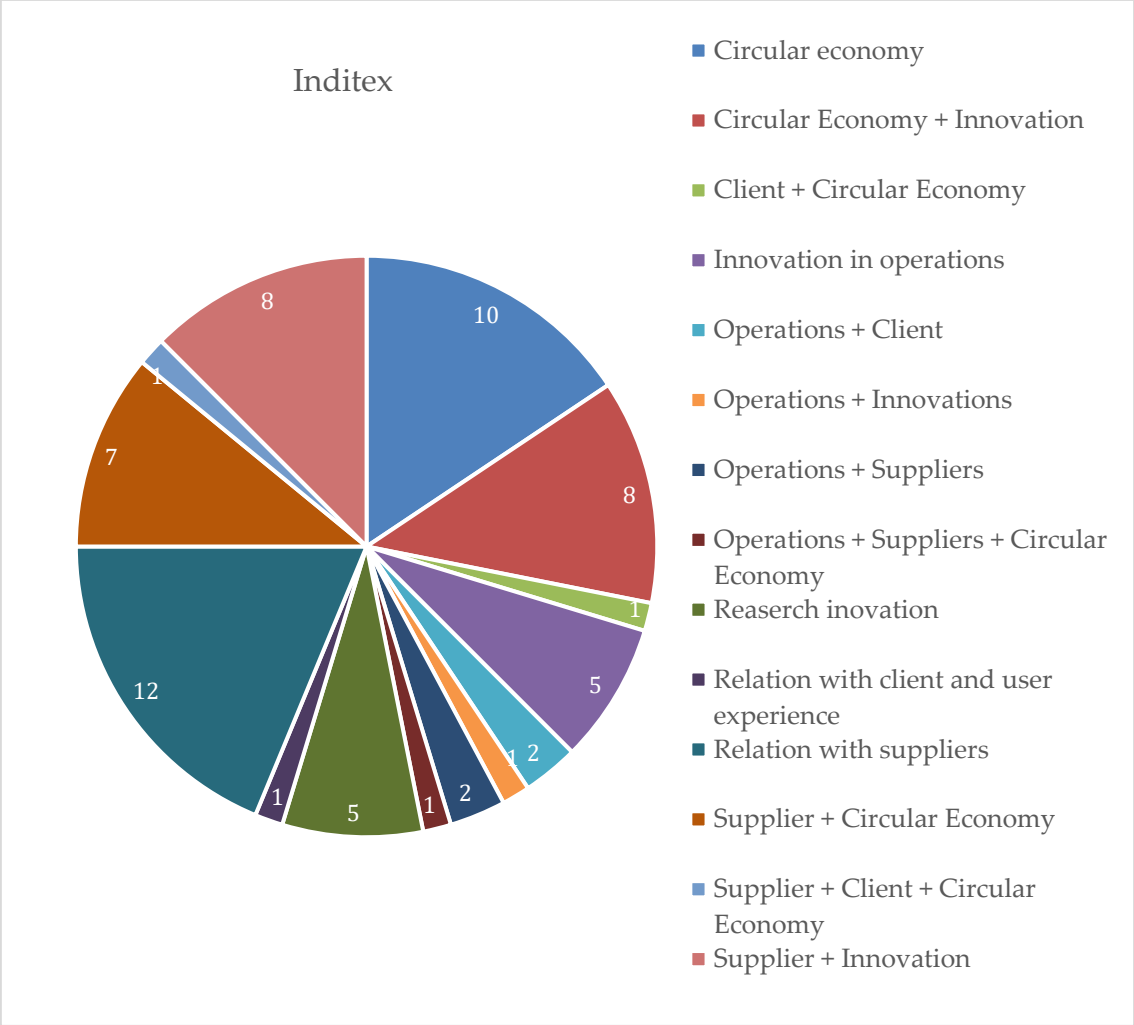

Figure 5: Inditex Count of Initiatives by Dimension

Dimension	Count of Initiatives
Innovation in operations	5
Relation with suppliers	12
Relation with client and user experience	1
Circular economy	10
Research innovation	5
Operations + Client	2
Operations + Innovations	1

Dimension	Count of Initiatives
Operations + Suppliers	2
Operations + Suppliers + Circular Economy	1
Supplier + Circular Economy	7
Supplier + Innovation	8
Client + Circular Economy	1
Supplier + Client + Circular Economy	1
Circular Economy + Innovation	8
Total	64

Table 4: Count of Initiatives by Dimension - Inditex

3.2.2.1 Innovation in operations

Inditex is improving their sustainability in operations using digital transformation initiatives such as the **Shop&Go service** for payments from anywhere inside the store, the implementation of **Radio Frequency Identification (RFID**) technology in products' tags and the **Integrated Stock Management System (SINT)** that integrates inventory management across all brands for greater efficiency.

3.2.2.2 Relation with suppliers

Working with the right suppliers has a great impact, and that's why Inditex developed several standards to choose them correctly. Suppliers go through tests to confirm if they are a good choice for the Group, such as **Green to Wear**, **Safe to Wear** or **Clear to Wear**, but also different audits and tests to confirm the fulfilment of such standards like **Root Cause Analysis**, **Physical Testing Requirements** or the **APPLABs programme**. Inditex also created **The List** procedure for classifying chemicals that improve production processes and shared it with the Zero Discharge of Hazardous Chemicals (ZDHC) Foundation's Gateway platform. In this sense, these initiatives all have an impact in the relation between Inditex and its suppliers.

3.2.2.3 Relation with client and user experience

Shop&Go service is a technology that enables customers to pay for their garments from anywhere inside the store, improving sustainable efficiency by reducing the number of employees needed and invoices issued. Besides thinking about the client, it is also a priority for Inditex to improve staff's knowledge and innovation, and **Tra!n** is a learning platform developed that offers them digital content on several subjects, being sustainability one of them

3.2.2.4 Circular economy

Inditex is developing a transition to a circular economy through resources, products, and waste management. It has created, in partnership with Jeanologia, the **Air Fiber Washer**, an innovative industrial air extraction system that reduces microfibres shedding, and in partnership with BASF, **The Laundry**, the first detergent to also reduce microfibre shedding in washing. The use of "preferred" materials is also a big compromise as they chose to use recycled materials made from textiles such as **acquiring cycora®** from Ambercycle, and **use of Circulose® pulp** from Renewcell. **Textile recycling projects** and **The Clothing Collection programme** transform products that cannot be reused into new textile fibres or make them into new materials for industrial use.

Inditex also gives the opportunity to its customers to repair, resale or donate their used clothing using the **Zara pre-owned** platform.

3.2.2.5 Research for innovation

Several projects and initiatives started being developed in the **Sustainability Innovation Hub**, a platform where Inditex is continuously searching for the best materials, approaches, and processes, either in the Group or in collaboration with other associations or start-ups. For example, the **Ultramid® CcyledTM,** a recycled polyamide, and the **SOKALAN HP 56 A** system to implement and

optimise the first industrial cold washing system., both developed in collaboration with BASF, but also **PIGMENTURA**, an innovative dyeing solution that does not require washing and drying processes, thereby reducing the energy needed to heat the water used in conventional production processes, developed in collaboration with CHT.

Chapter 4
Discussion

Based on Time & Statista (2024) ranking, Moncler and Inditex are the two most sustainable companies of 2024 in the fashion industry, and besides coming from two different segments, high fashion and fast fashion respectively, and having different strategies, they both have strong principles when it comes to sustainability and digital transformation, that they share publicly in their reports. The findings also suggest that both companies integrate the concepts both individually, as well as combined, in several initiatives, but for this study, it was only considered the ones that combined both concepts.

In both cases, it is possible to conclude that there is a strong relation between innovation, operational efficiency, and environmental responsibility, which aligns with Henfridsson & Liu (2017), Vial (2019) and Colombi & D'Itria (2023) findings.

Starting with the **"innovation in operations"** dimension, both Moncler and Inditex implement digital tools to improve their internal processes and reduce environmental impact. For example, Moncler's implementation of 3D technology to develop products with fewer prototypes leads to less waste and faster development cycles. Similarly, Inditex uses the Integrated Stock Management System (SINT) and RFID technologies to streamline operations, reduce excess inventory, and optimise resource use, all in line with the idea that digital transformation improves operational efficiency (Tian et al., 2023). These

initiatives confirm that innovation not only enhances productivity but also supports sustainability (Colombi & D'Itria, 2023).

Accordingly with Moretto et al. (2018), organizations should extend the issue of sustainability along the supply chain, and in the **"relation with suppliers"** dimension, both companies invest their efforts in transparency and traceability. When choosing a supplier to work with, both companies apply protocols and standards that suppliers must fulfil. Moncler uses IT systems to map supply chain stages and ensure compliance with environmental standards, applying in this way traceability protocols for key raw materials. Inditex, on the other side, uses digital platforms to monitor chemical use and factory compliance. These efforts match the findings of Pagoropoulos et al. (2017), who affirmed that data collection and integrated systems can support circular economy practices and enable better supplier coordination, and Colombi & D'Itria (2023) affirmation on technology generating transparency and consequently, sustainable supply chains.

