
**ENVIRONMENTAL SUSTAINABILITY INDEX FOR THE
TEXTILE INDUSTRY AND PERCEPTIONS OF
ENVIRONMENTAL SUSTAINABILITY DRIVERS IN FAMILY-
OWNED TEXTILE COMPANIES**

Tiago Mateus Sarabando Matias

Dissertation

Master's in Economics and Management of Innovation

Supervised by

Renata Blanc Esteves Bento de Melo

2nd of July 2023

Acknowledgments

To all those who contributed with orientation, council and/or criticism I am very grateful.

I would like to express my sincere gratitude to Professor Renata Blanc, for her support, guidance, constant availability and friendship.

To Professor Manuel Castelo Branco, I want to convey my deep thanks for his wise council.

To my dear friend Julia Cavaz, for her availability and mathematical support.

To my mother, for her help throughout the entire process, for her criticism and encouragement.

To my grandfather, for his willingness to help and his network of contacts, without which we would never have brought together so many companies in the study.

To Eng. César Lima and Eng. Mário Jorge Machado, who contributed with valuable insights about the textile and apparel industry.

To all the companies who participated in this study, I would like to extend my heartfelt appreciation. It is rare to find openness to participate in academic studies nowadays.

To my family and friends, for their encouragement and support, especially during this difficult year.

To all, thank you.

Abstract

Sustainability has emerged as a crucial concept in contemporary society. Climate change, natural catastrophes and resources depletion are topics with increasing relevance. The textile and apparel (hereafter T/A) industry has been drawing special attention due to being recognized as one of the most polluting industries globally, with significant adverse environmental impacts.

Despite the extensive academic attention devoted to sustainability and its drivers across sectors, there is a lack of research specifically in what regards T/A companies.

Based on extensive literature review, a T/A Environmental Sustainability Index (hereafter TESI) was developed, thus providing a measurement framework to assess the maturity of environmental sustainability practices in T/A companies. The TESI was tested through a survey, run among T/A companies and validated through semi-structured interviews with its representatives. Given the family-owned profile of 84% of the companies that participated in the survey, and based on the Stakeholder and Socioemotional Wealth theories, we then investigated the possible relationship between family firms (hereafter FF)' characteristics and environmental sustainability maturity, both through the application of a survey and semi-structured interviews.

Regarding the TESI, it was considered interesting and useful by the enquired companies, so we expect it may be useful for wider T/A companies' application. In what concerns the relationship between FF characteristics and the level of environmental sustainability (as measured by the TESI) even though, in most cases, the quantitative analysis did not provide significant support to prove several hypotheses (potentially due to sample composition), the results of the study offered valuable insights, namely the importance of family values and stakeholder engagement in driving environmental sustainability.

The results of this study are deemed relevant for practitioners and policymakers in the T/A industry and offers additional contribution to understanding the interplay between FF characteristics and environmental sustainability, highlighting the complexity of this relationship and the need for further research.

Key Words: sustainability, textile and apparel industry, family-owned companies, environment, drivers of sustainability, stakeholders, sustainable development.

Resumo

A sustentabilidade surge como um conceito decisivo na sociedade atual. As alterações climáticas, as catástrofes naturais e a escassez de recursos são temas com relevância crescente. A indústria têxtil e do vestuário (doravante T/A) tem merecido especial atenção por ser reconhecida como uma das indústrias mais poluentes a nível mundial, com impactos ambientais adversos significativos.

Apesar da vasta atenção académica dedicada à sustentabilidade e aos seus determinantes, em vários setores da indústria, existe falta de investigação específica no que respeita a empresas do T/A.

Com base numa extensa revisão da literatura, foi desenvolvido um Índice de Sustentabilidade Ambiental (designado por TESI), que estabelece um modelo de medição para avaliar a maturidade das práticas de sustentabilidade ambiental em empresas T/A. O TESI foi testado através de um questionário, realizado a empresas do setor T/A e validado através de entrevistas semiestruturadas com alguns dos seus representantes. Tendo em conta o perfil familiar de 84% das empresas que participaram no inquérito, e com base nas teorias dos Stakeholders e da Riqueza Socio-emocional, investigou-se a possível relação entre as características das empresas familiares (doravante FF) e a maturidade da sustentabilidade ambiental, através da aplicação de um inquérito e de entrevistas semiestruturadas.

Relativamente ao TESI, foi considerado interessante e útil pelas empresas inquiridas, pelo que esperamos que possa ser vantajoso para uma mais ampla aplicação por empresas T/A. No que diz respeito à relação entre as características das FF e o nível de sustentabilidade ambiental (medido pelo TESI), apesar de, na maioria dos casos, a análise quantitativa não ter permitido comprovar várias hipóteses (potencialmente devido à composição da amostra), os resultados do estudo permitiram obter informações valiosas, nomeadamente a importância dos valores familiares e do envolvimento dos stakeholders na promoção da sustentabilidade ambiental.

Os resultados deste estudo são considerados relevantes para os profissionais do sector T/A e responsáveis políticos e oferecem um contributo adicional para a compreensão da interação entre as características das FF e a sustentabilidade ambiental, salientando a complexidade desta relação e a necessidade de prosseguir a investigação.

Palavras-Chave: sustentabilidade, indústria têxtil e de vestuário, empresas familiares, ambiente, determinantes da sustentabilidade, stakeholders, desenvolvimento sustentável.

General Index

Acknowledgments	iii
Abstract.....	v
Resumo	vii
General Index.....	ix
Tables' Index.....	xii
Figures' Index.....	xiv
Nomenclature.....	xv
CHAPTER 1. Introduction	1
CHAPTER 2. Literature Review.....	2
2. Environmental sustainability	9
2.1 Environmental Sustainability concept and measurement.....	9
2.2 Environmental Sustainability in the Textile Industry	10
2.2.1. T/A industry supply chain and sustainable issues.....	10
2.2.2. Sustainable practices across the T/A industry supply chain.....	13
2.3 Environmental Sustainability in T/A Family Firms	18
2.3.1. Drivers of environmental sustainability in family-owned T/A businesses: theoretical framework	19
2.3.2. Drivers of environmental sustainability in family-owned T/A businesses: research hypotheses.....	20
CHAPTER 3. Research Methodology	9
3.1 Methodology for the Development of the TESI Index	25

3.1.1. Index design.....	25
3.1.2. Sample and data collection	32
3.1.3. Characterisation of the Sample	35
3.2 Methodology for the research of FF characteristics impacting the TESI level.....	37
3.2.1. Sample and data collection	38
3.2.2. Descriptive Statistics and Characterisation of the Sample.....	42
CHAPTER 4. Main findings and results' discussion	25
4.1. Environmental Sustainability Index (TESI).....	49
4.1.1. Perceptions and validation of the TESI	50
4.2. Drivers of environmental sustainability in family-owned businesses: hypothesis testing	52
• H1: The sustainability level of a FF depends positively on having a family member as CEO.....	53
• H2: The sustainability level of a FF depends positively on the share of the company owned by the family.	56
• H3: The sustainability level of a FF depends positively on the percentage of family members on the Board.	59
• H4: The sustainability level of a FF depends positively on having a family member as the chairperson of the board of directors.	62
• H5: The sustainability level of a FF depends positively on the number of family members working in the company.....	64
• H6: The sustainability level of a FF depends positively on the wish to preserve the company in the family throughout the generations.....	67
• H7: The sustainability level of a FF depends positively on the correlation between the company and family's reputations (the family's name is also the company's one).70	
CHAPTER 5. Conclusion.....	47

CHAPTER 6. References	73
Appendix 1 - Survey.....	86
Appendix 2 – Interview Script.....	99

Tables' Index

Table 1: List of sustainability indicators and indexes	10
Table 2: The T/A supply chain	11
Table 3: Key issues throughout the T/A supply chain	13
Table 4: sustainability practices (summary).....	16
Table 5: Previous studies on sustainability measurement and used criteria	26
Table 6: TESI - Commitment, Policy and Transparency	28
Table 7: Sustainability Index - Emissions	29
Table 8: TESI - Chemicals, Water and Microfibre Pollution.....	29
Table 9: TESI - Materials	30
Table 10: TESI - Waste.....	31
Table 11: TESI – Monitoring	32
Table 12: Rules applied in the conversion in one single scale of the collected answers	34
Table 13: TESI - qualitative analysis: coding system.....	35
Table 14: Segment distribution of the sample	35
Table 15: Selected studies on the factors influencing the investment in sustainability	37
Table 16: Hypotheses and rules applied in the conversion in one single scale of the collected answers	39
Table 17: Non-parametric tests used to test the hypothesis	40
Table 18: Qualitative analysis - coding system	40
Table 19: Sample characterisation and descriptive statistics: CEO is a family member	42
Table 20: Sample characterisation and descriptive statistics: Share of the company owned by the family	43
Table 21: Sample characterisation and descriptive statistics: Board ownership by family members.....	43

Table 22: Sample characterisation and descriptive statistics: Chairperson is a family member	44
Table 23: Sample characterisation and descriptive statistics: Intention to pass on the business to the next generation	44
Table 24: Sample characterisation and descriptive statistics: Family and company share the same name	45
Table 25: Sample characterisation and descriptive statistics: Proportion of employee family members in the total number of the company's employees.....	46
Table 26: Calculating the ESI for the Company AK.....	49
Table 27: Test of Normality.....	52
Table 28: H1 - Mann-Whitney Test.....	53
Table 29: Content Analysis - Perception of H1 (reasons for agreeing).....	54
Table 30: Content Analysis - Perception of H1 (reasons for disagreeing).....	55
Table 31: H2 - Pearson Correlation.....	57
Table 32: Content Analysis - Perception of H2 (reasons for agreeing).....	58
Table 33: Content Analysis - Perception of H2 (reasons for disagreeing).....	59
Table 34: H3 - Pearson Correlation.....	60
Table 35: Content Analysis - Perception of H3 (reasons for disagreeing).....	61
Table 36: H4 - Mann-Whitney Test.....	62
Table 37: H5 - Pearson Correlation.....	64
Table 38: Conventional Approach to Interpreting a Correlation Coefficient	65
Table 39: H6 - Mann-Whitney Test.....	68
Table 40: Content Analysis - Perception of H6 (reasons for agreeing).....	69
Table 41: H7 - Mann-Whitney Test.....	70

Figures' Index

Figure 1: Circular process in the textile industry.....	14
Figure 2: Hypothesis of the study	37

Nomenclature

T/A – Textile and Apparel

FF – Family Firm(s)

TESI –Environmental Sustainability Index for the textile and apparel industry

ATP – Portuguese Textile and Apparel Association

CE – Circular Economy

CSR – Corporate Social Responsibility

NA – Not Applicable

CMIA – Cotton made in Africa

BCI – Better Cotton Initiative

RSL – Restricted Substance List

MRSL – Manufacturing Restricted Substances List

CHAPTER 1. Introduction

Sustainability has become “the cornerstone” of our time. Recent events have caught society’s attention on this issue – floods, droughts, heat waves and huge storms haunt people every day, all over the world. Simultaneously, the temperatures of both the atmosphere and oceans are rising, and water pollution has been responsible for the deterioration of the environment and even human lives (Adejumoke *et al.*, 2018; Sabater *et al.*, 2023).

The need to opt for sustainable development seems to be, therefore, imperative. Heinberg (2010) mentions the word “sustainable” is used to merely refer to practices which are considered more environmentally concerned than others. Other authors describe sustainability as the ability to preserve and maintain a process continuously (Heinberg, 2010; Mollenkamp, 2022), meaning that an unsustainable society may easily perish. According to the World Commission on Environment and Development, sustainable development can be defined as the process of ensuring society’s future welfare while meeting its current needs (Commission on Environment, 1987). Mollenkamp (2022) and Sreitzer *et al.* (2012) suggest that sustainable development aggregates a triple bottom line of environmental, economic and social performance and includes all stakeholders regardless time and space.

Environmental is one of the most researched pillars of sustainability (Purvis *et al.*, 2019). Goodland (1995) mentions that environmental sustainability (ES) aims the global protection of all systems impacting human life’s prevalence, by targeting the maintenance of the resources and the discouraging its overuse. Besides aiming the regeneration of the environment (Morelli, 2011) it is also related to ensuring human continuity (Goodland, 1995). However, the reality is that most production systems around the world are leading to the depletion and degradation of the so called “natural capital” – soil, waters, biodiversity, among others (Goodland, 1995). Nevertheless, increasing pressures from a wide range of stakeholders are leading companies to behave responsibly, ensuring greater transparency about their operations and, above all, their supply chain (M. Li & Zhao, 2021; Yadav *et al.*, 2018). Thus, many companies have adopted several sustainability practices, communicating their efforts and improvements to the public, as well as control their supply chain, for example by setting codes of conduct and audits to monitor suppliers’ sustainability performance (M. Li & Zhao, 2021).

Industry wise, the T/A is one of the most relevant industries to blame, regarding environmental sustainability threats. Choudhury (2014) considers this industry as one of the most polluting worldwide. Costa *et al.* (2020) mention its enormous ecological footprint,

since the T/A industry consumes high quantities of chemicals, water and energy, throughout its supply chain. These same authors raise awareness to the fact that about 20% of the water's contamination derives from textile treatments and that greenhouse gases' emissions are a constant throughout the industry's supply chain, something exacerbated by the fast fashion concept.

A considerable number of studies have explored sustainability related issues as well as the drivers that motivate such implementations. However, only a few are dedicated to the T/A industry and most provide fragmented focus on specific parts of the supply chain. In addition, no evidence seems to exist on sustainability practices and its drivers on T/A businesses. Our research aims to address those gaps.

Based on extensive literature review, we developed a T/A Environmental Sustainability Index (TESI), to measure the maturity of environmental sustainable practices in companies of the T/A industry. To ensure its validity, the TESI was firstly tested through a survey, run in the T/A companies from the North of Portugal and validated through semi-structured interviews with some of their representatives.

Manuel Serrão, Executive President of *Associação Selectiva ModaPortugal* considers Portugal as “the most trusted producer of sustainable T/A” worldwide (Brands Eco, 2022).

In Portugal, T/A is regarded as one of the oldest and most traditional industries (Direção-Geral das Atividades Económicas, 2018; Martins Da Silva, 2013), with significant impact on the economy, representing around 10% of the country's total exports (ATP, 2020). Among other causes, this industry's successfulness is due to the concentration of the entire value chain, organised in cluster, the access to innovation and knowledge centers, as well as to advanced technologies and equipment, not to mention the prestigious design and quality, associated with speed and flexibility in production (Direção-Geral das Atividades Económicas, 2018; Martins Da Silva, 2013). Although being mostly composed of microenterprises (60,65%), the small and medium-sized ones employ most people (76,82%) and contribute the most for the T/A industry's sales (74,2%) (Banco de Portugal, 2022). In Portugal, most T/A companies (86,39%) are located in the North region, especially in the districts of Porto and Braga (Banco de Portugal, 2022), hence companies of this region were selected as sample.

