SDGs and Textiles

Martin Wynn
Tina Wiegand *Editors*

Sustainability, the Circular Economy and Digitalisation in the European Textile and Clothing Industry

How Digital Technologies are Enabling the Circular Economy

Springer

SDGs and Textiles

Series Editor

Hafeezullah Memon, International Institute of Silk, Zhejiang Sci-Tech University, Hangzhou, China

The book series “SDGs and Textiles” addresses the strategies to achieve sustainable development goals (SDGs) in the present, past, and future. It presents books about the present and future policies of textile ministries of different countries, and books related to sustainability education around different parts of the world in the textile sector. Moreover, it would welcome the conference proceeding related to SDGs and Textiles. The series would cover books comparing the sustainability and SDGs of different institutions and countries. The individual book volumes in the series are thematic. The goal of each book is to give readers a comprehensive overview of a different area of sustainability in the textile sector. As a collection, the series provides valuable resources to a broad audience in academia, the research community, industry, and anyone looking to expand their knowledge of SDGs and Textiles.

Textiles and life are together – life cannot be separated from textiles as it is the most important need for human beings after food. In 2015, the United Nations General Assembly proposed 17 interlinked global goals to be achieved by 2030. Since then, academia and industry have paid much attention to achieving these goals. Textile found its close relation with almost all of these 17 goals.

SDG 1 - No Poverty: Poverty would never be overcome by a charity only; it is essential to develop people’s skills to have a better and wealthy life. Thus, the textile can be considered an excellent discipline to achieve this goal by creating jobs and small and medium businesses.

SDG 2 - Zero Hunger: Through the effective utilization of advanced application of Agrotech Textiles, it is possible to have higher crop yields and save crops from rough weather, unexpected rains, floods, insects, etc.; thus, geotextiles play an essential in achieving this goal of sustainable development.

SDG 3 - Good Health & well-being: There has been much health consciousness after Covid19, and medical textiles assist in getting good health and well-being.

SDG 4 - Learning & Education: Textile or fashion has remained a significant discipline for societies for ages, and there has always remained much to explore in this field. Textile-related universities may play a vital role by offering free access to their education resources, training and spreading information among the locals.

SDG 5 - Gender Equality: The textile sector is one of the industrial sectors that accepted gender equality long ago; in particular, the garment sector has more females than males. Thus, the textile sector has been doing gender equality. Moreover, there has been a recent trend for Gender Neutral Clothing, which need worth studying and may further assist gender equality.

SDG 6 - Clean Water & Sanitation: Textiles could be achieved through filtration, and of course, textile is one of the critical materials for filtration.

SDG 7 - Affordable & Clean Energy: With the recent advancement in material science and engineering, the textile sector has come on the front for, not only by using this clean energy during textile production but also by assisting the production of this clean energy, either in the form of wind turbines blades made of textile composites or by energy harvesting from T-Shirts, etc.

SDG 8 - Decent Work: Recently, there has been much attention that the textile workers are not paid well, labor rights are not cared about, etc.

SDG 9 - Industry and innovation: Textile Industry always follows innovation; the textile companies that do not chase innovation cannot survive in the market.

SDG 10 - Reduced Inequalities: Getting better life and well-being would help reduce inequalities in the textile industry.

SDG 11 - Sustainable Cities: Sustainable Textile Cities through Buildtech and transport textiles.

SDG 12 - Consumption and Production: Textile and garment consumption and production all come under.

SDG 13 - Climate Action: Oekotech or Ecotech Textile, waste management of textiles are upfront to achieve this goal of sustainable development.

SDG 14 - Life Below Water: Mitigating microfiber waste in rivers and oceans may come under the context of it. There has been much attention on this subject after passing the bill at the parliament level of the UK.

SDG 15 - Life on Land: Geotech or Geotextiles studies life on land.

SDG 16 - Peace, Justice, and Strong Institutions: Protective textiles are doing their best to achieve peace, justice, and strong institutions.

SDG 17 - Partnerships for the Goals: The application of textiles to achieve sustainable development goals is only an example. In all textiles sectors, combined efforts of all the goals are essential to achieve true sustainability.