Regarding the **"relation with client and user experience"**, both brands are worried with the consumers need to evolve and are leveraging digital channels to offer more sustainable and engaging experiences. Moncler's Omnichannel New Experience (ONE project) and tools like Moncler Live Boutique and the MonClient app help deliver personalized and efficient service while reducing physical paperwork and improving post-sale services like repairs. Inditex's Shop&Go service and online platforms for resale (Zara Pre-Owned) show a shift toward client-centred digitalization aligned with sustainability. These initiatives reflect what Verhoef et al. (2021) said regarding the fundamental aspect of business model transformation, where digital tools reshape the customer interaction and needs.

The **"circular economy"** dimension is supposed to reflect the companies' initiatives to transition from a linear economy to a more circular one, either by

developing new business models, or focusing on the production and durability of the garments. Moncler's initiatives like the Closed Loop project and the DIST recycling machine reflect their efforts to recover and reuse materials within the production cycle. Inditex has partnerships to develop and launch fibre-to-fibre recycling projects, like the one with Circ or Ambercycle, and supports repair and resale services like Zara pre-owned platform. This meets the circular economy principles described by Esbeih et al. (2021) and Gazzola et al. (2020), showing how companies rethink the end-of-life of products through restoration and reuse.

Lastly, the **"research for innovation"** dimension reveals how both companies collaborate with external stakeholders, most times startups and institutions specialized in technology and sustainability to develop and co-create solutions. Moncler participates in multiple associations and supports R&D through its LAB and Sustainable Innovation Team, while Inditex works with MIT, BASF, and other partners through its Sustainability Innovation Hub. These examples confirm that innovation play a central role in enabling long-term sustainability, as highlighted by Ingemarsdotter et al. (2019) and Tangwaragorn et al. (2024).

In conclusion, the comparison between both organizations confirms that digital transformation can significantly impact sustainability in the fashion industry by supporting process optimization, enhancing transparency, developing circular models, and fostering innovation. Although the companies differ in the industry segment and strategy, they share similar approaches to respond to the arising issue of sustainability, making the most out of digital tools. Digital transformation and sustainability are shown as strategic approaches to remain competitive nowadays, just like Gazzola et al. (2020), Gomes de Oliveira et al. (2022) and Colombi & D'Itria (2023) affirmed when mentioned sustainability as a competitive necessity.

In this way, digital transformation becomes a tool not just for innovation, but for survival, helping companies respond to increasing market pressure,

stakeholder expectations, and regulatory changes, all while gaining operational efficiency and a competitive edge. The findings in this study support this claim, as both Moncler and Inditex demonstrate how aligning digital and sustainability efforts allows fashion businesses to thrive in a complex and rapidly evolving environment.

Despite all the agreement of the study with the literature already available, it was possible to identify certain aspects that were less explored in academic research or not fully mentioned by the companies themselves.

Pagoropoulos et al. (2017) and Ramos et al. (2020) studies mention the need to have clear metrics and performance indicators to evaluate the impact of digital transformation on sustainability. However, although Moncler and Inditex both share a wide range of innovative initiatives, the reports have limited information regarding the quantification of its efforts, making it difficult to compare and maybe even to other companies to replicate.

Moretto et al. (2018) and Vial, 2019) findings highlight the complexity in implementing and integrating technology, due to internal resistance to change, technological issues or tensions between economic and environmental objectives, but despite that, both companies made the author perceived that the integration between sustainability and DT occurs in a smooth and strategic way, lacking information on the challenging aspects of the implementation and development of initiatives.

Conclusion

This research study primarily aimed to explore how digital transformation can impact and support sustainability in the fashion industry by analysing and comparing the cases of Moncler and Inditex. The objectives were then to understand and compare both companies' initiatives and study the applicability of digital technologies to enhance sustainable practices in real case studies.

The findings show that, even though Moncler and Inditex work in different segments of the fashion industry (luxury and fast fashion), they have similar strategies and approaches when it comes to integrate sustainability and digital transformation. It was possible to develop five dimensions to categorize the organizations' initiatives – innovation in operations, relation with supplies, relation with client and user experience, circular economy, and research for innovation – and in this way highlight how digital tools are being used to optimize processes, increase transparency in the supply chain, enhance customer engagement, support circular initiatives, develop new opportunities for innovation, and remain competitive.

By aligning the findings with the existing literature, the study reinforces the idea that digital transformation is a strategic enabler of sustainability in the fashion industry and also helps to fill a gap by providing concrete examples of how companies implement digital solutions in practice.

The study presents some limitations when it comes to the information available. Since it was all based on publicly available reports, shared by the companies themselves, it's probable to have missing information and not fully capture the reality in internal processes or challenges faced by the companies, and then the author judgement could be biased and not reflect all relevant and comparable initiatives. Additionally, the analysis and comparison were limited

to only two case studies, which may not be representative of the entire fashion industry.

With that said, future research could include more companies in the analysis and the development of a framework to be implemented by companies who want to take the next step and include digital tools. Instead of using public information, interviews with the teams responsible for the implementation could also be beneficial to understand the impact of digital transformation in sustainability, and to have more quantitative data to understand its real impact.

In conclusion, this study contributes to the growing topic around digital transformation and sustainability in fashion industry, by exposing how fashion companies are using technology not only to innovate, but to reshape their role in a more responsible and conscious economy. The research was focused on a positive side of the companies' efforts, trying to mitigate their impact and become more sustainable, but greenwashing is a reality, and companies could exaggerate or selectively communicate their sustainability achievements. With that in mind, it remains open if these initiatives are enough to offset the negative side of the fashion industry, such as overproduction, waste, labour exploitation, and resource exhaustion.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of my thesis, "Digital Transformation Supporting Sustainability – A Comparative Case Study in the Fashion Industry", Chatgpt and Xmind were used for the following tasks: summarize articles, discover new authors, organize information, discover patterns, review text, and creation of mind maps, with the prompts used listed at the end of the document in the Prompts List section. After using these tools, I reviewed and edited the content as necessary, and I take full responsibility for the content of the work presented.

I also declare that I am aware of and respect the Artificial Intelligence Rules of Conduct of Católica Porto Business School.

Prompts List

1- Summarize the following academic article, highlighting the main arguments, methodology, findings, and conclusion.
2- Provide a concise summary of this paper in 200 words, focusing on how it contributes to the topic of digital transformation in sustainability.
3- Based on this article, suggest other relevant authors who work in this field or have cited this work.
4- Who are some key authors or researchers working on digital transformation and sustainability in recent literature?
5- Organize the following research findings into thematic categories to support the literature review chapter.
6- What patterns or connections can you find from these different studies?
7- Review this paragraph and provide feedback on structure, grammar, and logical flow for academic writing.
8- Translate de following text to English.
9- Organize this list of abbreviations by alphabetical order but write it like this example: “DT - Digital Transformation”.

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Appendices

1. Moncler's Initiatives

Initiative	Partnership	Description	Impact	Dimension
LAB		"Constant, deep and relentless research into the transformation and enhancement of fibres and fabrics"	"Leads to the discovery of new materials and production techniques that have never been previously used in the clothing industry"	Operations + Innovations
Acquisition of a first production site in Romania		"To create an industrial and technological R&D hub for down jackets and vertically integrate part of its production"	"Moncler completes the set-up process at the production site in Romania"	Innovation in operations
Moncler Genius		"a hub of creators operating in unison while cultivating their singularity to reinterpret the essence of the Moncler brand"	"Increase the impact of social media, the in-store traffic and the media campaign performance"	Client + Innovation

Initiative	Partnership	Description	Impact	Dimension
launch BIO-based and carbon neutral down jacket		"Designed with plant-based and natural materials and a range of products made with recycled materials for the Grenoble line"		Circular Economy + Innovation
Hackathon		"a real 24-hour digital marathon with 450 employees from all over the world coming together in an event "	"Dedicated to accelerating and generating innovation"	Client + Innovation
Born to Protect		"Range of jackets made entirely "preferred" materials"		Circular economy
new headquarters		"a project having experience, well-being and sustainability at the core"		Innovation in operations
Member of Re.Crea	Re.Crea consortium	"a consortium founded to organise the management of end-of-life stage of textile and fashion products and to promote research and development of innovative recycling solutions"		Circular Economy + Innovation

Initiative	Partnership	Description	Impact	Dimension
The Sustainability Unit		"is responsible for proposing the Group's sustainability strategy" "It also prepares the Consolidated Non-Financial Statement and spreads a culture of sustainability within the Group"		Operations + Innovations
"smart factory" in Trebaseleghe (Padua)		"uits products to be manufactured at the production site owned by Moncler in Romania"		Innovation in operations
joined the Science-Based Targets initiative (SBTi)	SBTi	"setting targets for reducing greenhouse gas emissions in line with the United Nations' commitment to limiting the maximum increase in global temperatures from pre-industrial levels"		Operations + Innovations