Given the family-owned profile of 84% of the companies that participated in the TESI

development survey, and based on the Stakeholder and Socioemotional Wealth theories, we then investigated the possible relationship between FF characteristics and its environmental sustainability level (measured by TESI), both through the application of a survey and semi-structured interviews, to the same companies.

Following Allouche *et al.* (2008) (*apud* Cho *et al.*, 2017), we considered a family business, a business in which at least one family significantly influences the company's decisions through ownership of its capital, and desire to transmit the business to the next generation, bearing in mind the importance of the business for the interests and objectives of the family.

Our study examines environmental sustainability in two specific and under-researched topics: T/A and family-owned companies.

Concerning the TESI, it was considered interesting and useful by the enquired companies, so we expect it may be useful for wider T/A companies' application. In what concerns the relationship between FF characteristics and the level of environmental sustainability (as measured by the TESI), even though, in most cases, the quantitative analysis did not provide significant support to prove several hypotheses (potentially due to sample composition), the results of the study offered valuable insights, namely the importance of family values and stakeholder engagement in driving sustainability. The study is organized as follows.

In the first chapter – Introduction, we provide the context in which the study takes place.

In the second chapter - Literature Review, we analyse existing literature and develop the research hypotheses. For a better presentation of the topics, we divided it into several subchapters. The first subchapter introduces the concept of environmental sustainability and its measurement. The second subchapter dives into environmental sustainability in the T/A industry, its issues, and sustainable practices. The third and last subchapter addresses environmental sustainability in family-owned companies, as well as the drivers of environmental sustainability in T/A FF.

The third chapter focuses on the methodology.

In the fourth chapter we present the main findings, confronting them with previous similar studies, addressed in the literature review chapter.

The fifth chapter presents the major conclusions of the study.

CHAPTER 2. Literature Review

2. Environmental sustainability

In the present chapter we present a literature review on environmental sustainability regarding the main concepts and measurement frameworks, as well as environmental sustainability issues related to the T/A industry's value chain, and the practices capable of minimising this industry's footprint.

2.1 Environmental Sustainability concept and measurement

The concept of sustainable development aims the maintenance of the long-term stability of ecological systems, bearing in mind the economic and social solidity (Beekaroo *et al.*, 2019). Sustainable development, however, are two words with an interestingly opposite meaning. Whilst sustainable means to maintain something within the limits, development is the concept of pursuing continuous growth. However contradictory it may seem, literature defends that sustained development brings on economic growth, as well as technology and certain behaviours capable of facing environmental issues, which may need to be dealt with (Beekaroo *et al.*, 2019).

In this context, literature raises awareness to the hazardous footprint of human activities in the environment, which are responsible for the degradation of the planet (Beekaroo *et al.*, 2019) and calls for the development of actions to minimize this impact. Environmental sustainability has become part of our everyday life, being regarded as a matter of primary importance.

Considering this situation, the measurement of environmental sustainability of a company is essential. Decision making on environmental sustainability depends on several indicators which may include sustainability practices and behaviours that contribute to the achievement of a better environmental performance (Beekaroo *et al.*, 2019). These indicators allow a more holistic approach, as they help understanding environmental issues surrounding production, target goals and monitor the company's progress towards sustainability. Table 1 compiles a list of the indicators and indexes, which according to Beekaroo *et al.* (2019) are most widely quoted.

Table 1: List of sustainability indicators and indexes

No	Indicator set	Components
1	Global Report Initiative (GRI)	70 indicators
2	Dow Jones Sustainability Index (DJSI)	12 criteria based single indicator
3	2005 Environmental Sustainability Indicators	76 building blocks
4	2006 Environment Performance Indicators	19 Indicators
5	United Nations Committee on Sustainable Development Indicators	50 indicators
6	OECD Core indicators	46 indicators
7	Indicator database	409 indicators
8	Ford Product Sustainability Index	8 indicators
9	ISO 14031 environmental performance evaluation	155 example indicators
10	Walmart Sustainability Product Index	15 questions
11	Environmental Indicators for European Union	60 indicators
12	Science and Technology Indicators	13 indicators

Source Beekaroo et al., 2019, pp.3

The combination of various indicators allows the construction of a reliable sustainability index, an important asset to measure a company's environmental sustainability performance (Beekaroo *et al.*, 2019).

Unfortunately, none of the aforementioned indicators focus exclusively on the T/A industry, thus being less specific. This industry's practices and issues regarding environmental sustainability diverge from other manufacturing industries, demanding unique indicators.

2.2 Environmental Sustainability in the Textile Industry

2.2.1. T/A industry supply chain and sustainable issues

The T/A industry has a long and complex supply chain consisting of four main groups: textile production, apparel manufacturing, distribution and sales, and consumption and

disposal. Each of these groups aggregate multiple phases as shown in Table 2 (J. Li & Leonas, 2022).

Table 2: The T/A supply chain

Segment	Coding	Process
Textile production	S1	(1) Fiber production (2) Fiber-to-yarn (3) Yarn-to-fabric (4) Fiber-to-fabric (5) Coloring and finishing (6) Transportation
Apparel manufacturing	S2	(1) Product development (2) Mass garment production (cut and sew) (3) Finishing and packaging (4) Transportation
Distribution and sales	S3	(1) Marketing (2) Transportation (3) Wholesaling and retailing
Product consumption and disposal	S4	(1) Purchase and use (2) Disposal (3) Transportation

Source: J. Li & Leonas (2022), pp. 4

J. Li & Leonas (2022) are of the opinion that the most critical issues across the entire supply chain are: water consumption and pollution, the carbon footprint and solid waste.

- Water consumption and pollution

The authors point out the enormous quantities of water required during the processes of natural fibre cultivation, dyeing, printing and washing. In addition, they enhance the fact that the T/A industry is recognised as the second-largest polluter of water due to the massive usage of hazardous chemicals during these processes. Choudhury (2014) mentions that these chemicals either evaporate, dissolve in the water (discharged to the environment) or remain stuck in the fabric (causing possible health issues). Another current issue lies on the microfibers (<5 mm) that derive from the shredding of T/A products. These plastics are a major marine pollutant with severe environmental consequences.

- Carbon footprint

The T/A industry is the fifth-largest CO₂ emitter, creating around 1.3 billion tons of

CO₂ equivalents, generated through the boiling of fossil fuels, and other chemicals during production (Choudhury, 2014). J. Li & Leonas (2022) also suggest that the problem may originate in the usage of low-efficient energy equipment and on the lack of greenhouse gases offset (i.e. forestation).

- Solid waste

Statistics predict that 92 million tons of textile waste is generated yearly. Modi (2013) divides T/A waste into three major categories:

1. Post-industrial or production waste: which originates from the manufacturing process;
2. Pre-consumer waste: the purposely unsold inferior quality garments; and
3. Post-consumer waste: generated by consumers, when a product achieves its end-of-life stage, either by being worn out, damaged or unwanted.

The authors mention that once disposed and placed in landfills, toxic substances are released into the soil, contaminating all its surroundings. Choudhury (2014) is of the opinion that textile waste should be recycled (if talking of non-renewable resources) or composted (if talking of renewable resources).

Furthermore, single-usage plastic packaging is another big polluter deriving from the T/A industry. Ideally, the choice of packing materials should focus on recycled, eco-friendly and biodegradable products (Choudhury, 2014).

The raw material sourcing is another issue addressed by J. Li & Leonas (2022). Literature divides textile fibres into 3 major categories:

- Natural (for example cotton, linen, hemp or silk);
- Artificial or Man-made (those deriving from the transformation of natural polymers – viscose and lyocell, for example); and
- Synthetic (organic based or petrochemical based, such as polyester and nylon).

Each fibre has its own environmental footprint. For example, cotton fibre sourcing is associated with water consumption and pollution. Its production involves heavy usages of pesticides and fungicides (Chen & Burns, 2006). Notwithstanding, polyester fibre sourcing involves a high carbon footprint, as it originates from non-renewable petroleum resources and is essentially non-biodegradable. In what regards to artificial fibres, Costa *et al.* (2020)

refer that they are mainly produced based on cellulose from various sources and, therefore, its environmental footprint depends on the tree type used for its production.

A summary of the above-mentioned issues is shown in Table 3.

Table 3: Key issues throughout the T/A supply chain

Dimension	Theme	Issue	Coding of issues	Segment ^a
Environmental	Water	Water pollution	Water – pollution	S1
		Water consumption	Water – consumption	S1, 2, 3, 4
	Carbon	Microfiber pollution	Water – microfiber	S1, 4
		Use of ecologically unfriendly energy resource	Carbon – resource	S1, 2, 3, 4
		Heavy energy resource consumption	Carbon – consumption	S1, 2, 3, 4
		Lack of GHG offset (i.e. planting trees)	Carbon – offset	S1, 2, 3, 4
	Waste	Pre-consumer yarns, fabrics, cutoffs, unsold garments	Waste – pre	S1, 2, 3
		Post-consumer discarded garments	Waste – post	S4
		Single-use packaging (i.e. plastics and billboards)	Waste – packaging	S2, 3
	Material	Plant-based natural fibers (cotton, hemp, linen, etc.)	Material – plant	S1
		Animal-based materials (wool, down, leather, etc.)	Material – animal	S1
		Manmade cellulosic fibers (viscose, rayon, lyocell, etc.)	Material – MCF	S1
		Synthetic fibers (polyester, polyamide, etc.)	Material – synthetic	S1
		All the materials mentioned above, unspecified	Material – general	S1

Note: a “segment” is the supply chain segment

Source: J. Li & Leonas (2022), pp. 5

Environmental issues surrounding the T/A industry need to be managed accordingly in order to allow the company to achieve better environmental performance.

2.2.2. Sustainable practices across the T/A industry supply chain

Several behaviours and technologies rise to minimise the impact of human activities on the environment. Literature suggests several practices capable of facing the above-mentioned issues. Costa *et al.* (2020) defend an approach based on the 3R's:

1. **Reduce** clothing consumption, by increasing products' quality and consequently its life-cycle and price;
2. **Reuse** high quality obsolete items; and
3. Incorporate **recycled** fibres and promote recycling strategies, so to reduce waste.

In addition, Warwas *et al.* (2021) enhances the importance of the concept of circular economy (CE), defined as “an industrial system that is restorative or regenerative” (Macarthur, n.d.), extending a product's life cycle to its very limits, diminishing waste rates and triggering the use of non-toxic renewable energies and sustainable raw materials (Macarthur, n.d.; Warwas *et al.*, 2021).

In recent years, upcycling has become one of the leading trends in the circular economy (Figure 1). Modi (2013) defines upcycling as the process of converting waste into new materials, or products of higher quality and environmental significance. The fabric leftovers – the offcuts and end-of-rolls – are considered the major problem (Muthu, 2018). Those could be used to produce new garments (Giordano, 2019) without requiring virgin raw materials, hence reducing the demand for water, energy and chemicals in the production chain (Leal Filho *et al.*, 2019).

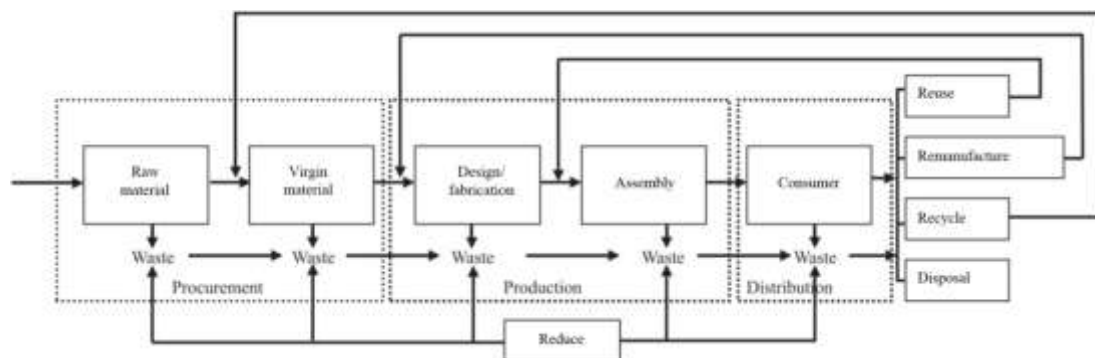


Figure 1: Circular process in the textile industry

Source: Jia *et al.* (2020), pp. 12 (*apud.* Sarkis, 1995)

Lee (2016) also suggests a few other practices contributing towards environmental sustainability:

Alternative Materials

The author is of the opinion that T/A companies should opt for recycled polyester, as it requires around 33–53% less energy, as well as it generates 54.6% fewer CO₂ emissions, when compared to virgin polyester. Commonly used natural fibres could also be replaced by organic ones, what may save up to 90% of water and 60% of energy consumption.

Textile Manufacturing Processes

Bleaching

Eco-friendly bleaching methods have been developed based on hydrogen peroxide, made from oxygen and wastewater treatment. This method reduces significantly the toxic and perilous chemical residuals and water waste.

Additionally, laser technology could be an alternative to traditional bleaching processes, easily changing a material's appearance. Moreover, the authors suggest resorting to ozone bleaching methods, which enables the same effects, by turning to ozone gas instead of chemicals and high quantities of water. This process could be considered as more efficient, given that it saves up to 30 min when compared to traditional chemical methods.

Dyeing and finishing

Once bleached, fabrics are dyed for recolouring. This requires high quantities of hazardous chemicals and water. A viable alternative is the usage of natural dyeing methods, resorting to, for example, wild plants and lichens, or “Air Dyeing”, a dyeing method using air, not water, consuming around 87% less energy, hence diminishing the amount of greenhouse gases emissions.

Printing

Textile printing is the process of creating designated patterns through colour application, resorting to several perilous chemicals and high quantities of water. In alternative, the author suggests digital printing, which allows less material and energy

usage, as well as increased process efficiency, and a longer equipment life span.

Assembling

The finished garment is obtained through the gathering of each component. This includes processes, such as sewing, which may create material wastes. Furthermore, during assembly processes, a significant amount of energy is consumed by the equipment. Therefore, organisations should consider alternatives, such as the zero-waste garment design, an approach which aims the minimisation of fabric scrap. This process is based on the carefully thought assembling of the various components as a puzzle and may reduce millions of tons of fabric waste yearly.

Another interesting solution is the seamless manufacturing, suggested by both Lee (2016) and Costa *et al.* (2020). This technology avoids the weaving, knitting, cutting and sewing steps, saving between 30% to 40% of production time, as well as energy. These technologies are imperative as companies move towards sustainability, given that they consume less energy, produce less waste and allow better efficiency, when compared to conventional machinery.