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Foreword

The textile and clothing sector was the cradle of the first industrial revolution in Europe and it has historically been shaped by structural changes driven by evolving external conditions. Nowadays the textile sector is one of the least sustainable industries worldwide. It is resource intensive and wasteful. A recent European Union report argued that "the textile industry is among the top three pressures on water and land use and the top five for raw materials use and greenhouse gas emissions worldwide".[1] The report emphasised the importance of taking action in order to address alarming figures that show that the production of textiles around the world doubled in the years 2000–2015, and that it is set to "more than double by 2030".

Due to its significant impact on the environment, health, and economic development across many parts of the world, the transformation of the textile and clothing industry towards sustainability and the circular economy is a crucial component in achieving the United Nations' Sustainable Development Goals. To this end, the European Commission published an *EU Strategy for sustainable and circular textiles,* which proposes strategic interventions that aim to tackle the lifecycle of textile products with a view of implementing actions that impact the production and consumption of textiles. The strategy was launched in 2020 and has gone through various revisions and adaptations. Although its goals and proposed actions are clearly laid out[2], their impact is still to be demonstrated.

Today, the European textile and clothing industry stands at a critical crossroads, influenced by sustainability and digital transformation. This is notable in some of the recent initiatives that have been introduced in order to ensure that consumers are

[1] European Commision. *How is the EU making fashion sustainable?*. Available at: https://environment.ec.europa.eu/topics/circular-economy/reset-trend/how-eu-making-fashion-sustainable_en. Accessed on: August 23, 2024.

[2] European Commission. *EU strategy for sustainable and circular textiles.* Available at: https://environment.ec.europa.eu/strategy/textiles-strategy_en#timeline. Accessed on: August 23, 2024.

protected from greenwashing[3] and that the new Ecodesign for Sustainable Products Regulations (ESPR) are understood and implemented.[4]

If the European textile and clothing industries embrace digital transformation, and if they succeed in reducing their overall environmental and climate impact on the EU market, then they have the potential to usher in the 5th Industrial Revolution in Europe by embracing and shaping the digital shift from linear mass production and outsourcing to more sustainable, collaborative practices and new consumption patterns, once again becoming the engine of economic and social development in Europe.

This book contains chapters on nine different European countries. A combination of qualitative and quantitative research methods is used across these chapters to answer three core research questions concerning sustainability strategies, circular economy practices and digital technology deployment in the textile and clothing industry. Martin Wynn and Tina Wiegand have provided us with unique insights into the intersection of sustainability, the circular economy, and digitalisation within the industry, and the carefully selected expert contributors offer new perspectives on how digital technologies can revolutionise sustainability and circular practices in manufacturing, supply chain management, and product lifecycle strategies.

The findings and case studies will be of interest to researchers and practitioners and for anyone who wants to support the transition to a sustainable and circular future in the European textile and clothing industry. For researchers, it offers broad approaches for further interdisciplinary research that combines environmental science, digital technology, economics and social sciences to address complex challenges related to industrial and social transformation. For policy makers and industry leaders, it offers approaches, strategies and ideas to shape sustainable and digital transformation in a way that could make the industry a beacon of international competitiveness again.

We are each implicated in this debate; and we ought to be invested in the successful transition of the European textile and clothing industry towards more sustainable models of production. Ultimately, however, it is our consumer behaviour that will ensure that these industries shift towards more responsible approaches.

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[3] European Commission. *The Road to Green 12: How is the EU Combatting Greenwashing*. Available at: https://environment.ec.europa.eu/news/video-how-eu-combating-greenwashing-2024-06-26_en. Accessed on: December 24, 2024.

[4] European Commission. *What's changing with new Ecodesign for Sustainable Products Regulation?*. Available at: https://environment.ec.europa.eu/news/video-ecodesign-sustainable-products-regulation-explained-2024-07-19_en. Accessed on: July 19, 2024.

Preface

The European textile and clothing (T&C) industry is at a critical crossroads, facing unprecedented challenges and opportunities driven by the twin forces of sustainability and digitalisation. The integration of these elements into the industry is not merely a trend but a fundamental shift that will determine the future of this sector. The journey towards a sustainable and circular textile economy, alongside the adoption of digital technologies, presents both immense potential and significant obstacles for companies of all sizes across Europe.