Initiative	Partnership	Description	Impact	Dimension
Supplier Code of Conduct		"includes principles of animal welfare" "outlining the principles and guidelines that inspire the Group's business and guide the behaviour and actions of all those with whom Moncler and Stone Island interact"	"ensure that their subcontractors comply with them as well. Violation of these principles constitutes a breach of contract, with the right, depending on the severity of the situation, to immediately terminate the relationship"	Relation with suppliers
Environmental Policy		"committed to investing the technical, economic and professional resources necessary to comply fully with the guidelines of the Policy."	"The Policy lays down the Group's ambitions in the following areas: -fight against climate change; -safeguard biodiversity; -water and waste stewardship; -manufacture of products with "preferred" materials; -spread of a culture of sustainability."	Supplier + Circular Economy

Initiative	Partnership	Description	Impact	Dimension
Group's Product Restricted Substances List (PRSL)		"Suppliers are contractually bound to comply with the guidelines" "applies to materials, treatments and products, and includes not only the requirements of the most restrictive regulations of the producing and selling countries, but also other more stringent voluntary requirements in line with a precautionary approach."	"The proper implementation of these guidelines is verified through tests on the chemical composition of the raw materials carried out at specialised third-party laboratories by the supplier and/or Moncler and Stone Island." "important parts of the Group's strategy aimed at continuing to reduce potential environmental impacts"	Relation with suppliers

Initiative	Partnership	Description	Impact	Dimension
Manufacturing Restricted Substances List (MRSL)		"Suppliers are contractually bound to comply with the guidelines"	"The proper implementation of these guidelines is verified through tests on the chemical composition of the raw materials carried out at specialised third-party laboratories by the supplier and/or Moncler and Stone Island." "important parts of the Group's strategy aimed at continuing to reduce potential environmental impacts."	Relation with suppliers
100% renewable energy		"We only use energy from renewable sources in our locations and stores"	"have reduced direct emissions by 50% compared to 2021"	Innovation in operations
traditional lighting systems have been replaced with LED lights and thermal insulation systems		"traditional lighting systems have been replaced with LED lights and thermal insulation systems"	"to ensure greater energy efficiency"	Innovation in operations

Initiative	Partnership	Description	Impact	Dimension
application of Building Management Systems (BMS)			"at Moncler stores for more efficient management of energy consumption"	Innovation in operations
MAKE		"Training meetings and digital courses" "Moncler Academy for Knowledge and Excellence, is a learning ecosystem"	"for personal development of Moncler and Stone Island people in terms of knowledge and skills, but also of mental approach, working methods and organisational awareness."	Client + Innovation
MONCampus	delivered through MAKE	"corporate training programme for young talent, at global level"		Client + Innovation
eMpower project		"begin with enhancing digital skills, such as Excel and PowerPoint, and extend to promoting collaboration within the work team."	" They then focus on workshops dedicated to time management, creativity and personal development. eMpower accompanies training activities with opportunities for engagement"	Client + Innovation

Initiative	Partnership	Description	Impact	Dimension
MINE corporate platform		"internal communication and collaboration among employees"		Operations + Client
member of The Fashion Pact	The Fashion Pact	"a coalition that includes among its main objectives the fight against climate change and that is committed to train and inform"	"support its member companies in the processes of transformation and innovation required to reduce their environmental impacts"	Circular Economy + Innovation
member of Camera Nazionale della Moda Italiana	Camera Nazionale della Moda Italiana	"is engaged in advocacy activities with all Italian brands to promote a responsible and sustainable fashion"	"is based on, among other things, principles for reducing the environmental impact of business activities"	Supplier + Innovation
member of Fondazione Altagamma	Fondazione Altagamma	"promotes reduction of environmental impact among its members"		Reaserch inovation

Initiative	Partnership	Description	Impact	Dimension
"Launch of regenerative agriculture projects in the cotton and wool supply chains"		"to reduce and/or avoid the impacts on biodiversity" "is an approach that aims to improve the health and fertility of the soil, increasing its capacity to absorb carbon from the atmosphere, while also protecting water resources and biodiversity."	"allow to increase the capacity of the soil to retain water, improving the resilience of crops and reducing the need for irrigation of the fields" "mitigation effects on both the impact on biodiversity and greenhouse gas emissions"	Operations + Suppliers + Circular Economy

Initiative	Partnership	Description	Impact	Dimension
use of recycled materials		"More than 40% of the nylon used in the SS and FW 2023 collections is made with recycled material" "More than 12% of cotton used in SS and FW 2023 collections is organic or recycled" "Over 65% of the merino wool used in the SS and FW 2023 collections is made with materials that are certified mulesing free" "Over 45% of the wool used in the SS and FW 2023 collections is made with certified materials" "100% of nylon scraps recycled from own direct sites. Recycling extended to Moncler external outerwear production network, reaching 55% of total outerwear nylon scraps"		Circular economy

Initiative	Partnership	Description	Impact	Dimension
Extra-Life		"advanced repair service developed at global level"	"the underscored importance for the Group of integrating circular economy principles from the design and creation process to the choice of materials and product longevity guarantee."	Client + Circular Economy

logistics packaging made with "preferred" materials		"replaced the traditional stone paper used for its shopping bags with recycled paper" "the years the single-use plastic packaging used for logistic transport of shoes has been eliminated, and a procedure has been introduced to optimise the amount of packaging used for the internal shipment of samples of fabric and accessories between the various company functions with consequent savings in the materials used" "Annual R&D investment is thus allocated to explore and identify solutions with lower environmental impact than the conventional alternatives, also with the support and in collaboration with international start-ups"	"85% of the materials used in packaging is recyclable and recycled" "resulting in a 35% reduction in the weight of each bag"	Relation with suppliers

Initiative	Partnership	Description	Impact	Dimension
Raw Materials Manual			"strenghthen traceability systems of raw materials"	Relation with suppliers
digital career days	Glion Institute of Higher Education, Les Roches International School of Hotel Management and Ecole Hotelière de Lausanne	"digital career days were organised with the aim of identifying new resources to be included at the Moncler Ski Resorts"		Client + Innovation

Initiative	Partnership	Description	Impact	Dimension
Kindergarten in Romania	Reggio Children	"opening of a kindergarten for the children of employees in Romania"	"offers an innovative learning experience based on one of the most internationally renowned teaching approaches developed by the Reggio Children organisation" "The project adheres to the most innovative protocols and policies that promote health, safety and well-being, based on several factors, including the quality of light, water and air, energy efficiency, interior comfort and the quality of food offered."	Relation with client and user experience

Initiative	Partnership	Description	Impact	Dimension
Supply Chain Excellence programme		"Today's critical factors of success were analysed, along with those needed for the future, and specific projects were therefore launched, all with the aim of achieving operational excellence in terms of quality, time to market, sustainability, reliability, flexibility and efficiency."		Operations + Suppliers
Collection Excellence: Product Lifecycle Management		"All information relating to the development of the collections is now in a single environment shared by all the functions involved in the process, fostering its sharing and efficiency."	"In 2023, the platform's operational functions were further refined, with particular advantages above all in monitoring and managing workflows."	Innovation in operations

Initiative	Partnership	Description	Impact	Dimension
Data-based scientific approach		"in order to constantly improve supply chain management processes, each quarter the management team meets to monitor operating performance based on a set of indicators that analyse the performances of the various operating areas of Supply Chain & Operation processes"	"The quarterly monitoring and analysis cycle allows for a proactive approach to continuous improvement. Through this process, the company can constantly optimise processes, improve the quality of services offered and reduce operating costs."	Innovation in operations

Continuous improvement of garment quality		"the process of honing internal technical skills continued to ensure constant oversight of the design, industrialisation, pre-production and production phases, whether performed internally or by suppliers"	"This approach entails a constantly increasing focus on the quality of upstream process execution that will help reduce possible non-conformities of finished products. Over time, an approach based on the monitoring and analysis of performance has been consolidated: detailed study of production data makes it possible to quickly identify areas for improvement and always pursue the finest quality. To this end, a pre-testing process has been set up directly at suppliers' premises. This allows the language and quality standards to be brought directly into the production phase and enables swift repairs and greater quality control throughout the production process."	Innovation in operations

Initiative	Partnership	Description	Impact	Dimension
Shipment tracking		"the project involves accurate tracking of shipments, from raw materials to distribution of the finished product, to obtain timely information on the progress of the various phases, including through an ad hoc report."	"In 2023, the project sought to optimise shipments of raw materials to façon manufacturers, reducing the variability of delivery times. In 2024, it will be extended to the transport of finished products to the logistics hub."	Innovation in operations
3D Project		"In 2018 Moncler started to integrate 3D technology into its product development process. Digital design minimises the need for physical samples, reducing waste, development times and prototype production costs"	"This makes it possible to digitally adjust the fit, find the right proportion for each size and check the rendering of different fabrics, colours and patterns."	Operations + Innovations