Complementing the above-stated approaches, J. Li & Leonas (2022) compiled a few sustainable practices for the T/A industry, by analysing significant literature. These were included in Table 4:

Table 4: sustainability practices (summary)

Theme	Issue	Practice
Water	Water - pollution	Chemical management (RSL, MRSL ¹), wastewater treatment, eco-friendly dyes, reduce chemical usage (pretreatment, waterless dyeing)
	Water consumption	Reduce washing times (anti-odor fabric), water reuse, reduce water usage (pretreatment, waterless dyeing), improve efficiency
	Water - microfiber	Bio-polymer coating, biodegradable polyester, washing machine filters, release analysis

¹ MRSL and RSL are terms used to manage restricted substances during the manufacturing process and finished products respectively.

Water/ Chemicals	Bleaching	Hydrogen peroxide bleaching, laser bleaching, ozone bleaching
	Dyeing and finishing	Natural dyeing methods (wild plants and lichens), air dyeing
	Printing	digital printing
Carbon	Carbon - resource	Clean energy (i.e. wind, solar), electric vehicles
	Carbon consumption	Transportation (shipping routes design, order consolidation, ocean replace air freight), improve energy efficiency in buildings (i.e. LED lighting), in wet processing (i.e. reduce washing, dyeing time)
	Carbon - offset	Forestation (plant trees), regenerative agriculture, soil health
Waste	Waste - pre	Circular design (Figure 1); zero-waste garment design; repurpose yarns, offcuts, unsellable garments; recycle; repair; cease burning waste; 3D knitting reduces castoff; reduce unwanted products (customization, big data)
	Waste - post	Circular design, repurpose (redesign, donation), repair, recycle, resale, takeback programs, renting, waste sorting techniques
	Waste - packaging	Recycle, reuse, reduce single-use plastic, re-design packaging (i.e. size modification, alternative materials)
Material	Material - plant	Recycled, organic, BCI ² , CMIA ³ cotton, cotton leads ⁴ , hemp, bamboo
	Material - animal	Recycled, organic, eco-friendly wool, vegan leather, recycled down
	Material - MCF	Not from ancient, endangered forests
	Material - synthetic	Recycled polyester, recycled nylon, biodegradable polyester alternative
	Material - general	Recycled, sustainable materials, new materials (i.e. sugarcane-, algae-based)

Source: own elaboration, based on Costa *et al.* (2020), Lee (2016) and J. Li & Leonas (2022)

² BCI = “Better Cotton Initiative”, aiming the improvement of the agricultural community.

³ CMIA cotton = cotton made in Africa.

⁴ Cotton Leads = program aiming responsible cotton production.

On the whole, the textile industry's sustainability potential, as outlined above, is present throughout the industry's value chain. Of course that the option for sustainability-related practices is very much dependent on several factors, considered by each company individually.

2.3 Environmental Sustainability in T/A Family Firms

FF account for about 65% to 80% of the total number of companies in Europe. Literature enhances their long-term economic stability and their significant commitment to the community and family values that shape corporate decisions and operations. (Curado & Mota, 2021)

Diverging from non-family firms, FF integrate corporate social responsibility (CSR) into their overall strategic approach (López-González *et al.*, 2019). Kraus & Britzelmaier (2012) mentions that CSR refers to the concept where companies take responsibility for their impact on various stakeholders, including environmental sustainability-related topics.

Literature suggests that FF tend to adopt a long-term perspective, emphasizing the alignment of CSR practices with their family values, reputation, and intergenerational goals (López-González *et al.*, 2019). Similarly, Curado & Mota (2021) suggest that FF often have a strong commitment to social and environmental responsibilities, due to their desire to preserve their family legacy and values. The authors suggest that these values guide their decision-making process.

Furthermore, it is suggested that FF are driven by a number of intrinsic factors (Curado & Mota, 2021), which may originate in various stakeholders, aiming the implementation of sustainability initiatives. With this in mind, Bendell (2022) suggests that stakeholder management is of vital role in a firm decision-making process regarding innovation. These relationships are also considered of great influence in what regards the nature and scope of CSR activities undertaken by family firms (López-González *et al.*, 2019).

2.3.1. Drivers of environmental sustainability in family-owned T/A businesses: theoretical framework

We adopt a two lenses framework to understand if FF characteristics impact environmental sustainability in T/A companies, based on the Stakeholder Theory and on the Socioemotional Wealth Theory.

Family Firms and the Stakeholder Theory

Bischoff (2021) suggests that the stakeholder theory is based on the ability of an organisation to satisfy dynamic stakeholder's needs, as well as to afford a positive and lasting relationship with them. Similarly, Curado & Mota (2021) mention that even though the organisation's main purpose is to generate profit for its owners, it must also care for its other stakeholders.

In other words, the stakeholder theory highlights the role of those who have an interest in the firm, as well as the significance of investing in relationship engagement with them (Singh & Mittal, 2019). According to Nguyen & Nguyen (2020), stakeholders include competitors, customers, shareholders, the media, suppliers, employees, managers, local communities, creditors and future generations. The particularity of FF lies on the fact that family members are also to be taken into consideration (despite not owning any shares, they influence management decisions).

Jaffe (2021) is of the opinion that the very nature of the FF goes along with this theory, given that their aim goes way beyond profit maximisation, impacting the construction of positive relations with various stakeholders. It is highlighted that this theory promotes the idea that organisations have an ethical and social responsibility to consider the impact of their actions on stakeholders, hence encouraging the investment in environmental sustainability.

Family Firms and the Socioemotional Wealth (SEW) Theory

Zientara (2017) is of the opinion that FF are characterized by the need to preserve SEW. This theory is based on the fact that owning families are willing to make decisions that are not motivated by an economic logic (Cennamo *et al.*, 2012), resorting to the emotional value of the FF, thus satisfying the family's affective needs, like influence and affinity. Additionally,

Berrone *et al.* (2012) refer that this affective compromise includes the emotional attachment to the company, as well as the appointment of trusted family members to important posts, the preservation of the family identity and reputation, the perpetuation of the family's dynasty, the adoption of family values by the company, which shape organizational culture and so on.

The authors suggest that in theory SEW makes FF more inclined to engage in sustainability-related initiatives, what could be explained by the owning family's inclination for proactive stakeholder engagement, hence meeting the core message of the stakeholder theory.

2.3.2. Drivers of environmental sustainability in family-owned T/A businesses: research hypotheses

Family Member CEO

In view of the aforementioned theories, Curado & Mota (2021) and Duran *et al.* (2016) suggest that the implementation of sustainable practices depends on factors, such as family's values and involvement, firm's culture and the founder's participation in decision-making. Furthermore, Duran *et al.* (2016) also raises awareness to the desire to maintain the family's reputation and legacy, leading FF to a greater commitment to sustainability goals.

Singh & Mittal (2019) mention that the choice of a family CEO and its successor plays a relevant role in the adoption of sustainable practices. Zellweger *et al.* (2012) suggest that family CEOs bring unique qualities and values to the business, such as a long-term perspective, commitment to the family legacy, and a sense of stewardship. The authors refer that a family CEO prioritises goals beyond immediate financial gains, based on the emotional attachment to the company.

Consequently, we state the following hypothesis:

H1: The sustainability level of a FF depends positively on having a family member as CEO.

Ownership Composition

Moreover, Breton-Miller & Miller (2016) suggest that the ownership composition influences the investment in such practices. The authors are of the opinion that the dispersion of

ownership may create conflicting objectives and opinions. Furthermore, Duran *et al.* (2016) are of the opinion that family firms with a higher percentage of family ownership are more likely to engage in environmental sustainability initiatives.

In this context, we propose the hypothesis:

H2: The sustainability level of a FF depends positively on the share of the company owned by the family.

Board Members Composition

In addition, Saeed & Kersten (2019) consider top management responsible for defining the company's vision and policies, hence the consciousness of sustainability topics is essential. Oudah *et al.* (2018) are of the opinion that family firms need excellent management to succeed, especially when composed by multiple generations - several stakeholders and board members are usually genetically related. Chua *et al.* (1999) suggested that by including family members on the board and as its chairperson, a FF enhances its commitment and stewardship, leading to better sustainability practices. The authors mention that family members often have a stronger sense of responsibility towards the long-term success of the firm, due to their emotional attachment and wish to maintain the family's legacy.

As a result, we put forth the following hypotheses:

H3: The sustainability level of a FF depends positively on the percentage of family members in the Board.

H4: The sustainability level of a FF depends positively on having a family member as the chairperson of the board of directors.

Family Members as company's employees

Literature also suggests that it is common to find family members working in the company, leading to an easier and more coherent information sharing and innovation process, guiding companies towards environmental sustainability (Oudah *et al.*, 2018).

In light of this, we present the hypothesis bellow:

H5: The sustainability level of a FF depends positively on the number of family members working in the company.

Generational transition

Breton-Miller & Miller (2016) and Oudah *et al.* (2018) address the family's intention to pass on the business to the next generation, as it may contribute towards the embracing of sustainability. The authors suggest that long-term orientation generates a willingness to invest in the future of the firm through stakeholder engagement. That, in turn, raises the interest in investing in sustainability-related initiatives.

Accordingly, we present the following hypothesis:

H6: The sustainability level of a FF depends positively on the wish to preserve the company in the family throughout the generations.

Interconnection of reputations

Family firms are more embedded in a community and aim maintaining its reputation (both the family's and company's), thus being more likely to invest in sustainability initiatives (Breton-Miller & Miller, 2016). As a result, the disclosure of the sustainability practices and its outcomes are perceived as a "dialogue" between the firm and its stakeholders (Curado & Mota, 2021), as well as a way of ensuring transparency (Tate *et al.*, 2010, *apud* Saeed & Kersten, 2019). Furthermore, T. Zellweger *et al.* (2010) mention that the family's reputation can serve as an important intangible asset for FF, contributing to their environmental sustainable development.

As such, we outline the hypothesis as follows:

H7: The sustainability level of a FF depends positively on the correlation between the company and family's reputations (the family's name is also the company's one).

CHAPTER 3. Research Methodology

In this Chapter we present the methodology adopted for the present research. Given that the study has two parts – i) development of an environmental sustainability maturity measurement instrument for T/A companies and ii) research on the impacts of FF characteristics on the maturity level of T/A FF – the methodology will be presented separately for each part.

3.1 Methodology for the Development of the TESI Index

One goal of this study was to measure the environmental sustainability maturity in the T/A industry. In the literature review we concluded that the T/A industry had many complexities that should be considered when accounting for companies' efforts. One of those complexities was, for instance, that the T/A industry involved a long and complex value chain, many times entailing multiple players. In the index construction we considered the division of the textile value chain suggested by J. Li & Leonas (2022):

- fibre production;
- yarn production;
- Fabric/knit production;
- Fabric/knit colouring and finishing; and
- Cutting, sewing and packaging.

Given the inexistence of an environmental sustainability index specifically applicable to the T/A industry, we developed our own index.

3.1.1. Index design

The index was built based on a thorough literature research on environmental sustainability practices (more detail in CHAPTER 2), as well as in some previous studies, mentioned in Table 5.

Table 5: Previous studies on sustainability measurement and used criteria

Study	Author	Criteria	Sub-criteria	Reference
The Sustainability Gap	BOF	Transparency	Traceability	(BOF - Business of Fashion, 2021)
			Disclosure	
		Emissions	Greenhouse gas emissions	
		Water and Chemicals	Water use	
			Harmful pollution	
			Hazardous chemicals	
			Microfibre pollution	
		Materials	Preferred materials	
			Regenerative agriculture	
			Recycled polyester	
		Workers' Rights	Corporate strategy	
			Purchasing practices	
			Living wages	
		Waste	Waste to landfill, plastic packaging	
			Waste-free production	
			Circular business models	
Green Index	Anabela Goçaves; Carla Silva	Climate impact	Greenhouse gas emissions through production	(Gonçalves & Silva, 2021)
		Chemicals Used	Presence of hazardous substance	
		Resource consumption	Reduced by the use of recycled, organic and renewable materials	

Developing a sustainability index for Mauritian manufacturing companies	Dickcha Beekaroo; Devkumar S. Callychurn; Dinesh Kumar Hurreeram	Environmental indicators	Water Intensity	(Beekaroo <i>et al.</i> , 2019)
			Energy intensity	
			Solid wastes Intensity	
			Emissions into air	
			Wastes water Intensity	
			Use of renewable energy	
			Greenhouse gas emissions	
			Re-used material ratio	
			Land cover (Building area/overall site area)	
			Hazardous material ratio	
			Recyclable material ratio	

Source: own elaboration

With this in mind, the TESI included 6 categories and a total of 30 subcategories/ criteria, so to achieve an holistic approach of environmental sustainability in T/A companies, depending on the segment of the T/A value chain a company belongs to.

The criteria considered in the TESI was organised as it follows:

Category 1: Commitment, Policy and Transparency

BOF - Business of Fashion (2021) regards transparency as the “cornerstone” that enables true and worthwhile commitment to change, establishing accountability. These topics allow stakeholders to assess companies' genuine dedication to sustainability, thus its importance for the index.

“Public disclosure of this [environmental-related] information, which would drive improvements in data quality and create accountability for progress, is still in its

infancy but it is a foundational and urgent area for the industry to address.”

Linda E. Greer, Institute of Public and Environmental Affairs, in BOF - Business of Fashion (2021), pp. 14

The criteria included in this category is shown in Table 6.

Table 6: TESI - Commitment, Policy and Transparency

Category	Code	Criteria	Measure	Question number in the survey
Commitment, Policy and Transparency	C1	The company considers environmental sustainability as one of its strategic pillars.	Yes/ No	1.1
	C2	Environmental sustainability is included in the company’s strategic plan.	Yes/ No	1.2
	C3	The company prepares a stand-alone sustainability report.	Yes/ No	1.3
	C4	The company does supply chain traceability and discloses its suppliers.	Yes/ No	1.4
	C5	The company has an autonomous sustainability department.	Yes/ No	1.5
	C6	The company integrates environmental sustainability-related topics in its code of business conduct.	Yes/ No	1.6
	C30	The company has a sustainability-oriented website tab.	Yes/ No	Not included

Source: own elaboration

Category 2: Emissions

The textile industry has a significant impact on global greenhouse gases emissions, which are commonly generated through the boiling of fossil fuels, and other chemicals throughout production (Choudhury, 2014). In this context, efforts are being made in order to *get aligned* with global goals to limit climate change.

The set of criteria encompassed within this category can be observed in Table 7.

Table 7: Sustainability Index - Emissions

Category	Code	Criteria	Measure	Question number in the survey
Emissions	C7	Approximate percentage of reduction of greenhouse gases emissions in the last 3 years	%	2.1.1
	C8	Approximate amount of investment in technologies with a positive impact on reducing greenhouse gases emissions and other pollutants in the last 3 years (i.e. by investing in LED lighting; by investing in new more efficient equipment; ...)	€	2.1.2

Source: own elaboration

Category 3: Water, Chemicals and Microfibres

The usage of water and chemicals throughout the T/A industry's supply chain may jeopardise ecosystems and global health. In addition, microfibres that escape in the washing process may contaminate water resources. (BOF - Business of Fashion, 2021)

In view of the above, we considered the criteria mentioned in Table 8.