This book, entitled *Sustainability, the Circular Economy and Digitalisation in the European Textile and Clothing Industry—How Digital Technologies are Enabling the Circular Economy* seeks to explore this transition in depth. It aims to provide a comprehensive understanding of how the industry is navigating complex changes within various national and regional contexts. The chapters contained herein analyse the strategies, challenges, and success factors of various companies within the textile value chain, from small and medium-sized enterprises (SMEs) to multinational companies. This exploration is further enriched by the perspectives of various stakeholders, including suppliers, customers, consumers, and recovery actors, all of whom play a crucial role in shaping the industry's path forward.

The European Union's legislative framework, increasingly focused on sustainability, circularity, and digital transformation, provides the backdrop for this investigation. Various laws and regulations, such as the Extended Producer Responsibility (EPR) scheme and the Eco-design for Sustainable Products Regulation (ESPR), are pushing companies toward more sustainable practices. However, as the chapters in this book reveal, the pace and extent of this transformation vary significantly across countries and companies, depending on local market conditions, the availability of human and financial resources, and corporate culture.

This book covers nine countries, each presented in a dedicated chapter, with the findings eventually synthesised into an overarching conclusion. A brief overview of the main topics of each chapter is provided below.

The **UK chapter** focuses on five major textile manufacturing companies and five leading clothes retailers in the UK, predominantly multinational companies with global supply chains. The **Romania chapter** also examines large companies but pays particular attention to the strategies and practices of international brands operating in the country.

In contrast, the **Denmark chapter** focuses on SMEs with domestic production and recovery actors, intentionally excluding large international brands and retailers from the analysis.

The **Italy chapter** examines both small businesses within a traditional wool-processing industrial district and multinational luxury brands, both with a focus on innovative and collaborative approaches. The analysis of primary data also provides deep insights into company practices and allows conclusions to be drawn about industry-wide development paths.

The **chapter on France** limits its analysis also to SMEs involved in national sustainability initiatives, while the **chapters on Bulgaria, Türkiye, and Portugal** analyse randomly selected industry representatives from their respective countries. Finally, the **Germany chapter** builds upon a previous study to examine various manufacturing SMEs across different stages of the textile value chain. Drawing on primary data from interviews with industry representatives, the chapter provides new insights into the sustainability strategies, CE practices, and the state of digitalisation within these companies.

The extent to which the portrayal of each country, as presented in these studies, is comprehensive or influenced by the authors' disciplinary perspectives and the specific companies analysed, is difficult to determine. Nevertheless, the involvement of numerous authors, case studies, and analytical focuses collectively provides a broad overview of a highly heterogeneous European T&C industry. Despite significant national differences and challenges, the industry shares an awareness of its significant impact on sustainable development and is increasingly committed to developing innovative solutions to meet this responsibility.

The insights derived from these studies offer indications of general trends and innovative solutions within the European T&C industry, which are synthesised in the **final conclusion** into a maturity matrix which may usefully serve as a basis for further research and the development of innovative approaches and policy concepts to shape a sustainable and circular future for the industry in Europe.

This book provides a comprehensive overview of the diverse ways in which the European T&C industry is responding to the demands of sustainability and digitalisation. These responses not only reflect the industry's adaptability but also highlight the critical role that innovation, collaboration, and strategic foresight will play in determining its future. It is our hope that this book will serve as both a resource and an inspiration for those seeking to understand and contribute to the ongoing transformation of this vital industry.

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Chapter 1
Introduction

Tina Wiegand and Martin Wynn

1.1 Background

The production and consumption of industrial-scale products result in substantial natural resource depletion, with a projected demand that could exceed the capacity of almost three Earths by 2050 to sustain current lifestyles (United Nations, 2022). Within the same timescale, annual waste generation is expected to increase by 70 percent to over 3 billion tonnes (Kaza, 2018). If unchecked, this combination of resources depletion and waste increase will have catastrophic environmental impacts, including climate-damaging greenhouse gas emissions, biodiversity loss, and air, soil and water pollution (OECD, 2019).