Initiative	Partnership	Description	Impact	Dimension
Zero Waste Project		"all obsolete materials (fabrics, components, etc.) in the Moncler brand's main warehouse began to be classified and verified starting in 2021."	"This activity allowed to have a timely view of inventories, making them available for the production of new collections, thus reducing the generation of waste."	Circular economy
Early Product Engineering Programme		"enables any critical issues to be identified and addressed in advance with all development teams so that the problem can be solved quickly: the so-called, design for manufacturing."		Innovation in operations
MATE (Moncler Academy for Technical Excellence) programme		"create a school of craftsmanship aimed at training technical personnel such as prototypers, pattern-makers and quality experts"		Reaserch inovation

Initiative	Partnership	Description	Impact	Dimension
Pattern Making School training programme		"the aim of increasing skills among Moncler's personnel and thus strengthening certain departments such as modelling, CAD, development and placements through the training and recruitment of local students"		Reaserch inovation
vendor rating system		"assigns an overall supplier rating also considering sustainability aspects."	"Each indicator is weighted and helps to assess a supplier based on the results achieved in each area"	Relation with suppliers

Initiative	Partnership	Description	Impact	Dimension
Moncler technical DIST Protocol (Down Integrity System & Traceability)		"Moncler only purchases down that is DIST-certified. Among the basic requirements that must be respected across the entire supply chain: — down must be exclusively sourced from farmed white geese and as a by-product of the food chain — no form of live-plucking or forced feeding is permitted."	"ensure a scientific and holistic approach to the topic of animal welfare and product traceability"	Relation with suppliers

Initiative	Partnership	Description	Impact	Dimension
Traceability of key raw materials		"Key raw materials (nylon, polyester, cotton, wool and down) traced" "The project involved an initial phase of analysis and selection of the IT systems and tools necessary to collect and trace the data and information of the various supply chains. Then, a subsequent phase was launched, to define the process methods for tracing strategic raw materials and the required level of information detail according to their nature."	"the Group traced at the region level more than 80% by volume for each of the nylon, polyester, cotton and wool fabrics and yarns, in addition to the 100% already traced for the down raw material. In particular, raw materials of natural and animal origin, i.e. cotton and wool, were traced from the growing or farming stages, including, where applicable, the processes of spinning, warping or weaving, knitting, dyeing and finishing. Synthetic raw materials, i.e. nylon and polyester, were traced from the spinning stages, including, where applicable, the processes of warping or weaving, dyeing, printing and finishing"	Operations + Suppliers

Initiative	Partnership	Description	Impact	Dimension
Omnichannel Excellence		"from the redesign of the client experience to the organisation of stores and of sales personnel, to the redefinition of working processes and methods. The aim is to get to know and engage clients, increasing their loyalty and developing an increasingly omnichannel approach."	"get to know and engage clients, increasing their loyalty and developing an increasingly omnichannel approach"	Relation with client and user experience
Digitalisation of stores		"turn stores into places for even more unique and personalised experiences through a comprehensive technological management of stores and enabled by systems such as the Match to Traffic"	"which allows activities to be scheduled on the sales floor thus improving the service to client"	Operations + Client

Initiative	Partnership	Description	Impact	Dimension
digital payment service		"active at a global level, allowing purchases to be finalised directly on the sales floor and without having to go to the checkout"	"thus making the in-store experience even more enjoyable and faster."	Operations + Client
omnichannel data collection service		"allows clients who register in the store to immediately have an active account on the online channel, is part of a process designed for clients who take non-linear paths, who interact with the brand in physical stores as well as in the online store and through the various digital channels"	"thus enjoying a consistent, personalised and integrated experience while being increasingly involved in a real community."	Operations + Client
Omnichannel New Experience (ONE) project		"led to the internalisation of the Moncler e-commerce channel, with a gradual implementation by geographical area"		Operations + Client

Initiative	Partnership	Description	Impact	Dimension
Distance sale service		"was digitalised in Moncler to allow clients to purchase garments safely from home, by telephone or videocall, with the support of sales personnel."		Relation with client and user experience
Smart Entrance service		"to manage and optimise the presence of clients at retail stores"		Operations + Client
Moncler Live Boutique		"new tool to support its sales staff, aimed at improving management of virtual appointments and distance sales through the use of external channels (including Whatsapp, Facetime, Line, etc."		Operations + Client

Initiative	Partnership	Description	Impact	Dimension
Client Service		"a channel for constant dialogue with a view to continuous improvement. The service handles support requests from clients from the various channels, physical and digital, in an omnichannel perspective at global level. In 2023 the Company consolidated the process of digitalising Client Service by strengthening its social media presence, using instant messaging, implementing web chat and integrating clienteling activities."		Operations + Client

Initiative	Partnership	Description	Impact	Dimension
MonClient app		"The application is based on a centralised and integrated management of the CRM calendar, enabling Client Advisors to manage appointments, plan and record activities related to the Client Moment, check product availability, make sales, enhance client database and handle after-sales requests"		Relation with client and user experience
Distante Repairs service		"the Client Service arrange a pick-up of the garment directly from the client if the client cannot visit the store."		Client + Circular Economy

Initiative	Partnership	Description	Impact	Dimension
authentication-tracking system		"This system provides a unique alphanumeric code, a QR code and an NFC (Near Field Communication) tag that allows the end client to immediately receive feedback on the authenticity of the garment purchased by scanning the NFC using a smartphone or tablet, which can be verified on the code.moncler.com website, directly managed by Moncler."		Relation with client and user experience

Initiative	Partnership	Description	Impact	Dimension
Moncler Digital Hub		"a department aimed at guiding Moncler's digital transformation and acceleration and to spread the culture throughout the Company, around five strategic pillars: D-Commerce, D-Marketing, D-Intelligence, D-Operations and Consumer Engagement."		Innovation in operations
Use of "preferred" materials		""Preferred" materials are those that aim to have a lower impact compared to conventional solutions used by the Moncler Group."		Supplier + Circular Economy
Life Cycle Assessment (LCA)		"analyses that quantify the potential environmental impacts"	"useful tool for various considerations on the sustainability of the products, processes and materials use"	Circular economy

Initiative	Partnership	Description	Impact	Dimension
Closed Loop project		"aim of recovering cotton scraps generated by suppliers during garment production by subjecting them to a mechanical recycling process."	"This process yields 50% recycled cotton fabric used to make about 20 models, including outerwear, trousers, sweatshirts and t-shirts, included in the 2024 summer and winter collection. In addition, the finished garments were treated with pigments of natural, plant or mineral origin. The entire process was verified by a third party that validated the recycled content and its origin from production scraps."	Circular economy

Initiative	Partnership	Description	Impact	Dimension
create a machine used to recycle DIST		"through an innovative mechanical process"	"this process has led to the recycling of approximately 5 tonnes of down present in Moncler garments, certified according to the R•DIST module of the DIST protocol, which sets the requirements for recycled down certification"	Circular economy
The sustainable Innovation team		"search for innovative solutions" "in identifying partners in the various Regions that can guarantee the most innovative, cutting-edge techniques for recycling the main product categories. In addition, it has set up working groups with the Sustainability Unit to identify circularity solutions aimed at reducing the impact of materials."		Circular Economy + Innovation

Initiative	Partnership	Description	Impact	Dimension
Down quality standards		"Each batch of down is double-checked to verify it complies with 11 parameters, relating to quality (as well as aspects of hygiene and health), identified by the strictest international regulations and the restrictive requirements established by the Company: first through sophisticated analysis by an accredited independent body and then through further tests carried out at Moncler's internal laboratory, home to highly-specialised down technicians"	"the technical quality of Moncler down is ensured by a complex process that ensures that only the best white goose down is used to make garments."	Relation with suppliers
Greentech	GreenTech	"plastic recycling with a high efficiency system"	"allows the reduction of emissions compared to traditional disposal methods"	Reaserch inovation

Initiative	Partnership	Description	Impact	Dimension
Henrietta Solar		"is a project certified according to the Verified Carbon Standard that involves the installation of a photovoltaic energy system in Mauritius, which is severely exposed to climate change and classified as Small Island Developing States (SIDSs)"	"the project will provide sustainable energy to 40,000 people, while preserving an agricultural area of over 20 hectares. The solar panels will generate around 26,500 MWh, replacing the current energy mix with clean, renewable energy, reducing its greenhouse gas emissions by more than 25,000 tonnes of CO2 a year"	Reaserch inovation