Table 8: TESI - Chemicals, Water and Microfibre Pollution

Category		Criteria	Measure	Question number in the survey
Chemicals	C9	Approximate percentage of reduction of chemical usage during the last 3 years, by resorting to other techniques and methodologies throughout production.	%	2.2.1
Water	C10	Approximate percentage of reduction of the washing times, in the last 3 years.	%	2.2.2
	C11	Approximate percentage of reused water throughout production.	%	2.2.3
	C12	Approximate percentage of reduction of water usage throughout production, in the last 3 years.	%	2.2.4
Microfibre Pollution	C13	Approximate percentage of washing machine with filters.	%	2.2.5
	C14	The company invests in releases analysis.	Yes/ No	2.2.6

	C15	The company practices wastewater treatment.	Yes/ No	2.2.7
	C16	The company actively engages in industry efforts to minimise microfibre pollution.	Yes/ No	2.2.8

Source: own elaboration

Category 4: Materials

The choice of materials is a crucial input towards environmental sustainability. According to BOF - Business of Fashion (2021) polyester and cotton are the most used fibres in the textile industry. The same article refers that improving the raw material's supply chain could be an opportunity, for market purposes as well as sustainability-related ones. Daniela Ibarra-Howell reminds us that:

“Greater education is required to ensure executives and employees understand the impact of their sourcing choices and are empowered to make better decisions for the planet.”

Daniela Ibarra-Howell, CEO and Co-Founder Savory Institute, in BOF - Business of Fashion (2021), pp. 26

Considering the aforementioned information, we grouped the criteria shown in Table 9.

Table 9: TESI - Materials

Category	Code	Criteria	Measure	Question number in the survey
Materials	C17	Approximate percentage of raw materials purchased from environmentally responsible sources	%	2.3.1
	C18	Approximate percentage of reduction of the usage of virgin synthetic fibres (such as polyester, nylon,...) in the last 3 years.	%	2.3.2
	C19	Approximate percentage of usage of recycled/organic/ eco-friendly materials.	%	2.3.3
	C20	The company prefers biodegradable materials.	Yes/ No	2.3.4

	C21	The company uses new materials (i.e. sugarcane-, algae-based).	Yes/ No	2.3.5
	C22	Approximate percentage of recyclable materials used in the packaging.	%	2.3.6
	C23	The company practices upcycling and/or recovers waste and/or overproduction	Yes/ No	2.3.8

Source: own elaboration

Category 5: Waste

A considerable amount of waste is produced due to overconsumption and overproduction. Circularity has been introduced as a viable solution for this topic, however, it could be challenging to implement it.

This reasoning led us to set the criteria as presented in Table 10.

Table 10: TESI - Waste

Category	Code	Criteria	Measure	Question number in the survey
Waste	C24	Level of circularity practices throughout the company's production process.	1-7	2.4.1
	C25	The company practices eco-design.	Yes/ No	2.4.2
	C26	The company practices 3D seamless manufacturing.	Yes/ No	2.4.3
	C27	The company practices waste sorting	Yes/ No	2.4.4

Source: own elaboration

Category 6: Monitoring

Companies are encouraged to measure, manage, and reduce their environmental footprint, improving their long-term resilience and ensuring stakeholders engagement (Avery & Bergsteiner, 2011).

The criteria considered for this category is indicated in Table 11.

Table 11: TESI – Monitoring

Category	Code	Criteria	Measure	Question number in the survey
Monitoring	C28	The company is certified ISO 14001	Yes/ No	3.1
	C29	The company uses metrics to measure the accomplishment of sustainability-related goals	Yes/ No	3.2

Source: own elaboration

Calculating the TESI

The calculation of the index follows a very simple line of thought, as we consider all variables to have the same weight in the total of the index, thus not giving more importance to a certain variable over another. The total score of the index equals the number of applicable criteria, meaning that when the company answers that a specific question does not apply to their productive process (“NA”), that same question is automatically removed from the total score, hence not being considered in the calculation of the index.

In this context, we propose the following formula as to calculate the environmental sustainability level of a T/A company:

$$\text{TESI (\%)} = \frac{\sum_{\alpha=1}^{30} C\alpha}{\text{MAX.APPLICABLE SCORE}} \times 100 \quad (C\alpha^5 \neq \text{NA})$$

3.1.2. Sample and data collection

Portugal has been recognized as a leading T/A manufacturer in Europe (Dugal, 2023) with around 58% of its companies located in Porto and Braga (AEP, 2019). According to the Portuguese T/A Association (ATP), the successfulness of the industry is due to the organisation of the value chain in cluster (ATP, 2020), with each company playing a role in the value chain. ATP is the largest representative organization of the Portuguese T/A sector

⁵ Cα= Criteria 1 to 30

and one of the most important in Europe (ATP, n.d.). ATP was contacted by the research team and showed interest in collaborating with this study. The sample for the TESI testing was then made of T/A ATP associates, located in the districts of Porto and Braga, totalising 499 companies, our population.

With this in mind, primary data was gathered through the application of a survey (Appendix 1 - Survey), applied from the 1st of May, 2023 until the 15th of June, 2023, and sent to all companies integrated in the study's population. A total of 50 answers was achieved, thus our sample being composed of 50 companies, corresponding to 10% of the study's population. The acceptance of this sample was based on previous similar studies, for example the sustainability index developed by Beekaroo *et al.* (2019), who included 30 companies as their sample.

The survey was divided into three main sections:

1. the first section, with questions about the company, allowing us to distinguish it based on the position occupied in the value chain, as well as the ownership composition (crucial for the second part of the research);
2. the second section regarded TESI, focusing on environmental sustainability-related initiatives and behaviours that take place in each company, following the aforementioned categories; and
3. the third section, respecting the second part of the research, which will be discussed shortly.

In the survey we resorted to nominal scale questions, 7-Point Likert scale questions, rating scale questions, targeting a percentage, and open-end questions, where the inquired would insert a number, which could vary greatly depending on the company.

Complementing the information collected we resorted to SABI database to access the operating turnover of all respondents.

We, then, standardised all answers into one single scale, following the rules shown in Table 12.

Table 12: Rules applied in the conversion in one single scale of the collected answers

Question Type	Possible Answers	Conversion
Nominal	Yes/ No/NA	Yes= 1
		No= 0
		NA= missing value
7-Point Likert scale	1. Null	$N^{\circ}(1-7)/7$, totalising a number between 0 and 1
	2. Very Low	
	3. Low	
	4. Medium	
	5. High	
	6. Very High	
	7. Total	
Rating Scale	% / NA	%/100, totalising a number between 0 and 1
		NA= missing value
Open-end questions	Amount (€)	Proportion Amount/Operating Turnover, totalising a number between 0 and 1

Source: own elaboration

Once the index was calculated the results were sent to the inquired companies, as well as the calculation framework.

In order to confirm the viability of the TESI we resorted to semi-structured interviews, following a script (Appendix 2 – Interview Script). For this part of the study our sample was composed of 11 companies, the ones which demonstrated interest in continuing the study after the survey's application. To ensure the anonymity of the companies, an alphabetical code was assigned to identify each one of them. In this context, the qualitative analysis included the companies corresponding to the codes: AC, AF, AI, AK, AQ, O, R, T, U, V, Z.

All interviews were recorded, transcribed for analysis and codified using the software MAXQDA 2022, a procedure debated with Professor Rui Brites in a training session in which we took place.

We codified the 11 interviews following the coding system available in Table 13. This coding system was constructed based on a prior analysis of all interviews' content.

Table 13: TESI - qualitative analysis: coding system

Code System	Frequency
No indicator to add	10
Quality in the index construction	3
Future Adequacy	1
Validation/ Holistic Approach	11
Future Research	3

Source: own elaboration

3.1.3. Characterisation of the Sample

Our main sample is composed of 50 T/A companies, all associates of ATP. From those companies, 26% are based in the district of Porto and 74% in the district of Braga.

In accordance with what was previously stated regarding the complexity of the textile value chain, the sample shows the variety of companies targeting one or more segments. According to Table 14, the majority of the sample is composed of companies specialised in the segments: fabric/knit colouring and finishing, and cutting, sewing and packaging.

Table 14: Segment distribution of the sample

Segment	Frequency	%	Cumulative %
Fabric/knit colouring and finishing	11	22	22
Fabric/knit colouring and finishing; Cutting, sewing and packaging	2	4	26
Cutting, sewing and packaging	17	34	60
Fibre production	1	2	62
Yarn production	2	4	66
Yarn production; Cutting, sewing and packaging	1	2	68
Yarn production; Fabric/knit production; Fabric/knit colouring and finishing; Cutting, sewing and packaging	2	4	72
Fabric/knit production	3	6	78
Fabric/knit production; Fabric/knit colouring and finishing	2	4	82

Fabric/knit production; Fabric/knit colouring and finishing; Cutting, sewing and packaging	5	10	92
Fabric/knit production; Cutting, sewing and packaging	4	8	100
Total	50	100	

Source: own elaboration

In what regards to their nature, 84% of the sample (42 companies) is composed of FF, whereas 16% is composed of non-family firms.

3.2 Methodology for the research of FF characteristics impacting the TESI level

As a second goal of this research, we investigated if FF specific characteristics contributed towards the investment in sustainability-related initiatives, hence increasing the level of the environmental sustainability maturity, measured by the TESI.

The literature review resulted in a set of hypotheses, explained in the previous chapter, and summarised in Figure 2.

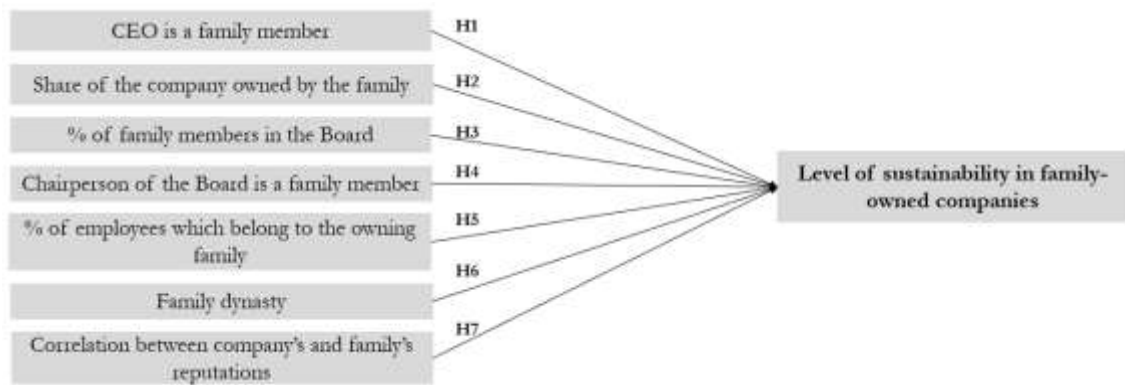


Figure 2: Hypothesis of the study

Source: own elaboration

The investigation was done resorting to both quantitative and qualitative research approaches, resorting to statistical tests, based on data collected on a survey and content analysis from conducted interviews, decision based on previous similar studies (Table 15).

Table 15: Selected studies on the factors influencing the investment in sustainability

Title	Authors	Country	Methodology	Source
Factors Influencing Green Performance in Manufacturing Industries	H. Rashid, S. Zobair, J. Shadek, A. Hoque, A. Ahmad	Bangladesh	Quantitative (Survey)	H. Rashid <i>et al.</i> (2019)
What drives environmental sustainability in the New Zealand wine industry? An examination of driving factors and practices	R. Dodds, S. Graci, S. Ko, L. Walker	New Zealand	Quantitative (Survey) + Qualitative (interviews)	Dodds <i>et al.</i> (2013)

Drivers of environmental processes and their impact on performance: a study of Turkish SMEs	Y. Agan, M. Acarb, A. Borodin	Turkey	Quantitative (Survey)	Agan <i>et al.</i> (2013)
Supply chain drivers that foster the development of green initiatives in an emerging economy	C. Hsu, K. Tan, S. Zailani, V. Jayaraman	Malasya	Quantitative (Survey)	Hsu <i>et al.</i> (2013)
Drivers for the Adoption of Sustainable Manufacturing Practices: A Malaysia Perspective	S. Rashid, N. Sakundarini, R. Ariffin, T. Ramayah	Malasya	Quantitative (Survey)	Abdul-Rashid <i>et al.</i> (2017)
Developing a sustainability index for Mauritian manufacturing companies	Dickcha Beekaroo, Devkumar S. Callychurn, Dinesh Kumar Hurreeram	Mauritius	Quantitative (survey) Qualitative (interviews)	(Beekaroo <i>et al.</i> , 2019)

Source: own elaboration

3.2.1. Sample and data collection

Quantitative Analysis

Studies suggests that most of the T/A companies located in the districts of Porto and Braga are family owned (AEP, 2019), information which was confirmed by ATP. This characteristic is also clear in the distribution of the sample, which, as previously stated, is mostly composed of FF (84%). In this context, our sample for this part of the research included the 42 FF enquired.

Taking into account the already known family-owned profile of T/A companies located in the North of Portugal (AEP, 2019), the survey (presented in the methodology subchapter about the TESI) integrated a section regarding FF characteristics (Table 16) which drive companies to invest in environmental sustainability-related practices. This part of the survey was reserved only for FF respondents.

Complementing the information collected we used SABI database to access the total number of employees of all respondents.

To measure the criteria, we followed a similar approach as to the one of the Index. A summary is shown in Table 16.

Table 16: Hypotheses and rules applied in the conversion in one single scale of the collected answers

	FF characteristics	Possible Answer	Conversion
H1	CEO is a family member.	Yes/ No	Yes= 1
			No= 0
H2	Percentage of the company owned by the family.	%	% / 100, totalising a number between 0 and 1
H3	Percentage of the family members in the board.	%	
H4	Chairperson is a family member.	Yes/ No	Yes= 1
			No= 0
H5	Number of family members working in the company.	Number of family members as employees	Proportion No. family employees / Total N° Employees, totalising a number between 0 and 1
H6	The family intends to pass on the business to the following generation.	Yes/ No	Yes= 1
H7	The company and family share the same name (reputation)		No= 0

Source: own elaboration

The statistical analysis was performed using IBM SPSS Statistics for Windows v. 27 (IBM Corp., Armonk., N.Y., USA), for $\alpha = 0.05$. In all tests we considered the TESI as the dependent variable.

In order to test the hypothesis quantitatively, given the small sample size, we used the non-parametric tests shown in Table 17. (Marôco, 2021)

Table 17: Non-parametric tests used to test the hypothesis

Test Applied	When	Hypothesis
Mann-Whitney U Test	We measured a continuous level variable in two groups (Yes/ No), in order to test if the distribution of this variable is different depending on the group. (Pereira, n.d. & Marôco, 2021)	H1; H4; H6; H7
Pearson Correlation	Faced with 2 continuous variables. (Schober <i>et al.</i> , 2018 & Marôco, 2021)	H2; H3; H5

Source: own elaboration

Qualitative Analysis

In order to further our investigation in what regards to the research hypothesis we resorted to semi-structured interviews, following a script (Appendix 2 – Interview Script) of open-end questions.