The textiles and clothing (T&C) industry exemplifies wasteful resource utilisation. In recent decades, T&C production and consumption have undergone a significant escalation (Gözet & Wilts, 2022). Goods are discarded after an increasingly short use period, with only a low percentage being recycled into new textile fibres, resulting in significant environmental harm and resource depletion. The T&C industry is now the world's fourth-largest consumer of primary raw materials and water, and the fifth-largest emitter of greenhouse gases (European Environment Agency, 2019). Given the escalating detrimental impacts on both people and the environment, the prevailing linear "cradle-to-grave" approach to production and consumption, and the accompanying waste generation, are facing growing scrutiny.

The circular economy (CE) is viewed as a way to decouple future economic growth from resource consumption (European Commission, 2022a). The CE aims to achieve

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"zero waste and pollution throughout materials lifecycles" (Nobre & Tavares, 2021, p. 10) by replacing "the end-of-life concept with reducing, alternatively reusing, recycling, and recovering of materials throughout the supply chain" (Kirchherr et al., 2023, p. 4). In this context, the CE primarily pertains to the microeconomic level, focusing on businesses and their strategies to reduce resource consumption, mitigate environmental impacts like waste and emissions, and promote closed material loops.

While the concept of the CE is not new, it has grown in significance in recent years, becoming a focal point in various governmental and supranational sustainability agendas, such as the United Nations Sustainable Development Goals (United Nations, 2015) and the European Union's Green Deal (European Commission, 2019, 2020, 2022b). Digital technology deployment is seen as a crucial catalyst for orchestrating the comprehensive transition from a linear to a more circular economy, serving as a key enabler for implementing circular strategies and practices (European Commission, 2022a).

This transition poses significant challenges for companies, as decision-makers must accurately assess and reshape products, processes, relationships, systems and even business models, while considering competitive advantages and stakeholder interests (Battesini Teixeira et al., 2023; Franco, 2017; Jia et al., 2020).

1.2 The European Textile and Clothing Industry

The terms "textiles" and "clothing" are often used interchangeably, but there are significant differences. "Textiles" refer to structures made of natural or synthetic fibres, and the textile industry comprises companies involved in textile production or processing across four key areas: fibre preparation, fibre processing, yarn processing (e.g., knitting, weaving), and finishing (e.g., dyeing, printing) (Neugebauer & Schewe, 2015). In contrast, the "clothing" industry further processes textile products into clothing, encompassing activities such as design, creation and distribution of clothing on a national and international scale (Gesamtverband textil+mode, 2023). Figure 1.1 illustrates the primary products of the T&C industry.

With about 197,000 companies, more than 1.3 million employees and a turnover of around €170 billion in the T&C industry in 2023, the EU plays a pivotal role as a significant importer, exporter, and producer in a highly globalised T&C value chain (EURATEX, 2024). More than 90 percent of the companies are small and medium-sized enterprises with less than 250 employees. Italy leads the EU, with more than 40% of the total turnover of the EU's T&C industry, followed by Germany, France, and Spain (see Fig. 1.2). Within the EU, approximately 7 kg of textile products are produced per person per year, while per capita consumption is nearly 26 kg. The EU is, therefore, a net importer of textiles, these being mainly clothing products from Asia (European Environment Agency, 2019). Furthermore, in the EU, approximately 11 kg of textiles per person are discarded annually, with a very low collecting and recycling rate (EURATEX, 2022), with the majority of collected used clothing and textile waste being exported to Eastern European countries, Asia, and Africa, or

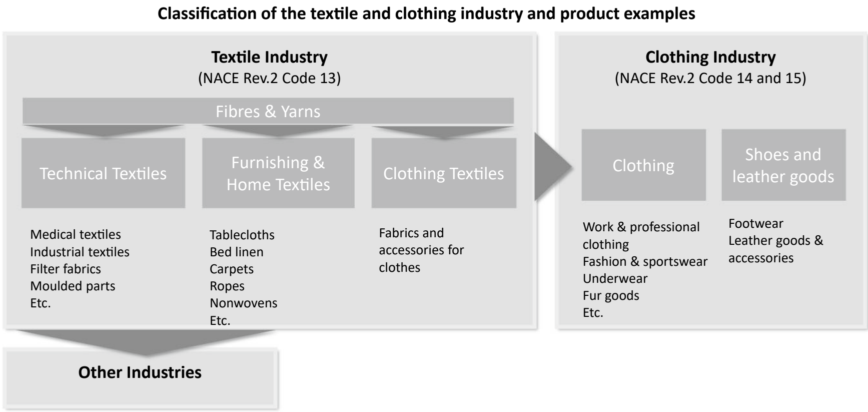

Fig. 1.1 Overview of the T&C industry. Based on Neugebauer and Schewe (2015) and EURATEX (2024)

ending up in landfills or incineration plants (European Environment Agency, 2019, 2023).