Initiative	Partnership	Description	Impact	Dimension
Sustainable mobility		"encourages its employees to adopt solutions with a low environmental impact" car pooling iniative company bicycles available shuttle bus service	"enables Moncler people to benefit from moments of socialisation with their colleagues, while also limiting the environmental impact of travel." "prevented the emission of over 1,670 tonnes of CO2, equals to a reduction of 43% compared to the emissions that would have been generated if each employee had moved by private means."	Relation with client and user experience
Work Home Travel Plan (WHTP)		"analyse workplace accessibility, the transport solutions used by employees, travel distance and time and possible areas of intervention were identified"	"to reduce pollutant emissions and promote alternative approaches to commuting"	Relation with client and user experience

Initiative	Partnership	Description	Impact	Dimension
Integrate recycling programmes		"in 2023 the Group sent 99% of all textile waste material for recycling"	"minimise the material sent to waste-to-energy and/or landfills"	Circular economy
Unlock Programme	The Fashion Pact	"both of which aimed to provide incentives for cotton farmers to apply regenerative and low-impact farming practices"		Innovation in operations
Cotton 2040 project	Ecosystem Services Market Consortium (ESMC)			Relation with suppliers
PUR Project		"promoting the use of regenerative practices in animal rearing"	"with the aim of improving the farming practices used"	Circular economy
One Health initiative		"a network of laboratories located in the Gilgit-Baltistan region (Pakistan) dedicated to studying and protecting the health of nature and animals"		Reaserch inovation

2. Inditex's Initiatives

Initiative	Partnership	Description	Impact	Dimension
Manufacturing Restricted Substances List (MRSL)	Zero Discharge of Hazardous Chemicals (ZDHC) Foundation	"This regulates the quality of discharges, facilitating compliance with requirements for both chemical suppliers and the facilities that use them"	"Improve environmental performance in our supply chain"	Relation with suppliers
Green to Wear standard		"expand knowledge about the water context in our supply chain. Parameters such as water stress, the source and distribution of the water used and water reuse and recycling help us to propose a strategy contextualised to suit the local situation of water resources at each facility."	"allows it to be adapted to the new production processes, as well as to foster, to the extent possible, even greater savings in water usage."	Supplier + Circular Economy
Safe to Wear standard		"we provide our suppliers with manufacturing guidelines that include measurement tables with specific safety requirements, such as the position of appliqués and	"In cases of initial non-compliance (1.8%), we apply re-operation protocols that allow these products to be properly corrected, eliminating the	Relation with suppliers

Initiative	Partnership	Description	Impact	Dimension
		cords or maximum lengths of free ends"	presence of restricted substances and improving parameters such as colour fastness to achieve compliance."	
Clear to Wear standard		"bring it into line with the latest regulatory developments and to further our alignment with the Apparel and Footwear International RSL Management (AFIRM)'s Restricted Substances List (RSL)."	"This standard covers restricted chemicals present in finished products."	Relation with suppliers
Physical Testing Requirements		"the standard which establishes the physical-chemical parameters for textile quality testing"	". In cases of initial non-compliance (1.8%), we apply re-operation protocols that allow these products to be properly corrected, eliminating the presence of restricted substances and improving parameters such as colour fastness to achieve compliance"	Relation with suppliers
Active to Wear		"a product quality tool that defines the minimum requirements for fabrics or garments labelled with a functional property that enhances		Relation with suppliers

Initiative	Partnership	Description	Impact	Dimension
		their performance under certain conditions of use or activities such as the water repellency."		
Minilabs		"portable laboratory that allows our external auditors to conduct, at the supplier's own facilities and at any stage of the production process, up to six screening tests for substances and parameters regulated in the Clear to Wear standard and Physical Testing Requirements."	"In 2023, we performed 3,656 Picking inspections with Minilab and carried out 31,268 analyses and screening tests43 (3,743 inspections and 33,029 analyses and screening tests in 2022)"	Reaserch inovation
Root Cause Analysis (RCA)		"enables us to conduct technical audits when we identify a non-compliance in the course of Picking inspections. These audits, which are carried out by specialists, are aimed at finding the root cause of the non-compliance in wet process facilities (dyeing, washing, tannery and printing, primarily)"	"proposing an action plan to remedy the defect" "allows us to generate and strengthen our expertise so as to be able to tackle and correct the causes of non-conformities and continue to improve our supply chain"	Supplier + Innovation

Initiative	Partnership	Description	Impact	Dimension
APPLABs programme		"This initiative ensures that the analysis process and the results provided by these laboratories on our articles are accurate and according to the particularities of our model. This confidence is crucial because this information determines whether a production meets our standards."	"In 2023, a total of 57 on-site audits were carried out at external laboratories and 47 comparison exercises, which involved analysing 6,821 samples (56 on-site audits, 35 comparison exercises and 5,951 samples in 2022)."	Supplier + Innovation
The List	ZDHC's Gateway platform	"This is a procedure for classifying chemicals that improves production processes and the health and safety of final garments"	"providing key information to determine whether a particular chemical is compliant with MRSL discharge parameters as well as applicable legal requirements"	Supplier + Innovation
Shop&Go service		"for payment from anywhere inside the store"		Operations + Client
developments in data management systems		"allow all our buying teams to know the performance of each supplier, encouraging responsible purchasing practices that allow them to make sustainability-focused business decisions."	"measure the sustainability performance of each supplier and factory"	Operations + Suppliers

Initiative	Partnership	Description	Impact	Dimension
new Zara.com building		"When building our headquarters, we follow bioclimatic criteria, encouraging the installation of photovoltaic panels, the collection of rainwater for non-drinking uses and the implementation of self-regulating lighting systems in accordance with outside light conditions, as specific examples of our sustainable practices."	"oversee, reduce and mitigate the impact of the consumption of resources."	Innovation in operations
Traceability strategy		"based on a management system whereby each supplier is required to know and share its supply chain data and report the facilities involved in the productions, and an verification process that confirms that production takes place in declared and authorised factories"	"helps us to ascertain in which production facilities our articles were created and to certify the use of more responsible materials"	Relation with suppliers
Tra!n learning platform		"learning platform offers a wide range of digital content tailored to each individual, and enables their in-person training to be recorded too. Fashion and product, Sustainability, Customer		Relation with client and user experience

Initiative	Partnership	Description	Impact	Dimension
		Experience, Operations, Skills or Digital are some of the subjects most demanded by our people when it comes to training in the platform. Tra!n is available in all markets where we operate except for Mainland China, where our employees have access to Grow, a local platform on which we offer content aligned with that of Tra!n"		
Sustainability Innovation Hub		"the platform with which we are continuously seeking the best materials, approaches and processes" "a platform that we created in 2020 to identify and test new technologies, materials and processes with the intention of scaling them to the textile industry, i"	"Research and development of new materials and production processes with a lower impact" "we support innovation in sustainability, contributing expertise, capital and commitment to discover more responsible materials, approaches and processes"	Circular Economy + Innovation
rollout of a guide to best manufacturing practices		"We also published the new guide to best manufacturing practices free of perfluoroalkyl and polyfluoroalkyl substances (PFAS). This guide provides		Relation with suppliers

Initiative	Partnership	Description	Impact	Dimension
		information on the sources and common uses of these synthetic compounds, a clear testing method at both the chemical and textile application level using more sensitive analytical techniques, and guidelines to prevent cross-contamination at manufacturing sites."		
Ultramid® CcyledTM	BASF	"commercial development of recycled polyamide"	"from waste tyres—which cannot be reused in its own industry—and agricultural waste, respectively. We have launched collections using this polyamide	Reaserch inovation
Green to Pack programme		"establishes the quality and environmental standards that our boxes must meet to allow their reuse and subsequent recycling. The programme also takes into account the social aspect and respect for human and labour rights in the manufacturing process"		Supplier + Client + Circular Economy

Initiative	Partnership	Description	Impact	Dimension
member of BC cotton	Better Cotton (BC)	"an initiative involving actors in the cotton supply chain aimed at training farming communities in best practices for growing cotton."		Supplier + Circular Economy
Picking Programme		"ensuring that our articles are made in accordance with our health and safety standards. This programme identifies potential non-conformities by means of a representative sample at the supplier's facilities and an analysis conducted by external laboratories approved by our APPLABS programme"	"In 2023, 60,685 Picking inspections were carried out, and 821,934 analyses and tests were performed41 (51,288 inspections and 721,980 analyses and tests en 2022)."	Supplier + Innovation
RFID alarm tags (Radio Frequency Identification		"application of Radio Frequency Identification (RFID) technology in the value chain and development of new mobile robotics technologies."	"our staff can quickly locate any article, regardless of where it is located, and make it available to customers."	Operations + Client
SINT (Integrated Stock Management System)		"we have merged the inventory management of all our brands"		Innovation in operations