As previously mentioned, the qualitative analysis sample was composed of 11 companies, the ones which demonstrated interest in continuing the study. All these companies respect FF, hence the sample considering 26% of the total of FF inquired (42 FF). All interviews were recorded, transcribed for analysis and codified using MAXQDA 2022. To ensure the anonymity of the companies, the alphabetical code previously mentioned was assigned.

By suggestion of Professor Rui Brites, we codified the 11 interviews following the coding system available in Table 18. This coding system was built based on the literature review, more specifically regarding the Stakeholder and Socioemotional Wealth Theories. Subcodes were created when a company would raise a topic, which could be included in one of the two theories.

Table 18: Qualitative analysis - coding system

Code System	Frequency
Code System	192
The adoption of the family name influences the ESI	
No	4
Stakeholder's needs (clients) & Strategy	4
Yes	7

Reputation	8
The wish to preserve the company in the family influences ESI	
No	2
Stakeholder's needs & Strategy	2
Clients	1
Yes	9
Stakeholder's needs & strategy	3
Perpetuation & preservation of family identity	10
No. family members working in the company influences ESI	
No	9
Firms' culture/ employees' alignment	9
Yes	2
Easier and coherent information sharing	5
Chairperson as family member influences ESI	
No	2
Stakeholder's needs and Strategy	2
Shareholder: Generate Profit	2
Yes	9
Family Values	9
% family member in the board influences ESI	
No	4
Firm's culture/ Employees' alignment	2
Stakeholder's needs and Strategy	2
Shareholder: Generate Profit	2
Yes	7
Family Values	7
CEO being a family member influences ESI	
No	4
Firm's culture	1
Stakeholder's needs and Strategy	3
Clients	1
Shareholder: Generate profit	3
Yes	7
Stakeholder's needs & Strategy	2
Shareholders: Generate Profit	1
Clients	1
Family Values	9
% company owned by the family influences ESI	
No	2
Stakeholder's needs & Strategy	2
Clients	1

Shareholders: Generate Profit	1
Firm's culture	1
Yes	9
Stakeholder's needs & Strategy	7
Family Values	14

Source: own elaboration (resorting to MAXQDA)

3.2.2. Descriptive Statistics and Characterisation of the Sample

Our sample included 42 FF, in most cases, with very similar characteristics, as suggested below.

Most of the following tables indicate a relatively small standard deviation suggesting a consistent pattern in FF's characteristics across this study's sample. The mode and median values further support this finding. Sample heterogeneity is only noticeable in what regards the company's chosen name and the proportion of family members working in the company. In these cases, the standard deviation suggests a moderate degree of variability in the sample.

Among the 42 FF, 88.1% refer that the CEO is a family member (Table 19).

Table 19: Sample characterisation and descriptive statistics: CEO is a family member

Variables		Frequency	%	Cumulative %
CEO is a family member	Yes	37	88.1	88.1
	No	5	11.9	100
	TOTAL	42	100	
Descriptive statistics	σ	0.32777		
	Mode	Yes		
	Median	Yes		

Source: own elaboration

Similarly, 92.9% of the FF inquired mention that the owning family holds 100% of the company's capital (Table 20).

Table 20: Sample characterisation and descriptive statistics: Share of the company owned by the family

Variables		Frequency	%	Cumulative %
Share of the company owned by the family (%)	65%	1	2.4	2.4
	90%	2	4.8	7.1
	100%	39	92.9	100
	TOTAL	42	100	
Descriptive statistics	σ	0.05745		
	Mode	100%		
	Median	100%		

Source: own elaboration

In what regards to the percentage of board seats held by family members, 71.4% refer that those are all held by a member of the owning family (Table 21).

Table 21: Sample characterisation and descriptive statistics: Board ownership by family members

Variables		Frequency	%	Cumulative %
Board ownership by family members (%)	2%	1	2.4	2.4
	20%	1	2.4	4.8
	30%	1	2.4	7.1
	33%	2	4.8	11.9
	50%	1	2.4	14.3
	60%	1	2.4	16.7
	67%	1	2.4	19
	75%	1	2.4	21.4
	90%	2	4.8	26.2
	95%	1	2.4	28.6
	100%	30	71.4	100
	TOTAL	42	100	
Descriptive statistics	σ	0.26405		
	Mode	100%		
	Median	100%		

Source: own elaboration

In 97.6% of the FF included in the study the Chairperson of the board is a family member (Table 22).

Table 22: Sample characterisation and descriptive statistics: Chairperson is a family member

Variables		Frequency	%	Cumulative %
Chairperson is a family member	Yes	41	97.6	97.6
	No	1	2.4	100
	TOTAL	42	100	
Descriptive statistics	σ	0.1543		
	Mode	Yes		
	Median	Yes		

Source: own elaboration

In what regards the future, the majority of FF inquired (92.9%) shares the intention of passing the business on to the next generation of the family (Table 23).

Table 23: Sample characterisation and descriptive statistics: Intention to pass on the business to the next generation

Variables		Frequency	%	Cumulative %
Intention to pass on the business to the next generation	Yes	39	92.9	92.9
	No	3	7.1	100
	TOTAL	42	100	
Descriptive statistics	σ	0.26066		
	Mode	Yes		
	Median	Yes		

Source: own elaboration

Concerning the correlation established between the company's and family's reputations, by sharing the same name, the collected data is more heterogeneous – 42.9% of the FF inquired share the family name, whereas 57.1% have a different name (Table 24).

Table 24: Sample characterisation and descriptive statistics: Family and company share the same name

Variables		Frequency	%	Cumulative %
Family and company share the same name	Yes	18	42.9	42.9
	No	24	57.1	100
	TOTAL	42	100	
Descriptive statistics	σ	0.501		
	Mode	No		
	Median	No		

Source: own elaboration

In what regards the number of family members working in the company, we highlight the need to analyse this numbers bearing in mind the total number of employees, so that the company size does not defraud our conclusions.

In this context we calculated the proportion of employee family members, in the total number of employees, using these values for our analysis. The standard deviation indicates some variability in the distribution of the proportions. The majority of companies have relatively low proportions, such as 1%, 2%, or 3%, of family members among the total employees. However, there are also instances where the proportion is higher, reaching up to 33%. This data is shown in Table 25.

Table 25: Sample characterisation and descriptive statistics: Proportion of employee family members in the total number of the company's employees

Variables		Frequency	%	Cumulative %
Proportion of employee family members in the total number of the company's employees	0.0%	1	0.02	2.0
	1.0%	8	0.19	21
	2%	2	0.05	26
	3%	5	0.12	38
	4%	3	0.07	45
	5%	6	0.14	60
	6%	2	0.05	64
	7%	1	0.02	67
	8%	2	0.05	71
	9%	4	0.10	81
	12%	1	0.02	83
	14%	1	0.02	86
	15%	2	0.05	90
	16%	1	0.02	93
	21%	1	0.02	95
	25%	1	0.02	98
	33%	1	0.02	100
	Total	42	1.0	
Descriptive statistics	σ	0.07126		
	Mode	multiple modes exist		
	Median	0.0474		
	Mean	0.069		

Source: own elaboration

CHAPTER 4. Main findings and results' discussion

4.1. Environmental Sustainability Index (TESI)

The TESI was developed in order to determine the level of maturity of environmental sustainability in a T/A company.

In line with what was explained in the methodology chapter, the following TESI calculation formula was proposed and applied:

$$\text{TESI (\%)} = \frac{\sum_{\alpha=1}^{30} C\alpha}{\text{MAX.APLICABLE SCORE}} \times 100 \quad (C\alpha^6 \neq \text{NA})$$

An example of the calculation of the TESI is shown in Table 26.

Table 26: Calculating the ESI for the Company AK

Company: AK			
C1	1	C16	1
C2	1	C17	0.72
C3	1	C18	0.36
C4	1	C19	0.4
C5	1	C20	0
C6	1	C21	0
C7	0.36	C22	1
C8	0.05	C23	1
C9	0.08	C24	0.43
C10	0	C25	0
C11	0.52	C26	NA
C12	0.13	C27	1
C13	1	C28	1
C14	1	C29	1
C15	1	C30	0
MAX. APLIC			29
INDEX (Σ)			19.05
INDEX (%)			65.68 ⁶ %

Source: own elaboration

⁶ C α = Criteria 1 to 30

4.1.1. Perceptions and validation of the TESI

International literature points out that environmental sustainability indicators allow a holistic overview of sustainability-related topics in a company (Beekaroo *et al.*, 2019). In this context, once the index was constructed it was shared with the companies who demonstrated interest in continuing the study. Company's interviewees were asked about their view over the TESI, and also about possible additional criteria that could have been considered for the analysis but was not included in the index.

All interviewees agreed that the TESI provided a holistic overview of sustainability-related practices and behaviours implemented in a company and all validated the index. Furthermore, 91% of the companies clearly mentioned that there was no other indicator that could be added to the index. Just like other companies, AK states:

"I think you have a good set of indicators here. It's very well thought out and it's able to give a general idea of the companies' maturity regarding this topic."

Company O also shares this opinion:

"I was impressed with the fact that you managed to group so many indicators and so many aspects of the textile processes. The index is very well built."

Additionally, companies also mention agreeing with the percentage given by the TESI. For example, company R refers:

"I think it's already quite complete. I think it shows the company's level of sustainability in a holistic way and I agree with the percentage you mentioned."

In what regards to the quality in the index construction, 27% of the interviewees clearly mention agreeing with the calculation methods. For example, company AI mentions:

"I think you got a good result. What you showed me makes sense and the calculation method is correct."

Looking ahead, company T refers the need of keeping up with science in this field, as to continuously updating the index, ensuring its future adequacy:

"If you intend to disseminate it [the ESI] and allow its public use, you must constantly be aware of science in the textile industry."

There were, however, 2 companies who mentioned that could be of some importance to include social and economic sustainability-related indicators, as to provide an entire overview of the concept of sustainability in a company. For example, company T refers:

“I think it would also be interesting to consider the other 2 pillars of sustainability. I don’t know if you thought about it, but nowadays we also talk a lot about the social aspect, more specifically about respect for human rights.”

Following this line of thought, company AK also mentions:

“Nowadays, the social aspect is very important, not to mention the economic aspect, because everything we do in a company has to be profitable.”

This is an important subject for future investigation.

In summary, the interviews we conducted yielded great relevance to our contribution to T/A companies. Interviewees mentioned that the index is relevant, is well constructed and does not need any other indicators, highlighting its holistic character. With this feedback we considered the TESI validated and proceeded our study.

4.2. Drivers of environmental sustainability in family-owned businesses: hypothesis testing

As previously mentioned, after applying the TESI among ATP's associates, we realised that 84% of the respondents were family-owned, what is in line with previous studies (AEP, 2019). To further understand those company's practices, based on the research hypothesis, we resorted to statistical tests and content analysis from conducted interviews, thus testing those hypotheses.

Quantitative Analysis

With this in mind, even though we opted for non-parametric tests, we started by testing whether the TESI followed a normal distribution. In accordance with Marôco (2021), we used the Shapiro-Wilk test, given the small sample size (42FF), concluding that this variable followed a normal distribution ($p\text{-value: } 0.101 > 0.05$) (Table 27).

Table 27: Test of Normality

	Shapiro-Wilk		
	Statistic	df	Sig.
TESI (%)	0.961	50	0.101

Source: own elaboration (resorting to SPSS)

This approach strengthens the robustness and reliability of our findings, as it allows us to confidently apply any type of tests and compare their results (Marôco, 2021).

Qualitative Analysis

Qualitative analysis was then conducted, as to further our investigation, overcoming the limits imposed by sample homogeneity, as discussed in the subchapter “3.2.2. Descriptive Statistics and Characterisation of the Sample”.

As previously mentioned, for this part of the study our sample was composed of 11 companies.

The results of both quantitative and qualitative analysis are shown below.

- **H1: The sustainability level of a FF depends positively on having a family member as CEO.**

Singh & Mittal (2019) suggest that the sustainability level of a FF is influenced by the adoption of a family member as CEO.

Quantitative analysis

In the quantitative analysis, the Mann-Whitney test we conducted indicated that the p-value (0.268) was greater than the significance level (0.05) (Table 28), leading to conclude that there is insufficient evidence to support the research hypothesis that the sustainability level of a family firm (FF) depends positively on having a family member as CEO.

Table 28: H1 - Mann-Whitney Test

CEO is a family member	N	Mean Rank	Sum of Ranks
0	5	27.2	136
1	37	20.73	767
Total	42		

p-value= 0.268

Source: own elaboration (resorting to SPSS)

This could be due to the limited number of FF with non-family CEOs, which could have hindered the ability to compare and identify meaningful differences in the sustainability levels between the two populations. With such a small representation of FF with non-family CEOs, it becomes challenging to draw robust quantitative conclusions about the influence of a family member CEO on sustainability.

Qualitative Analysis

The qualitative analysis, however, indicated relevant perceptions of interviewed FF, regarding the influence of having a family member as CEO on sustainability. 64% of the interviewees agreed that such an influence exists. These companies supported their opinion as stated in Table 29.

Table 29: Content Analysis - Perception of H1 (reasons for agreeing)

Code / Justification		Frequency	For example:
Family Values		9	Company O mentions: <i>"CEO being a member of the family (...) affects a lot because we ensure that our [family] values are applied."</i>
Stakeholder's needs and Strategy	Clients	1	Company AQ mentions: <i>"We work with several companies that demand investment from us in the area of sustainability – it is a requirement to work with these brands."</i>
	Shareholder: Generate profit	1	Company AQ mentions: <i>"The CEO also knows that these investments could increase the company's profit margin by working for these companies and thus generate more income."</i>

Source: own elaboration

In accordance with the literature (Curado & Mota, 2021), the interviewed companies are of the opinion that a CEO belonging to the family ensures the transmission and adoption of the family values by the company, as those are innate to the CEO, fact that is confirmed with the following transcribed opinions:

"The CEO is the management element that, in a way, guarantees the practical application of the interests of the shareholders. If this person belongs to the family, this question does not even apply as his interests are the family's ones".

Company AI

"The CEO has the family values and is, therefore, always concerned with this topic".

Company AC

This goes along with the Socioemotional Wealth Theory, which points out that FF's decisions are mostly based on emotional values, hence appointing trusted family members to important posts, which, in a way, ensures the preservation of the family values, reputation

and perpetuation (Berrone *et al.*, 2012).

Other reasons, related to stakeholder engagement were also addressed by the interviewees. Apart from the family, companies perceive clients as an intrinsic driver of environmental sustainability, what in a way may contribute towards the maximisation of profit, hence meeting the core of the Stakeholder Theory (Bischoff, 2021). This reasoning also goes along with Curado & Mota (2021) who state that a company's main purpose is to generate profit, while caring for other stakeholders' needs. In this context, the interviewees denote that the CEO must bear in mind the dynamic stakeholders' needs and ensure a positive lasting relationship with them. Being a member of the family, thus shareholder, will benefit from it too.