1.3 Problem Discussion and Research Objectives

According to the European Environment Agency (2019), clothing, shoes, and household textiles constitute the fourth-largest burden category (after food, housing, and transportation), as regards consumption of primary resources in the supply chain in the EU. This, coupled with the high environmental impacts and a low recycling rate, underscores the linear model of the textile supply chain and justifies its status as a focus industry within EU's Circular Economy Action Plan (European Commission, 2020), which aims to make textiles more durable, repairable, reusable, and recyclable, and promote innovation in the industry. New legal measures require T&C companies to have or provide new eco-design specifications, clearer information, a digital product passport, and specify carbon and environmental footprint reduction targets, among many other regulations (European Commission, 2022b). To achieve a fully circular economy, circularity and sustainability must be integrated into all stages of the value chain: from design and production to the use phase and waste management. However, the empirical exploration of what changes and collaborations are necessary and of value to implement sustainable and circular production and consumption patterns remains largely unexplored (Franco, 2017; Rinaldi et al., 2022). In particular, how digital technologies, such as Blockchain, Artificial Intelligence, the Internet of Things and others (Furferi et al., 2022; Rinaldi et al., 2022) can be effectively harnessed to support this transition has received relatively little focus in the research literature.

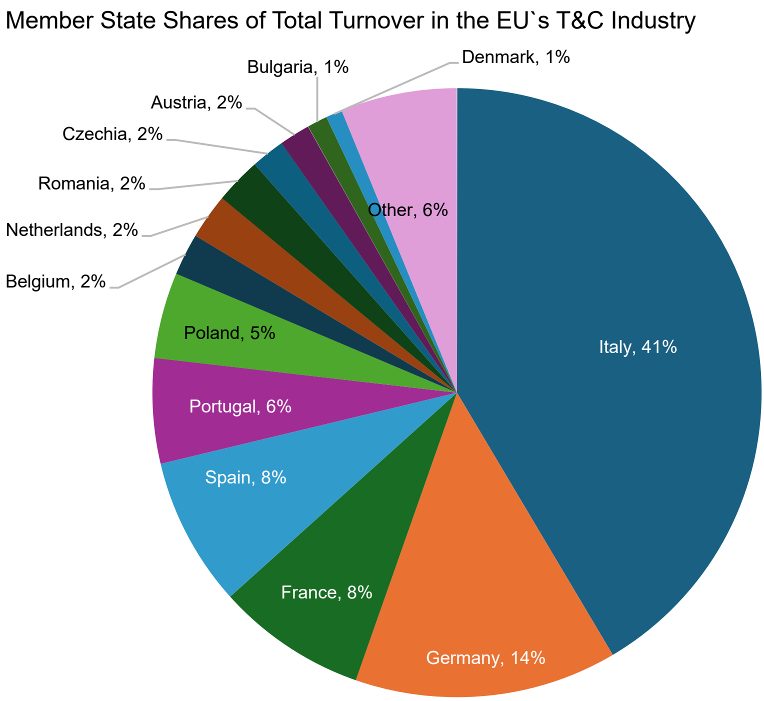

Fig. 1.2 Member state shares of total turnover in the EU's T&C industry (incl. NACE Rev. 2 Codes 13, 14, 15). *Source* Eurostat (2024)

Recently published research (Wiegand & Wynn, 2023) suggests that there are four conceptual and operational areas that must be progressed to successfully transition the T&C industry to a new model and sustainable future. First, the adoption of sustainable business strategies and activities that align with triple bottom line accounting and the United Nations Sustainable Development Goals; second, the integration of CE practices into the full range of business processes, from procurement and product design to production and customer engagement across the extended supply chain; third, the deployment and exploitation of digital technologies to enable and leverage CE practices and benefits; and fourth, an integrated management approach to holistic change that involves all relevant stakeholders—suppliers, manufacturers, retailers and consumers. The authors also suggested that this transition must encompass coordinated change in three main interrelated areas—processes, products and the organisation (Fig. 1.3).