Initiative	Partnership	Description	Impact	Dimension
Zara Pre-owned		"our platform for the repair, customer-to-customer resale and donation of used clothing in 16 markets the platform that allows the brand's customers to actively contribute to the circularity of their used clothing"	"with which we are lengthening the useful life of our products and helping our customers give their clothing a new life, actively contributing to industry circularity"	Client + Circular Economy
The Circ x Zara Collection	Circ (a U.S.-based fashion technology company specializing in textile recycling)	"Zara launches the first collection made by recycling blended textiles using Circ's innovative technology"	"Inditex acquired a stake in this startup last year as part of its commitment to fostering circularity."	Circular economy
Air Fiber Washer	Jeanologia	"innovative industrial air extraction system"	"reduces microfibre shedding by up to 60% in the first few washes, without using water or thermal energy, and without compromising fabric quality"	Circular economy
acquiring cycora®	from Ambercycle	"a recycled polyester made from textiles"	"made from 100% textile waste" "to help scale the production of recycled polyester made from textiles"	Circular economy
launch by Zara Home of a capsule collection made with the	generated from hemp by Circular Systems	"Inditex enhances strategic partnerships with the most innovative startups in lower environmental impact fibres"		Circular economy

Initiative	Partnership	Description	Impact	Dimension
Agraloop™ BioFibre™				
member of The Fashion Pact	The Fashion Pact	"is aimed at improving the fashion industry's impact on nature by protecting biodiversity, taking climate action and preventing microplastic ocean pollution"		Circular Economy + Innovation
The Fibres Plan		"with exacting commitments for the use of materials with lower impact, also known as preferred materials" "involves the use of organic and regenerative practices with the use of raw materials with a lower impact on water."	"concerning the target on the use of lower-impact textile raw materials."	Supplier + Circular Economy
Supply Chain Transformation Plan		"focuses on boosting our suppliers' and manufacturers' to achieve the sustainability goals"	"These plans serve the facilities of our suppliers and manufacturers to advance in minimizing impacts and transforming the sector."	Relation with suppliers
Virtual Power Purchase		"in place for periods of 10 and 12 years, with a total installed capacity of 136 MW"	"allow us to consume renewable energy regardless of the location of our operations, while	Innovation in operations

Initiative	Partnership	Description	Impact	Dimension
Agreements (VPPA)			contributing clean energy to the grid"	
Outer Port Wind Facility	Coruña's Port Authority	"promote self-consumption initiatives" "the installation of three wind turbine generators with an installed capacity of 5.5-6 MW"	"we aim to generate on-site the renewable energy necessary to cover the annual electricity required by our headquarters in Arteixo, and also to supply clean electricity to the port's own infrastructures"	Innovation in operations
ReHubs Europe	European Apparel and Textile Confederation (Euratex)	"an international non-profit organisation dedicated to promoting textile recycling" "comprises member companies and organisations from across the textile value chain, including textile manufacturers, fashion brands, waste managers, recyclers, chemical industry representatives and technology providers, with the aim of promoting the development of projects that generate industrial		Circular Economy + Innovation

Initiative	Partnership	Description	Impact	Dimension
		capacity and expertise on post-consumer textile waste recycling"		
SCRAP	together with other brands	"we co-founded the Association for the Management of Textile Waste with the aim of creating a Collective Extended Producer Responsibility Scheme (SCRAP) for textile and footwear waste in Spain."		Supplier + Circular Economy
LEAF Coalition	Emergent	"aims to encourage countries to promote measures geared to curbing deforestation in tropical and subtropical countries. The idea is to halt the loss of biodiversity and avoid the greenhouse gas emissions deriving from deforestation."		Circular economy
joined The Deforestation-Free Call to Action for Leather	Textile Exchange and the Leather Working Group (LWG)	"urges brands to commit to obtaining their bovine leather from deforestation-free supply chains by 2030 at the latest, investing to foster best practices in this regard."		Supplier + Circular Economy

Initiative	Partnership	Description	Impact	Dimension
LOOPAMID® x ZARA	BASF chemistry	"ZARA Studio has developed a single-material jacket made entirely with LOOPAMID®, a polyamide entirely created from textile waste. The fabric, padding, zipper, buttons and even the velcro are made from this innovative material created from textile waste."		Circular economy
The Laundry	BASF	"is the first detergent designed to reduce microfibre shedding in washing, and it is available in the brand's stores and online."	"is especially effective at low temperatures, yielding additional benefits such as lower energy consumption in washing or improved colour fastness, prolonging a garment's life."	Circular Economy + Innovation
SOKALAN HP 56 A	BASF	"to implement and optimise the first industrial cold washing system"	"This system significantly reduces water and energy consumption in exhaust dyeing systems"	Circular Economy + Innovation
Inditex-UDC Sustainability Chair	University of A Coruña (UDC)	"promote a space for community reflection, academic training and applied research on sustainability and social innovation"		Reaserch inovation

Initiative	Partnership	Description	Impact	Dimension
Water & Climate Fund	Water.org	"aimed at developing projects to improve global water and sanitation infrastructure, through the execution of climate-friendly interventions in countries such as Brazil, Indonesia, the Philippines, Kenya, Mexico, India and Malawi"	"has allowed us to improve access to water and sanitation for 1 million people in 2023."	Supplier + Innovation
PIGMENTURA	CHT	"an innovative dyeing solution" "a pigment dye that does not require washing and drying processes, thereby reducing the energy needed to heat the water used in conventional production processes"	"not only slashes water consumption by up to 96%, but also prevents microfibre shedding."	Circular Economy + Innovation
WWF Programme	WWF	"Inditex also carries out transformational work focusing on the impacts of its activity and of the fashion industry, we have financed projects for the protection and restoration of forest and fresh water ecosystems in different countries"		Circular economy

Initiative	Partnership	Description	Impact	Dimension
use of Circulose® pulp	Renewcell	"a new textile pulp produced from recycled cotton waste"		Circular Economy + Innovation
Knowledge transfer platform		"The measures to improve water consumption include optimising the production process, using certain chemical products or the possibilities of reusing and recycling water, always tailored to the production process at each facility."	"improve their water consumprion and the quality of wastewater discharges"	Supplier + Innovation
Biomethane Energy Project	Naturgy and EDAR Bens	"In 2023 we launched a collaborative project with Naturgy and EDAR Bens, the publicly owned water treatment utility that operates in the metropolitan area of A Coruña, to convert the biogas generated by wastewater into biomethane."	"phasing out fossil fuels"	Supplier + Innovation
Textile recycling project	other organisations	"At present, textile waste collection and sorting technologies and infrastructure are not capable of recovering large volumes of waste and		Supplier + Circular Economy

Initiative	Partnership	Description	Impact	Dimension
		transforming it into resources. An additional challenge is to ensure that recycled fabrics maintain a quality comparable to the original fabrics. At Inditex we are addressing this problem through our own textile recycling projects and in collaboration with other organisations."		
Waste management systems		"with strict operating requirements to allow us converting waste generated at our facilities into resources available for reuse or recycling."	"prevent the generation of waste materials where possible, and to enable the recovery, reuse and subsequent recycling of those that are ultimately generated. Thus, we transform these materials into resources that can continue to be used."	Circular economy
Climate Transition Plan		"which evidences our commitment to a more efficient and circular fashion industry capable of tackling the climate challenge."	"encompass our operations and value chain, and focus on the following aspects: Reduction, Neutralisation, Mitigation beyond the value chain"	Supplier + Circular Economy

Initiative	Partnership	Description	Impact	Dimension
Integrated Risk Management System (IRMS)		"establishes the Group's risk management and control framework. The IRMS, based on the COSO Enterprise Risk Management (ERM)6 framework, covers our entire Group, both at corporate level and in the different business units and subsidiaries, regardless of their geographic location. It is incorporated in our strategic planning process, in the definition of business objectives, as well as in the Group's day-to-day operations."	"The IRMS comprises both financial and non-financial risks (including tax, operational, technological, cybersecurity, legal/regulatory, social, environmental, climate change, political, reputational, corruption-related and other risks). We consider risk to be any potential event, regardless of its nature, that could adversely affect the achievement of business objectives."	Operations + Suppliers
Inventory system		"allows a streamlined response to the market is only possible thanks to the excellent work of our teams and the continuous improvement of our logistics systems."		Innovation in operations
signed an Infinna™ purchase agreement	Infinited Fiber Company	is a virgin-quality textile fiber regenerated 100% from textile waste		Circular Economy + Innovation

Initiative	Partnership	Description	Impact	Dimension
joined the Science-Based Targets initiative (SBTi)	SBTi	"We have submitted to SBTi our updated strategy for cutting our emissions associated with our business13 by over 50% reduce by 2030 compared to 2018."	"We expect this to help us advance in the right direction so as to achieve net-zero emissions by 2040, by reducing our scope 1, 2 and 3 emissions by 90% compared to 2018, while the remaining 10% will be neutralised through carbon sequestration initiatives."	Operations + Innovations
Emissions calculation methodology	Intergovernmental Panel on Climate Change and the World Resources Institute	"We calculate and report the Inditex GHG emissions in accordance with the guidelines of the Intergovernmental Panel on Climate Change (IPCC - Guidelines for National Greenhouse Gas Inventories, 2006) and the World Resources Institute (GHG Protocol, 2015), which divide emissions into scopes 1, 2 and 3."		Reaserch inovation
Global Energy Strategy		"This Strategy aims to promote the rational and efficient use of energy throughout our value chain"	"reducing GHG emissions and helping to mitigate their effects."	Relation with suppliers