"We work with several companies that require us to invest in the area of sustainability. (...) The CEO also knows that these investments could increase the company's profit margin by working for these companies and thus generate more income."

Company AQ

On the other hand, 36% of the sample disagreed with the hypothesis, citing reasons such as the firm's culture and alignment among all employees and the focus on profitability, as suggested in Table 30.

"The shareholder always looks at the return on investment part"

Company AF

Table 30: Content Analysis - Perception of H1 (reasons for disagreeing)

Code/ Justification		Frequency	For example:
Firm's culture		1	Company V mentions: <i>"The family itself, the administration itself, share these values. That alone is enough. We all adapt"</i>
Stakeholder's needs and Strategy	Clients	3	Company R mentions: <i>"Sustainability is essential for keeping certain customers."</i>

	Shareholder: Generate profit	3	Company U mentions: <i>"Being part of the family, he will think more about the issue of profit, return on investment, the need, or not, to implement a certain practice."</i>
--	---	---	--

Source: own elaboration

Considering these findings, it can be inferred that while the majority of companies interviewed perceive a positive influence of having a family member as CEO, hence agreeing with current literature, these findings are based on subjective opinions and may not necessarily reflect the actual sustainability outcomes in the FF.

In light of these limitations, it is crucial to acknowledge the need for further research with a more balanced and diverse sample to obtain more conclusive results.

- **H2: The sustainability level of a FF depends positively on the share of the company owned by the family.**

Studies mention that the ownership composition influences the investment in environmental sustainability (Breton-Miller & Miller, 2016). According to Duran *et al.* (2016) the higher the percentage of family ownership, the more likely a FF is to engage in environmental sustainability initiatives.

Quantitative analysis

The Pearson Correlation test used in the quantitative analysis did not provide evidence to support a significant correlation between the sustainability level of a FF and the ownership share of the family. The correlation coefficient of 0.085 indicates a negligible positive relationship, and the p-value of 0.592 (> 0.05) (Table 31) suggests that this relationship is not statistically significant. Therefore, the quantitative results do not support the research hypothesis.

Table 31: H2 - Pearson Correlation

	TESI	Share of the company owned by the family
Pearson Correlation	1	0.085
N	42	42

p-value = 0.592

Source: own elaboration (resorting to SPSS)

Once again, the sample composition reduces the variability in the data and limits the ability to detect significant differences between the two groups, what could have influenced the statistical test outcome.

Qualitative Analysis

With this in mind, we conducted several interviews aiming at the perception of FF regarding this subject. 82% of the interviewees agreed that the share of the company owned by the family (in all cases being of 100%) influences the level of environmental sustainability. They attributed this influence to family values, which they consider as the basis for their actions.

“When a company is 100% owned by a family, there are no big distinctions between the values of each one.”

Company AI

“Our values [family values] dictate our actions.”

Company AC

This perception meets current literature, which states that owning families are willing to make decisions that are not driven by an economic logic (Zientara, 2017).

“Family values clearly influence the company's investments and every year we make large investments in view of increasing sustainability.”

Company AQ

However, other drivers are taken into account by some interviewees, who identify other stakeholder's influence on the level of environmental sustainability. For example, company AK mentions:

"We are here to serve the customer, we have to position ourselves."

Company AK

This enhances the role of stakeholder theory as a determinant of the investment in environmental sustainability practices. Singh & Mittal (2019) highlight the importance of investing in relationship engagement with all those who have an interest in the firm, what is also perceived by the interviewees. It is important to bear in mind that stakeholder theory promotes the idea that organizations have an ethical and social responsibility to consider the impact of their actions on stakeholders.

A summary is exhibited in Table 32.

Table 32: Content Analysis - Perception of H2 (reasons for agreeing)

Code/ Justification	Frequency	For example:
Family Values	14	Company O mentions: <i>"In fact, family values influence the way the company works. And we are very concerned about sustainability."</i>
Stakeholder's needs & Strategy	7	Company AF mentions: <i>"We must be able to look at the business and identify sustainability as a highly differentiating element."</i>
		Company Z mentions: <i>"A very important parameter is what the market demands."</i>

Source: own elaboration

The interviewees who disagreed with H2 (18%) justified their opinion by considering factors mostly related to stakeholders' needs, strategy, and the firm's culture, as shown in Table 33. Those companies are of the opinion that sustainability is an important condition for operating nowadays, ensuring the satisfaction of dynamic stakeholders' needs (Bischoff,

2021). These companies consider that other stakeholders, rather than the family, contribute more positively towards environmental sustainability.

Table 33: Content Analysis - Perception of H2 (reasons for disagreeing)

Code / Justification		Frequency	For example:
Stakeholder's needs and Strategy	Clients	1	Company R mentions: <i>"In terms of strategy, we would have to choose that way because of our clients."</i>
	Shareholder: Generate profit	1	Company U mentions: <i>"All investments are analysed expecting return, within a reasonably short period of time."</i>
Firm's culture		1	Company R mentions: <i>"The company has a structure that would get there by itself."</i>

Source: own elaboration

Overall, while the quantitative analysis did not find a significant correlation between family ownership share and the environmental sustainability level, the qualitative interviews suggest that most interviewees agree with the research hypothesis. However, even though interviews contributed as valuable perspectives, it is essential to recognize that these findings rely on subjective viewpoints.

Considering these limitations, it is imperative to acknowledge the importance of conducting future research with a more balanced and diverse sample if possible.

- **H3: The sustainability level of a FF depends positively on the percentage of family members on the Board.**

Chua *et al.* (1999) suggested that by including family members on the board a FF enhances its commitment towards sustainable development, due to a stronger sense of responsibility towards the long-term success of the firm, as well as their emotional attachment and wish to maintain the family legacy.

Quantitative analysis

In the quantitative analysis, the Pearson correlation test (Table 34) indicated a very weak positive correlation coefficient of 0.052, suggesting that there is likely no meaningful association between the percentage of family members on the Board and the sustainability level of FF. Additionally, the p-value of 0.745, which is greater than the significance level of 0.05, indicates that this correlation is not statistically significant.

Table 34: H3 - Pearson Correlation

	TESI	Percentage of family members on the Board
Pearson Correlation	1	0.052
N	42	42

p-value = 0.745

Source: own elaboration (resorting to SPSS)

This could be explained by the fact that 71.4% of the companies in the sample have all board seats held by family members, which limits the variability in the data and reduces the ability to detect significant correlations.

Qualitative Analysis

The qualitative analyses, however, found that 64% of the interviewees agreed with the research hypothesis, stating that the percentage of family members on the Board (in most cases being of 100%), influences the level of environmental sustainability, thus agreeing with the literature. These companies believe that having family members on the Board ensures the transmission and adherence to family values throughout the entire organisation, as well as it shapes strategic decisions, including environmental sustainability-related ones.

“Family values greatly impact our activity and our priorities, therefore, the definition of objectives, goals, etc. gain a lot by having a Board 100% owned by the family.”

Company V

“Yes, in a way, we guarantee that the family values are verified in each functional area of the company and that, in strategic terms, sustainability is never neglected.”

Company AI

These opinions meet current literature which states that by appointing trusted family members to important posts, the family ensures the preservation of its identity throughout the entire firm (Berrone *et al.*, 2012).

The remaining 36% of the interviewees disagreed with the hypothesis, justifying their opinions both based on profitability maximisation reasons and on the organization culture itself, which ensures the alignment of employees, diminishing the importance of having family members on the Board. Table 35 provides a few examples.

Table 35: Content Analysis - Perception of H3 (reasons for disagreeing)

Justification		Frequency	For example:
Firm's culture/ Employees alignment		2	Company T mentions: <i>"From the moment that sustainability is a strategic pillar of the company, we all contribute to it. The important thing is that we are aligned."</i>
Stakeholder's needs and Strategy	Shareholder: Generate Profit	2	Company U mentions: <i>"Being part of the family, always pay attention to the return on investment. If it weren't, I think there would be a greater sensitivity to this type of subject."</i>

Source: own elaboration

Considering these findings, even though the quantitative analysis did not reveal a significant correlation between the percentage of family members on the Board and the sustainability level of FF, the qualitative analysis provided insights into the perceptions of the interviewees. Those highlighted the belief that family values and its representation on the Board contribute to sustainability efforts.

Nevertheless, it is important to note that these perceptions are subjective opinions and therefore may not necessarily reflect the reality in T/A FF. For future research it is important to consider a more diverse sample as to gain a deeper understanding of the relationship between the two variables in study.

- **H4: The sustainability level of a FF depends positively on having a family member as the chairperson of the board of directors.**

Socioemotional Wealth Theory suggests that the appointment of family members to important posts ensures the company's adoption of core family values and the preservation of its identity.

Quantitative analysis

In the quantitative analysis, the results indicated no statistically significant difference between companies with a family member as the chairperson and those without (Table 36). The p-value of 0.967, which is greater than the significance level of 0.05, suggests that any observed differences in the mean ranks are not statistically significant.

Table 36: H4 - Mann-Whitney Test

Chairperson is a family member	N	Mean Rank	Sum of Ranks
0	1	22	22
1	41	21.49	881
Total	42		

p-value = 0.967

Source: own elaboration (resorting to SPSS)

Once again, this could be explained by the fact that 97.6% of the companies in the sample have a family member as the chairperson of the board. This high concentration limits the variability in the independent variable, making it difficult to detect significant differences.

Qualitative Analysis

Hence, interviews were conducted and the results showed that 82% of the interviewees agreed with the research hypothesis. These companies believe that family values play a significant role in shaping the actions and decisions of the chairperson and the board, leading to a greater focus on sustainability. Company AQ refers that:

“The Chairperson, being a family member ensures that the values I have been referring to, apply in the company. I have no doubt that the president will not allow something that goes against his professional and personal ethics.”

Company V shared this opinion mentioning:

“Family values are always at the basis of the board's and chairperson's actions and this affects, a lot, decisions aiming greater sustainability in the company.”

They emphasize that family members are more likely to prioritize the company's long-term sustainability and align their actions with the values of the family, hence agreeing with current literature, which states that family members are more aligned with a sense of commitment and stewardship (Chua *et al.*, 1999).

On the other hand, 18% of the interviewees diverged from this opinion, suggesting that there is no direct connection between having a family member as the chairperson and the sustainability level of FF. They argue that family members, as chairperson, may prioritize financial considerations and return on investment over sustainability concerns.

“That implies that it is a shareholder (...) When this is the case, there are certain expenses that are blocked. Think twice before spending money.”

Company AF

Considering these findings, we can conclude that the quantitative analysis did not detect a statistically significant difference in the sustainability level between companies with and without a family member as the chairperson. However, the qualitative analysis provided

insights into the perceptions of the interviewees, with a majority supporting the idea that family members in the chairperson role, positively influences sustainability efforts, hence agreeing with current literature.

Nevertheless, it is important to highlight the need for future research, including a more diverse and balanced sample, in order to obtain more conclusive and generalizable results.

- **H5: The sustainability level of a FF depends positively on the number of family members working in the company.**

Literature suggests that when a company includes family members as its staff, communication is easier and more coherent, what contributes, consequently, to innovation on environmental sustainability (Oudah *et al.*, 2018).

Quantitative analysis

Based on the quantitative analysis, the results provide evidence to support a significant correlation between the sustainability level and the number of family members working in the company (Table 37). The p-value of 0.015 (< 0.05) indicates that the observed correlation is unlikely to have occurred by random chance.

Table 37: H5 - Pearson Correlation

	TESI	Proportion family members working in the company
Pearson Corelation	1	-0.372
N	42	42

*. Correlation is significant at the 0.05 level (2-tailed).

p-value = 0.015

Source: own elaboration (resorting to SPSS)

The correlation coefficient of -0.372 suggests what literature considers as a weak negative correlation (Table 38) (Schober *et al.*, 2018). This implies that as the proportion of family

members working in the company increases, the sustainability level tends to decrease, hence diverging from current literature.

However, correlation does not imply causation (Kornbrot, 2005), and other underlying factors may contribute to this relationship. Further research is needed to explore the causal mechanisms behind this correlation.

Table 38: Conventional Approach to Interpreting a Correlation Coefficient

Conventional Approach to Interpreting a Correlation Coefficient	
Magnitude of the Correlation Coefficient	Interpretation
0.00 – 0.10	Negligible Correlation
0.10 – 0.39	Weak Correlation
0.40 – 0.69	Moderate Correlation
0.70 – 0.89	Strong Correlation
0.90 – 1.00	Very Strong Correlation

Source: Schober *et al.* (2018)

Qualitative Analysis

With the qualitative analysis we concluded that contrasting to the research hypothesis, the majority of the interviewees (82%) disagreed with H5, expressing the opinion that all employees contribute equally towards innovation and sustainability, as long as there is alignment among them.

“We make sure that we all contribute to the topic of sustainability – we encourage people to come up with ideas, we hold workshops and talks about certain trendy practices in our industry... All this to ensure that everyone is aligned.”

Company AI

“We all have these matters under consideration, and we do many workshops and brainstorming to further develop the company in terms of sustainability, this allows

everyone to contribute. It wouldn't be because there were one or two other family members in the company that we would be more or less sustainable.”

Company AC

This fact contradicts current literature (Oudah *et al.*, 2018) given that interviewees consider that when aligned, all employees contribute equally to innovation, regardless being of the family or not.

On the other hand, the interviewees who agreed with the research hypothesis (18%) are of the opinion that family members communicate more easily and frequently, influencing positively environmental sustainability, hence agreeing with Oudah *et al.* (2018). The FF interviewed highlighted the benefits of having close family ties, what ensures open discussions, thus facilitating the process of sharing ideas.

“The fact that we are from the same family facilitates communication, there is no distancing between boss and employee.”

Company U

“We talk about company matters inside the company, outside the company, at family gatherings, when we go to fairs... We live this quite intensely. Besides, as we are family, we are also closer and we end up talking more often about company matters and with a very large degree of openness.”

Company O

The results from the quantitative and qualitative analyses provide a nuanced understanding of the relationship between the number of family members working in the company and the sustainability level of a FF. However, these results are divergent: while the quantitative analysis indicates a weak negative correlation, the qualitative analysis reveals a divergence of opinions among the interviewees, even though the majority considers that there is no correlation between the two variables.

These findings suggest that the influence of family members on the sustainability level of a FF is complex and may vary depending on various factors, for instance the inclusiveness in decision-making processes.

“We do many workshops and brainstorming to further develop the company in terms of sustainability, this allows everyone to contribute.”

Company AC

Therefore, it is crucial to consider the individual dynamics and organizational context when examining the impact of family members on sustainability outcomes.