The aim of this book is, therefore, to examine the nature of the European T&C industry, focusing on the relationship between sustainability strategies, CE practices, and digital technology deployment. The book provides a profile of the industry in several European countries, enabling comparisons and contrasts, as well as the development of recommendations for future changes and developments by:

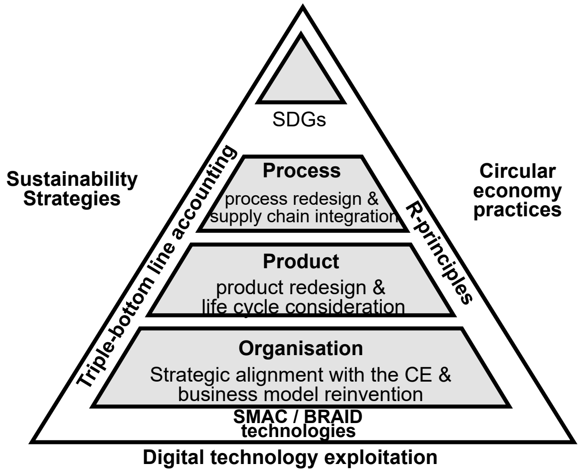

Fig. 1.3 A conceptual model for transitioning to the circular economy. *Source* Wiegand and Wynn (2023)

(1) exploring how the T&C industry is addressing sustainability in corporate strategies and activities
(2) assessing what strategies and activities relating to the CE are being pursued and
(3) examining the role of digital technologies in the transition to sustainability and the CE.

1.4 Research Methodology

The research methodology for this book is based upon a pragmatic case study approach, which emphasises the importance of practical implications and real-world applications and acknowledges the complex nature of the T&C industry. This is case study research in the sense that nine European countries are seen as case studies of how sustainability, the CE and digitalisation is impacting the T&C industry in each national context. However, within each case study, a number of different approaches are adopted to address the three main research objectives noted above. In the main, the approach is qualitative, with some chapters including primary data from interviews, for example, whilst other chapters rely mainly on secondary data sources. Overall, however, the chapters share the common ground of focusing on the three themes noted above, albeit the approach and methods vary somewhat from country to country (and from research team to research team).

According to Babbie (2010), the purpose of research is either exploratory, descriptive, or explanatory. Theory development in the field of sustainability, the CE and digitalisation is still in its infancy, and thus this research can be classified as mainly exploratory, with elements of descriptive research design which attempt to describe different characteristics of a phenomenon. Case studies are empirical inquiries which collect detailed information using a variety of data collection procedures over a sustained period of time (Stake, 2010). There is also a strong epistemological justification for using the case study methodology, since the aim is to achieve an understanding of a modern-day phenomenon that is both multifaceted and dynamic (Lewin & Johnston, 1997). In this context, the study aims to generate a comprehensive understanding of the status of the transition towards sustainability and circularity in the European T&C industry and the role digital technologies are playing in this transition.

A case study research strategy can be adopted to examine complex issues, allowing a full investigation and comprehension of emergent themes (Yin, 2017). It empowers a researcher with the tools necessary to inspect the information within a particular setting (Bernard, 2012) and it is a powerful research strategy that provides an all-encompassing, inside and out, examination of a particular phenomenon (Thomas, 2015). Yin (2017, p. 13) defines the case study research strategy as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used”. Simons (2009, p. 21) also defines case study as “an in-depth exploration from multiple perspectives on the complexity and uniqueness of a particular project, policy, institution, programme or system in a real-life context”.