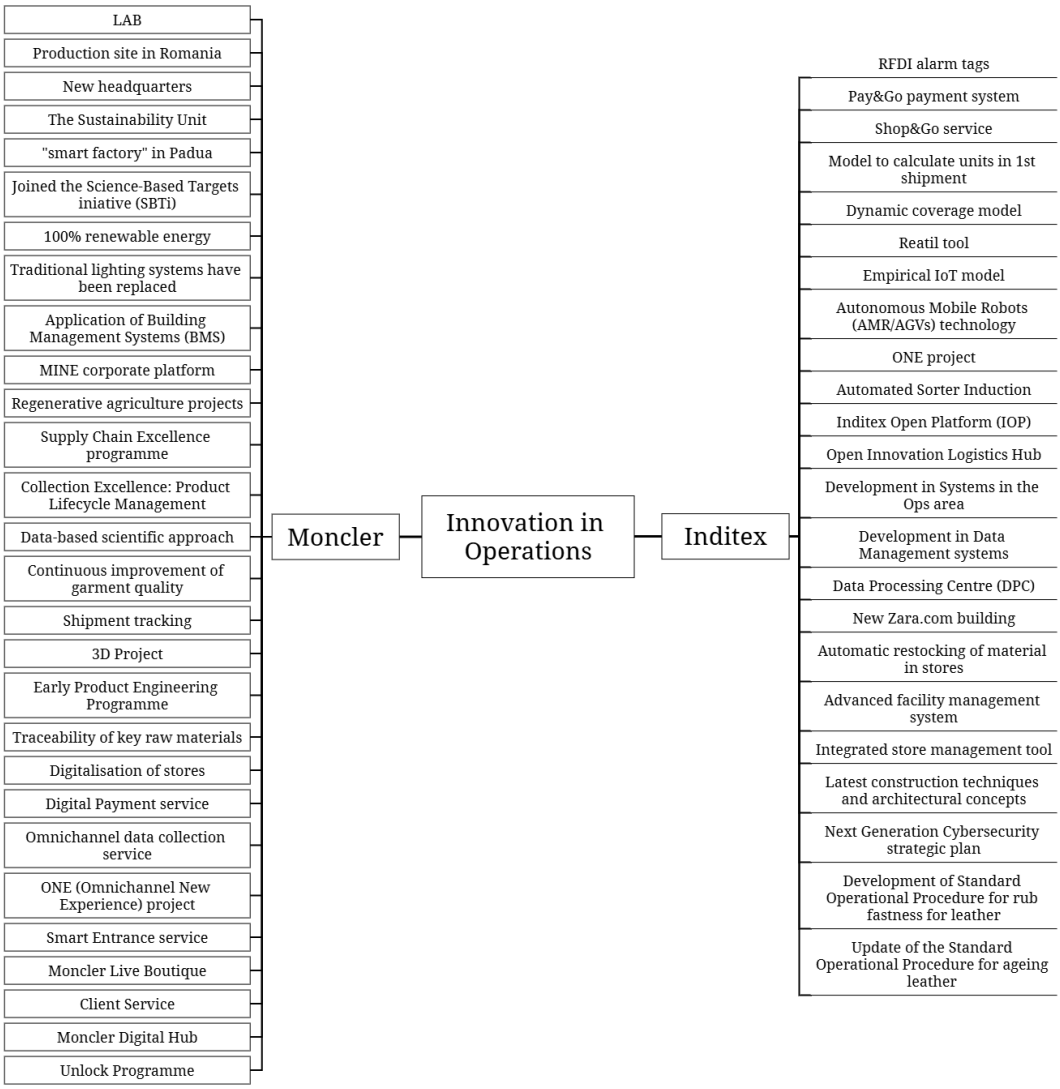
Initiative	Partnership	Description	Impact	Dimension
Environmental Management System (EMS)		"This system is implemented at 100% of our corporate headquarters and our own factories and logistics centres."	"enables us to advance in the use of renewable energy and transition towards more efficient and circular management models."	Relation with suppliers
Bangladesh Peer Action Group	United Nations Fashion Industry Charter for Climate Action	"we contribute to the promotion and development of renewable energy sources in the fashion industry."	"collectively move towards a planned strategy to phase out the use of coal"	Relation with suppliers
Sustainability Roadmap		"reflects Inditex's firm commitment to progressing towards a low-carbon economy model. The goal of net zero greenhouse gas emissions by 2040, science-based decarbonisation targets (SBTs) by 2030, and the commitment to using 100% renewable electricity at our own facilities, achieved in 2022."	"The Group collaborates with all the actors in the value chain and with stakeholders to tackle global challenges from a holistic standpoint."	Supplier + Innovation
Global Water Management Strategy		"aimed at ensuring sustainable and efficient water usage across our value chain while promoting activities linked to the protection	"we have different lines of action focused on the analysis of impacts and their mitigation, including: / The efficient and responsible	Relation with suppliers

Initiative	Partnership	Description	Impact	Dimension
		and restoration of river basins and other aquatic ecosystems"	use of water through the implementation of the best available technologies, reuse and recycling of water. / Improving the quality of the discharge and its responsible management such as the use of safe and sustainable chemical products. / The implementation of a fibre plan that involves the use of organic and regenerative practices with the use of raw materials with a lower impact on water. / The protection of aquatic ecosystems and the restoration of deteriorated water basins."	
The Clothing Collection Programme		"allows our customers to donate items they no longer use to more than 90 local community organisations in the markets where we operate. Donation is made through the containers	"these articles are classified in accordance to the principle of waste hierarchy. Thus, garments in good condition will be donated to people in vulnerable situations or resold to finance these organisations'	Circular economy

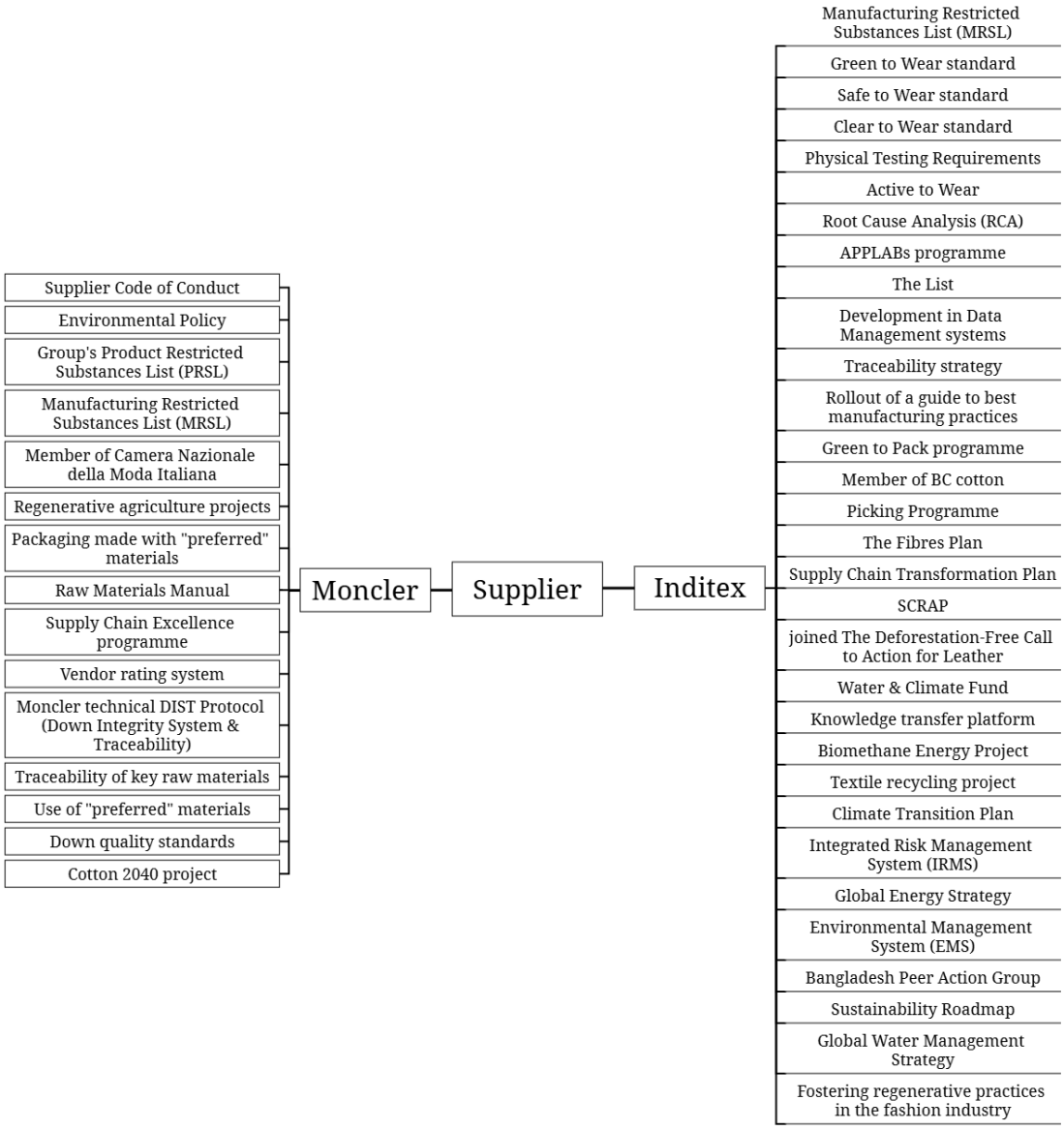
Initiative	Partnership	Description	Impact	Dimension
		located in our stores or Zara.com's home collection services"	community projects. Those products that cannot be reused will be transformed into new textile fibres (upcycling) or, as a last resort, are made into new materials for industrial use (downcycling)."	
Collaboration programme with the Massachusetts Institute of Technology (MIT)	Massachusetts Institute of Technology (MIT)	"The collaboration with MIT in education and research is structured around various action areas: creating Inditex chairs in areas such as operational research and sustainability; research and enhancement of knowledge in fields such as artificial intelligence, machine learning or data science; and the development of research lines in areas such as textile recycling or the creation of new fibres using sustainable technologies."		Reaserch inovation
Moda Re-	Caritas	"dedicated to collecting used textiles in order to recover and reuse them through a sustainable business model based on the	"2.6 million articles have been donated to vulnerable people; 3,520 sensor-equipped clothing collection containers of used	Circular economy