Overall, given the mixed results it is recommended to conduct further research with a larger and more diverse sample as to obtain more conclusive and generalisable results.

- **H6: The sustainability level of a FF depends positively on the wish to preserve the company in the family throughout the generations.**

Several authors suggest that the family's intention to pass on the business to the next generation contributes to a long-term orientation which consequently raises a willingness to invest in the future of the firm, through stakeholder engagement, which in turn, raises the interest in investing in sustainability-related initiatives (Breton-Miller & Miller, 2016; Oudah *et al.*, 2018).

Quantitative analysis

The results obtained in the quantitative analysis indicate that there is no statistically significant difference in the sustainability level between family firms that have a wish to preserve the company in the family and those that do not (Table 39). The p-value of 0.112 (> 0.05) suggests that any observed differences in the mean ranks could likely be due to random chance.

Table 39: H6 - Mann-Whitney Test

The company wishes to preserve the company in the family	N	Mean Rank	Sum of Ranks
0	3	10.67	32
1	39	22.33	871
Total	42		

p-value = 0.112

Source: own elaboration (resorting to SPSS)

Once again, the sample homogeneity could be an explanation factor. A large majority of the sample (92.9%) expressed the intention to preserve the company in the family throughout the generations. This reduces the variability in the data and limits the ability to detect a significant differences among the sample.

Qualitative Analysis

In what regards to the qualitative analysis, most companies interviewed (82%) agreed that the wish to preserve the company in the family influences the level of environmental sustainability. The FF interviewed wish to perpetuate and preserve of family identity within the company, fact that is most referred to by the Socioemotional Wealth Theory (Berrone *et al.*, 2012).

“Preserving the family legacy is essential.”

Company AK

Furthermore, the stakeholder engagement (Curado & Mota, 2021) is also considered as justifying, due to the fact that environmental sustainability is now seen as a priority by several stakeholders, thus being especial to ensure continuity.

A summary is shown in Table 40.

Table 40: Content Analysis - Perception of H6 (reasons for agreeing)

Justification	Frequency	For example:
Perpetuation & preservation of family identity	10	Company R mentions: <i>"In our case, it is already the second generation and there is a legacy to defend. Up until now, sustainability has always been seen as a priority and I think that it will continue to be the case because of this legacy issue."</i>
Stakeholder's needs & strategy	3	Company AI mentions: <i>"Sustainability is a basic condition for survival today. Most likely those that do not adapt to this reality will not last many more years."</i>

Source: own elaboration

The remaining 18% of the companies interviewed disagreed with H6, justifying their opinion based on market requirements and the company's strategic approach. Those consider these aspects as the true drivers of sustainability. They highlighted the importance of adapting to evolving market trends.

"In a few years time if a company is not sustainable it will not be able to operate. The market is evolving in this way and being sustainable is going to be a standard thing, with increasingly tighter rules towards sustainability."

Company V

In view of the above stated, the disagreement among interviewees highlights the complexity of the relationship between family legacy, sustainability, and long-term business continuity. Furthermore, we must bear in mind that these perceptions are subjective opinions and therefore may not necessarily reflect the reality.

Given these constraints, it is of utmost importance to recognize the necessity for additional investigation using a broader and more varied set of participants, in order to attain more conclusive results.

- **H7: The sustainability level of a FF depends positively on the correlation between the company and family's reputations (the family's name is also the company's one).**

The correlation between reputations among FF and its owning family is seen as a major driver of sustainability initiatives (Breton-Miller & Miller, 2016).

Quantitative analysis

The quantitative analysis revealed no statistically significant difference in the sustainability level of FFs based on the correlation between the company and family's reputations (Table 41). The p-value obtained (0.819) was well above the conventional significance level of 0.05, suggesting that other factors may play a more significant role in influencing the sustainability level of FF.

Table 41: H7 - Mann-Whitney Test

Family and company share the same name	N	Mean Rank	Sum of Ranks
0	24	21.13	507
1	18	22	396
Total	42		

p-value = 0.819

Source: own elaboration (resorting to SPSS)

However, it is crucial to interpret the quantitative results in light of the sample composition. Although the results were more divergent, the distribution of the sample suggests that there were more companies with a different name than those sharing the family name. This imbalance may introduce a bias in the analysis, as the larger group could have a stronger influence on the results.

Qualitative Analysis

The qualitative analysis, on the other hand, provided valuable insights into the perceptions of the interviewed companies. The findings indicated a divergence of opinions among the

participants. Approximately 64% of the interviewees agreed with the research hypothesis (H7), emphasizing the indistinguishability of family's and company's reputations. For example, company O mentioned:

"My name is on the door." The company has our name, it has our face – reputations are indistinguishable – the family is the company and the company is the family."

Furthermore, it is clear the relationship between reputation and accountability. For example, company AQ mention:

"Here in our community, the reputation of both is closely related and I believe that this fact contributes to the level of sustainability. It wouldn't be nice if it would contribute negatively."

These opinions go along with current literature (Breton-Miller & Miller, 2016) and share various similarities with the Socioemotional Wealth Theory, which states that a family's reputation is included in the affective compromise which influences decision making (Berrone *et al.*, 2012).

Contrastingly, the 36% of the interviewees who disagreed with the research hypothesis, highlighted that the family's reputation predominantly affected the local community and that clients were not necessarily aware of this reputation.

"The family may be known here in our local community, but for our customers, that's not the case."

Company AC

This perspective, raises special importance to clients' opinions in detriment of the community where the FF is included, hence diverging from the literature, which states that a FF is inclined for proactive stakeholder engagement (Berrone *et al.*, 2012).

Overall, while no statistically significant relationship was found in the quantitative analysis, the qualitative analysis revealed a range of perspectives among the companies interviewed. Furthermore, the qualitative analysis relied on self-reported perceptions, which may be subjective and influenced by individual biases.

CHAPTER 5. Conclusion

In this study, we developed and validated an environmental sustainability index specifically tailored to the T/A industry, as well as examined a possible relationship between T/A FF's characteristics and the environmental sustainability level of such companies. The study employed a mixed-methods approach, combining quantitative analysis of a survey-run data and qualitative analysis of interviews with FF's executives.

The TESI developed in the study, which was constructed based on a thorough literature review and on relevant indicators specific to the T/A value chain, serves as a comprehensive measure of the sustainability level of FF in the T/A industry. The index was well-received by the companies who participated in the study, who highlighted its holistic nature in assessing the environmental sustainability of T/A companies. In view of the comments, we consider the TESI to be prepared to be massively used by companies of this industry, as to determine their environmental sustainability position bearing in mind the current state of science in the field of environmental sustainability.

Regarding the effect of FF's characteristics on the maturity of environmental sustainability, measured by the TESI, the findings yielded mixed results.

On the one hand, the quantitative analysis did not provide significant support for the hypotheses, which stated that the environmental sustainability level of FF depends positively on aspects such as having a family member as CEO, the proportion of shares owned by the family, the percentage of family members on the board, having a family chairperson, the desire to preserve the company in the family throughout the generations, or the relation between the company's and family's reputations.

The limitations of the sample composition were acknowledged as potential factors justifying this outcome and it was suggested the need for future research with a more diverse and balanced sample, to obtain more conclusive and generalisable results.

On the other hand, the qualitative analysis concluded that the perceptions of the majority of the interviewees regarding family involvement were, in most cases, aligned with the existing literature (H1,2,3,4,6,7).

Many interviewees emphasized the importance of family values in shaping the sustainability practices of FF, highlighting the transmission of these values through family members in leadership positions. They argued that family members are more likely to prioritize long-term sustainability and align their actions with the values of the family. However, some

interviewees also pointed out the influence of other stakeholders in driving sustainability practices, indicating a more complex relationship.

Our study revealed a weak negative relationship between the number of family members working in the company and the sustainability level, indicating that as the proportion of family members increases, the environmental sustainability level tends to decrease. However, the qualitative analysis showed that most interviewees disagreed with H5, considering that all employees contribute equally to innovation and environmental sustainability when aligned.

Despite some limitations, such as sample dimension, this study contributes to a better understanding of the perception of the relationship between FF's characteristics and environmental sustainability in these companies. It highlights the complexity of this relationship and the need for further research to explore the underlying mechanisms and factors that influence sustainability practices in FF. The findings also underscore the significance of stakeholder engagement in shaping sustainability outcomes. In what regards to future research, we suggested that the methodology resorts to a wider sample, as to ensure more robust results. The choice of different instruments of data collection could be considered, due to the difficulty of motivating company's executives in participating in academic studies.

We expect the implications of this study to be relevant for practitioners and policymakers in the T/A industry, by shedding light on the driving factors of environmental sustainability in FF, and also by providing the TESI, an environmental sustainability maturity index specifically designed for the T/A industry.

CHAPTER 6. References

A

- Adejumoke, A. I., Babatunde, O. A., Abimbila, P. O., Tabitha, A. A.-A., Adewumi, O. D., & Toyin, A. O. (2018). Water Pollution: Effects, Prevention, and Climatic Impact. In *Water Challenges of an Urbanizing World* (pp. 33–42). InTech.
- AEP. (2019). Distrito de Braga tem 28% da indústria da fabricação do têxtil no país. *N Invest*. <https://www.n-investportugal.pt/pt/client/skins/geral1.php?id=254>
- ATP. (n.d.). *ATP - Quem Somos*. Retrieved June 28, 2023, from <https://atp.pt/pt-pt/quem-somos/>
- ATP. (2020). *ATP Estatísticas*. <https://atp.pt/pt-pt/estatisticas/caraterizacao/>
- Avery, G. C., & Bergsteiner, H. (2011). Sustainable leadership practices for enhancing business resilience and performance. *Strategy & Leadership*, 39(3), 5–15. <https://doi.org/10.1108/10878571111128766>

B

- Banco de Portugal. (2022, October 14). *Análise setorial da indústria dos têxteis e vestuário*. <https://bpstat.bportugal.pt/conteudos/publicacoes/1292>
- Beekaroo, D., Callychurn, D. S., & Hurreeram, D. K. (2019). Developing a sustainability index for Mauritian manufacturing companies. *Ecological Indicators*, 96, 250–257. <https://doi.org/10.1016/j.ecolind.2018.09.003>
- Bendell, B. L. (2022). Environmental investment decisions of family firms—An analysis of competitor and government influence. *Business Strategy and the Environment*, 31(1), 1–14. <https://doi.org/10.1002/bse.2870>
- Berrone, P., Cruz, C., & Gomez-Mejia, L. R. (2012). Socioemotional Wealth in Family Firms. *Family Business Review*, 25(3), 258–279. <https://doi.org/10.1177/0894486511435355>
- Bischoff, K. (2021). A study on the perceived strength of sustainable entrepreneurial ecosystems on the dimensions of stakeholder theory and culture. *Small Business Economics*, 56(3), 1121–1140. <https://doi.org/10.1007/s11187-019-00257-3>

BOF - Business of Fashion. (2021). The Sustainability Gap - How Fashion Measures Up. *BOF*.

Brands Eco. (2022, November 14). *A nível internacional Portugal é reconhecido como “o produtor mais fiável e confiável de moda sustentável”*. <https://eco.sapo.pt/2022/11/14/a-nivel-internacional-portugal-e-reconhecido-como-o-produtor-mais-fiavel-e-confiavel-de-moda-sustentavel/>

Breton-Miller, I. Le, & Miller, D. (2016). Family firms and practices of sustainability: A contingency view. *Journal of Family Business Strategy*, 7(1), 26–33.
<https://doi.org/10.1016/j.jfbs.2015.09.001>

C

Cennamo, C., Berrone, P., Cruz, C., & Gomez-Mejia, L. R. (2012). Socioemotional Wealth and Proactive Stakeholder Engagement: Why Family-Controlled Firms Care More about their Stakeholders. *Entrepreneurship Theory and Practice*, 36(6), 1153–1173.
<https://doi.org/10.1111/j.1540-6520.2012.00543.x>

Chen, H. L., & Burns, L. D. (2006). Environmental analysis of textile products. *Clothing and Textiles Research Journal*, 24(3), 248–261. <https://doi.org/10.1177/0887302X06293065>

Cho, N. M., Okuboyejo, S., & Dickson, N. (2017). Factors Affecting the Sustainability of Family Businesses in Cameroon: An Empirical Study in Northwest and Southwest Regions of Cameroon. *Journal of Entrepreneurship: Research & Practice*, 2017.
<https://doi.org/10.5171/2017.658737>

Choudhury, A. K. R. (2014). Environmental Impacts of the Textile Industry and Its Assessment Through Life Cycle Assessment. In *Roadmap to Sustainable Textiles and Clothing* (pp. 1–39). Springer, Singapore.

Chua, J. H., Chrisman, J. J., & Sharma, P. (1999). Defining the Family Business by Behavior. *Entrepreneurship Theory and Practice*, 23(4), 19–39.
<https://doi.org/10.1177/104225879902300402>

Commission on Environment, W. (1987). *Report of the World Commission on Environment and Development: Our Common Future Towards Sustainable Development 2. Part II. Common Challenges Population and Human Resources 4*.

Costa, C., Azoia, N., Silva, C., & Marques, E. (2020). Textile Industry in a Changing World: Challenges of Sustainable Development. *U.Porto Journal of Engineering*, 86–97.

Curado, C., & Mota, A. (2021). A systematic literature review on sustainability in family firms. *Sustainability (Switzerland)*, 13(7). <https://doi.org/10.3390/su13073824>

D

Direção-Geral das Atividades Económicas. (2018). *Indústria Têxtil e Vestuário (Sinopse 2018)*.

Dugal, J. (2023, June 17). *An Overview To The Portugal Textile Industry: A Strong Industry Known For Its Craftmanship And Quality*.

Duran, P., Kammerlander, N., Van Essen, M., & Zellweger, T. (2016). The Impact of Family Ownership, Management, and Governance on Social Responsibility Activities. *Academy of Management Journal*.

G

Giordano, D. (2019). *Weaving the Circle Exploring the potential and challenges to upcycle post-industrial textile waste of an outdoor apparel company*.

Gonçalves, A., & Silva, C. (2021). Looking for sustainability scoring in apparel: A review on environmental footprint, social impacts and transparency. In *Energies* (Vol. 14, Issue 11). MDPI AG. <https://doi.org/10.3390/en14113032>

Goodland, R. (1995). The Concept of Environmental Sustainability. *Annual Review of Ecology and Systematics*, 26, 1–24.

H

Heinberg, R. (2010). *The Post Carbon Reader Series: Foundation Concepts What Is Sustainability?* <http://www.postcarbonreader.com>.

J

Jaffe, D. (2021). From Shareholder Primacy To Stakeholder Primacy: How Family Businesses Lead The Way. *Forbes*. <https://www.forbes.com/sites/dennisjaffe/2021/02/24/from-shareholder-primacy->

to-stakeholder-primacy-how-family-businesses-lead-the-way/?sh=7464426a21ed

K

Kornbrot, D. (2005). Correlation. In *Encyclopedia of Statistics in Behavioral Science*. John Wiley & Sons, Ltd. <https://doi.org/10.1002/0470013192.bsa136>

Kraus, P., & Brtitzelmaier, B. (2012). A literature review on corporate social responsibility: definitions, theories and recent empirical research. *International Journal of Management Cases*, 14(4), 282–296.

L

Leal Filho, W., Ellams, D., Han, S., Tyler, D., Boiten, V. J., Paco, A., Moora, H., & Balogun, A. L. (2019). A review of the socio-economic advantages of textile recycling. In *Journal of Cleaner Production* (Vol. 218, pp. 10–20). Elsevier Ltd. <https://doi.org/10.1016/j.jclepro.2019.01.210>

Lee, K. E. (2016). *Textile Science and Clothing Technology: Environmental Sustainability in the Textile Industry*. <http://www.springer.com/series/13111>

Li, J., & Leonas, K. K. (2022). Sustainability topic trends in the textile and apparel industry: a text mining-based magazine article analysis. *Journal of Fashion Marketing and Management*, 26(1), 67–87. <https://doi.org/10.1108/JFMM-07-2020-0139>

Li, M., & Zhao, L. (2021). Exploring Global Fashion Sustainability Practices through Dictionary-Based Text Mining. *Clothing and Textiles Research Journal*. <https://doi.org/10.1177/0887302X21998268>

López-González, E., Martínez-Ferrero, J., & García-Meca, E. (2019). Corporate social responsibility in family firms: A contingency approach. *Journal of Cleaner Production*, 211, 1044–1064. <https://doi.org/10.1016/j.jclepro.2018.11.251>

M

Macarthur, E. (n.d.). *Founding Partners of the TOWARDS THE CIRCULAR ECONOMY Economic and business rationale for an accelerated transition*.

Marôco, J. (2021). *Análise Estatística com o SPSS Statistics* (ReportNumber, Ed.; 8th ed.).

Martins Da Silva, P. (2013). *As Redes de Relacionamento e as Capacidades Dinâmicas: A Indústria Têxtil e de Vestuário Portuguesa*.

Modi, D. (2015). *Upcycling fabric waste in design studio*.

Mollenkamp, D. T. (2022). What is Sustainability? How Sustainabilities Work, Benefits, and Example. *Investopedia*.

Muthu, S. S. (2018). *Sustainable Innovations in Recycled Textiles*.

<http://www.springer.com/series/13111>

N

Nguyen, A. H., & Nguyen, L. H. (2020). Determinants of sustainability disclosure: Empirical evidence from vietnam. *Journal of Asian Finance, Economics and Business*, 7(6), 73–84. <https://doi.org/10.13106/JAFEB.2020.VOL7.NO6.073>

O

Oudah, M., Jabeen, F., & Dixon, C. (2018). Determinants Linked to Family Business Sustainability in the UAE: An AHP Approach. *Sustainability*, 10(1), 246. <https://doi.org/10.3390/su10010246>

P

Purvis, B., Mao, Y., & Robinson, D. (2019). Three pillars of sustainability: in search of conceptual origins. *Sustainability Science*, 14(3), 681–695. <https://doi.org/10.1007/s11625-018-0627-5>

S

Sabater, S., Freixa, A., Jiménez, L., López-Doval, J., Pace, G., Pascoal, C., Perujo, N., Craven, D., & González-Trujillo, J. D. (2023). Extreme weather events threaten biodiversity and functions of river ecosystems: evidence from a meta-analysis. *Biological Reviews*, 98(2), 450–461. <https://doi.org/10.1111/brv.12914>

Saeed, M. A., & Kersten, W. (2019). Drivers of sustainable supply chain management: Identification and classification. In *Sustainability (Switzerland)* (Vol. 11, Issue 4). MDPI.

<https://doi.org/10.3390/su11041137>

Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation Coefficients. *Anesthesia & Analgesia*, 126(5), 1763–1768. <https://doi.org/10.1213/ANE.0000000000002864>

Singh, S., & Mittal, S. (2019). Analysis of drivers of CSR practices' implementation among family firms in India: A stakeholder's perspective. *International Journal of Organizational Analysis*, 27(4), 947–971. <https://doi.org/10.1108/IJOA-09-2018-1536>

Sreitzer, G., Porath, C. L., & Gibson, C. B. (2012). Toward human sustainability. How to enable more thriving at work. *Organizational Dynamics*, 41(2), 155–162. <https://doi.org/10.1016/j.orgdyn.2012.01.009>

W

Warwas, I., Podgórnjak-Krzykacz, A., Przywojska, J., & Kozar, Ł. (2021). Going green and socially responsible – textile industry in transition to sustainability and a circular economy. *Fibres and Textiles in Eastern Europe*, 29(3), 8–9. <https://doi.org/10.5604/01.3001.0014.7782>

Y

Yadav, N., Gupta, K., Rani, L., & Rawat, D. (2018). Drivers of Sustainability Practices and SMEs: A Systematic Literature Review. *European Journal of Sustainable Development*, 7(4). <https://doi.org/10.14207/ejsd.2018.v7n4p531>

Z

Zellweger, T., Eddleston, K. A., & Kellermanns, F. W. (2010). Family Reputation and Corporate Performance. *Entrepreneurship Theory and Practice*.

Zellweger, T. M., Nason, R. S., & Nordqvist, M. (2012). From Longevity of Firms to Transgenerational Entrepreneurship of Families. *Family Business Review*, 25(2), 136–155. <https://doi.org/10.1177/0894486511423531>

Zientara, P. (2017). Socioemotional Wealth and Corporate Social Responsibility: A Critical Analysis. *Journal of Business Ethics*, 144(1), 185–199. <https://doi.org/10.1007/s10551-015-2848-1>

Appendix 1 - Survey

Maturity and Determinants of Environmental Sustainability Practices

This survey is part of a research study conducted for a Master's thesis in Economics and Management of Innovation, at the Faculty of Economics of the University of Porto.

This survey's goal is to assess the level of environmental sustainability maturity in textile companies, located in the districts of Porto and Braga, as well as to determine whether certain factors related to family-owned businesses influence the investment in environmental sustainability within these organisations.

Sustainable development is understood as meeting the present needs without compromising the ability of future generations to meet their own needs. In an environmental context, sustainability aims to preserve resources by discouraging their excessive use, thereby ensuring the continuity of species.

This survey is divided into three distinct sections: the first section focuses on the company, the second section addresses environmental sustainability practices and behaviours, and the third section covers determinants of environmental sustainability, in family firms.

The obtained results will be used solely for academic and statistical purposes and will be handled and processed by the project's authors.

All collected information will be treated confidentially and used exclusively for the aforementioned purposes, in accordance with the legal provisions outlined in the General Data Protection Regulation (GDPR).

By submitting the survey, you expressly authorize the use of your responses.

The company

Company's name:

--

In which/which of the following stages of the textile process does your company fit?

☐	Fibre Production
☐	Yarn Production
☐	Fabric/knit production
☐	Fabric/knit coloring and finishing
☐	Cutting, sewing and packaging

Is your company a family-owned business?

☐	Yes
☐	No

If you are available for a brief conversation with the researchers, please provide your name and email.

--

Environmental Sustainability Maturity

1. Commitment, Policy, and Transparency.

1.1. Is environmental sustainability one of the strategic pillars of the company?

☐	Yes
☐	No

1.2. Is environmental sustainability represented in the company's strategic plan?

☐	Yes
☐	No

1.3. Does the company prepare a sustainability report?

☐	Yes
☐	No

1.4. Does the company track its supply chain and disclose its suppliers?

☐	Yes
☐	No

- 1.5. Does the company have an autonomous department or a formally responsible person for the sustainability area?

Example: Director, Responsible Person, ...

☐	Yes
☐	No

- 1.6. Does the company incorporate topics related to environmental sustainability into its code of conduct?

☐	Yes
☐	No

2. Implementation of Environmental Sustainability Practices

2.1. Greenhouse Gas Emissions and Other Pollutants

- 2.1.1. What was the approximate percentage of greenhouse gas emissions reduction achieved in the last 3 years?

--

- 2.1.2. What is the approximate investment value in technologies with a positive impact on reducing greenhouse gas emissions and other pollutants in the last 3 years?

For example: LED lighting; more efficient equipment; ...

--

2.2. Water and Chemical Usage and Production of Polluting Microfibers

2.2.1. What is the approximate percentage of reduction in chemical usage in the last 3 years, while alternatively adopting other techniques and methodologies throughout the production process?

2.2.2. What is the approximate percentage of reduction in the duration of washing processes in the last 3 years?

2.2.3. What is the approximate percentage of recycled water used in the production process?

2.2.4. What is the approximate percentage of reduction of water usage throughout production, in the last 3 years.

2.2.5. What is the approximate percentage of washing machine with filters?

2.2.6. Does the company invest in water releases analysis?

☐	Yes
☐	No
☐	Not Applicable

2.2.7. Does the company practice wastewater treatment?

☐	Yes
☐	No
☐	Not Applicable

2.2.8. Does the company actively engages in industry efforts to minimise microfibre pollution?

☐	Yes
☐	No
☐	Not Applicable

2.3. Materials

2.3.1. What is the approximate percentage of raw materials purchased from environmentally responsible sources?

--

2.3.2. What is the approximate percentage of reduction of the usage of virgin synthetic fibres (such as polyester, nylon,...) in the last 3 years?

--

2.3.3. What is the approximate percentage of usage of recycled/organic/ eco-friendly materials?

--

2.3.4. Does the company prefer biodegradable materials?

☐	Yes
☐	No
☐	Not Applicable

2.3.5. Does the company uses new materials (i.e. sugarcane-, algae-based)?

☐	Yes
☐	No
☐	Not Applicable

2.3.6. What is the approximate percentage of recyclable materials used in the packaging?

--

2.3.7. Does the company practices upcycling and/or recovers waste and/or overproduction?

☐	Yes
☐	No
☐	Not Applicable

2.4. **Waste**

2.4.1. What is the level of circularity practices throughout the company's production process?

☐	Null
☐	Very Low
☐	Low
☐	Medium
☐	High
☐	Very High
☐	Total

2.4.2. Does the company practice eco-design?

Note: The eco-design strategy aims to design products taking into consideration the environmental impacts they generate throughout their lifecycle.

☐	Yes
☐	No
☐	Not Applicable

2.4.3. Does the company practices 3D seamless manufacturing?

☐	Yes
☐	No
☐	Not Applicable

2.4.4. Does the company practices waste sorting?

☐	Yes
☐	No

3. **Monitoring**

3.1. Is the company certified ISO 14001?

☐	Yes
☐	No

3.2. Does the company use metrics to measure the accomplishment of sustainability-related goals?

☐	Yes
☐	No

Determinants of Environmental Sustainability Practices in Family-Owned Businesses

This part of the survey is reserved to family firms only. If you are representing a non-family firm, please do not answer the following questions and submit your answer. Thank you.

Does the CEO of the company belong to the owning family?

☐	Yes
☐	No

What is the percentage of the company's capital owned by the family?

--

What is the percentage of board seats occupied by family members in the company?

--

Is the Chairperson of the Board of Directors a member of the family?

☐	Yes
☐	No

How many family members are employed in the company?

--

Is there an intention from the family to pass the business to the next generation?

☐	Yes
☐	No

Is the name of the owning family present in the company's name?

☐	Yes
☐	No

Appendix 2 – Interview Script

Good morning/ afternoon,

First of all, I would like to thank you for your participation in this study.

As you might have already understood our study is divided into 2 parts:

1. Firstly, the development of an environmental sustainability index; and
2. Secondly, the determination of some factors that influence the level of sustainability in textile family businesses.

We hope you have received and analysed our email with information about the Environmental Sustainability Index, more specifically, the criteria used on it and the calculation methods, as well as the total score it attributes your company.

Summing up, the environmental sustainability index is based on the literature review that we carried out on the subject, as well as on indices already prepared in other similar studies.

For this, we considered 30 indicators, the 29 questions inquired in the survey we sent you a few weeks ago and an extra one respecting transparency, by publishing information about sustainability in a specific website tab.

When calculating this index, whenever there is a response considered “Not Applicable”, the criteria in question is automatically excluded from the index, resulting in a different maximum total (other than the 30 criteria mentioned before).

The sum of all points leads to a percentage which indicates the position occupied by the company in relation to current environmental sustainability practices and behaviours for the textile industry.

The calculation of this index allowed us to conclude that the [COMPANY NAME] has an environmental sustainability maturity of approximately [TESI RESULT] %.

1. Taking this into account, I would like to know your opinion regarding the indicators analysed in the index, if there is any extra one you might suggest including, and if you consider it a viable index.

With regard to the factors that lead family businesses to invest in environmental sustainability practices, many studies indicate that the values of the family that owns the company influence the organisation's culture, as well as the investment in various initiatives, including some related to sustainability.

2. Assuming that the company is 100% owned by the family, do you consider that this fact influences the level of sustainability of the company? If yes, to what extent? If not, what are the reasons that lead you to conclude that fact?

Those same studies also refer to a great deal of intervention by top management, both by the CEO, as well as by the board and the respective president.

3. Do you consider that the CEO, being/ not being part of the family, influences the company's level of sustainability? If yes, to what extent? If not, what are the reasons that lead you to conclude that fact?

In the survey, you mentioned that [% OF THE COMPANY OWNED BY THE FAMILY]% of the Board is made up of family members.

4. Do you consider that this fact has a positive impact on the company's level of sustainability? If yes, to what extent? If not, what are the reasons that lead you to conclude that fact?
- 5.

In the survey, you mentioned/ not mentioned that the chairperson of the board is a family member.

6. To what extent do you consider that this fact influences your company's level of sustainability?

Studies also indicate that the fact that there are several family members working in the company facilitates the process of sharing information regarding innovation in the production process, in view of reducing the company's ecological footprint.

7. Taking into account that [NO. OF FAMILY MEMBERS WORKING IN THE

COMPANY] family members work in the company, do you consider that this fact influences the level of sustainability? Do you think that if there were more family members working in the company, the contributions to innovation towards sustainability would be greater?

Now regarding the future, you mentioned that the family intends/ does not intend to pass the business on to the next generation. Several studies report that by wishing to keep the company in the family throughout generations contributes to management with a long-term vision and consequent adoption of measures related to sustainability.

8. Do you share this opinion?
9. Do you also consider that it is important for the company to adopt the family name as a reputation factor, contributing this to the level of sustainability? If yes, to what extent? If not, what are the reasons that lead you to conclude that fact?
10. Do you consider that the integration of issues related to sustainability in the code of business conduct positively influences the level of sustainability of your company? If yes, to what extent? If not, what are the reasons that lead you to conclude that fact?

That was my last question.

Thank you very much for your help and kindness, it was lovely talking to you. Your insights and perceptions are very useful for our study.

In case you are interested we can send you our findings once our study is concluded.

Wishing you all the best.