Initiative	Partnership	Description	Impact	Dimension
		circular economy. Its purpose is to generate employment for vulnerable people through the collection, recycling, and reuse of used garments."	garments have been installed in Spain, more than 121,000 tonnes of clothing have been collected, and 108 second-hand clothing stores have been opened or refurbished. The programme currently generates more than 1,400 jobs, 700 of them the result of insertion initiatives."	
Fostering regenerative practices in the fashion industry	Conservation International's Regenerative Fund for Nature	"focused on the transition to regenerative practices"	"for the benefit of biodiversity and communities, in production areas connected to materials used in the fashion world."	Operations + Suppliers + Circular Economy

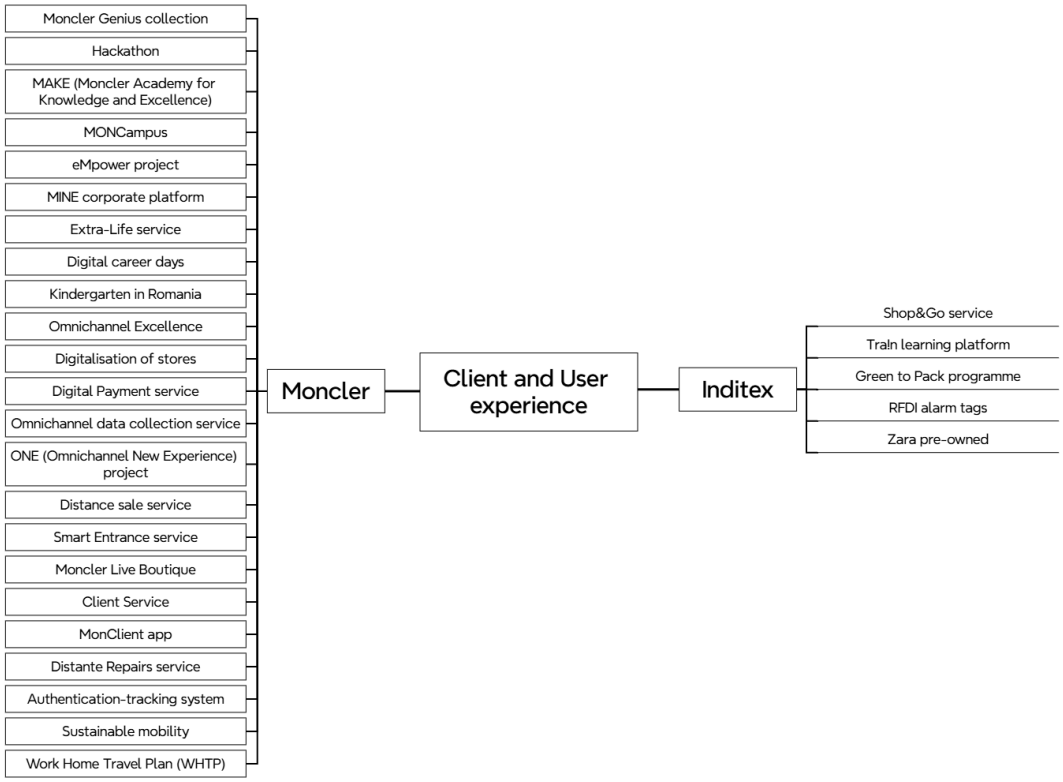
3. Mind map of Innovation in Operations



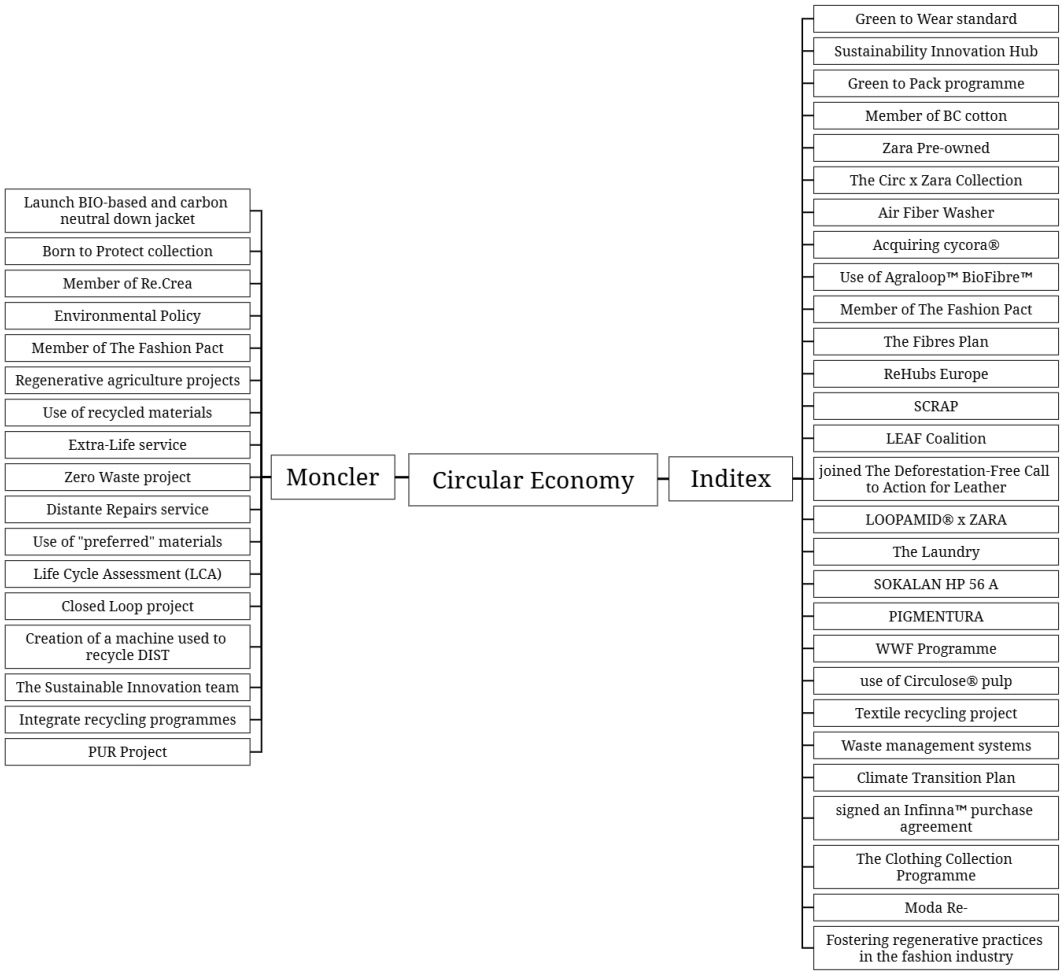
4. Mind map of Relation with suppliers



5. Mind map of Relation with client and user experience



6. Mind map of Circular economy



7. Mind map of Research for innovation