The case study is a widely used research method within business and academic research. Bryman and Bell (2011) argue that the case study is particularly appropriate when used in conjunction with qualitative research methods, allowing detailed and intensive research activity, usually in combination with an inductive approach as regards the relationship between theory, research and practice. This is of particular relevance to the study of the T&C industry in a range of European countries. Saunders et al. (2019) argue that case studies are of particular value for explanatory or exploratory investigation, such as that pursued in this research. While case study research usually involves working with one or more related cases, it often leads to the generation and collection of a lot of data (Gomm et al., 2000), and some researchers have indicated that conducting case study research can sometimes be rigorously long and hard to direct (Noor, 2008). Here, the case studies under investigation focus on the T&C industry in a range of European countries. The book reports on the findings from nine different countries and also draws upon available literature in a number of other European countries where the T&C industry has been the subject of recent research.

The generalisation of findings to a wider population is a significant issue. With the case study strategy, being able to generalise from one case study is quite complex (Thomas, 2015), and this is often seen as a limitation of the case study strategy. Tight (2017) suggests that the use of multiple case studies offers an obvious acceptable strategy to combat this limitation, and this study makes use of multiple case studies in order to support generalisation and validate findings. The use of multiple case studies allows the researcher to seek similarities or differences between cases (Baxter & Jack, 2008), and although information from one case study can provide insight into a phenomenon, multiple case studies allow for the aggregation of knowledge from multiple units (Noor, 2008). With multiple case studies, data from wider perspectives can be gathered and analysed rigorously with a mind to generalise the findings beyond

Table 1.1 T&C industry (incl. NACE 13, 14, 15) parameters in countries featured in the research as of 2020

Country	Turnover (€ million)	Number of companies	Number of employees
Italy	67,708	352,928	451,623
Germany	22,746	9,495	136,231
Türkiye	14,287[a]	91,788	1,131,497
France	13,010	27,433	121,476
UK[b]	10,695	8,987	95,136
Portugal	9,089	14,799	174,148
Romania	4,018	8,194	159,216
Bulgaria	1,753	4,893	89,898
Denmark	1,421	715	4,934

Source Eurostat (2024) and Turkish Statistical Institute (2023)
[a] Turnover in Euro (converted with exchange rate 1 TL = 0,034 Euro as of Oct 2023)
[b] Data for the UK as of 2018 (last year of EU Membership)

just a single unit but across industries, countries or other particular interests. Although they are generally considered time consuming, expensive and complex to carry out (Gustafsson, 2017), the results from these studies are generally accepted in academia to produce more reliable results when compared with single case studies (Baxter & Jack, 2008; Blaxter, 2010). Yin (2017) suggests that the use of six to ten case studies is sufficient to provide compelling support for an initial set of propositions, and this aligns with the approach adopted here.

The cases within the EU countries studied here include the top three in terms of revenue (Italy, Germany and France), the fifth and ninth (Portugal and Romania), and two of the smaller nations (Bulgaria and Denmark). Outside the EU, the UK has a turnover in excess of €10 billion in the industry, at roughly the same level as Portugal. Table 1.1 indicates turnover in 2020[1] for the countries studied, and in addition shows the number of companies and employees in the industry in each country. This reveals significant differences in the size of companies, with France averaging four employees per enterprise, whilst Germany has almost 15, Bulgaria more than 18 and Romania over 19. Turnover per employee also varies significantly with Denmark, Italy, Germany, and France being the most revenue generative, and Romania and Bulgaria the least. This no doubt reflects the differing nature of the industry in these countries, which is explored in more detail in the core chapters of the book that follow.

[1] Data from Eurostat for annual detailed enterprise statistics for industry (NACE Rev. 2, B-E) are only available for the years 2005–2020.

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Chapter 2
United Kingdom

Rachel Vieira and Peter Jones

Abstract The UK textile and clothing (T&C) industry has a global reach and embraces a range of elements, including raw material production, treatment and manufacturing, and all of these elements pose testing sustainability challenges. With this in mind, this chapter looks to explore how some of the major players within the UK's T&C industry are publicly addressing sustainability. More specifically, it focuses on three research questions. Firstly, how are the leading companies within the UK's T&C industry publicly communicating their transition to sustainability? Secondly, in what ways are the UK T&C companies harnessing the CE to support this transition? Thirdly, what role are digital technologies playing in facilitating sustainability and the CE in UK T&C companies? The findings reveal that while the majority of the selected companies have publicly addressed sustainability, albeit in varying measure, the companies have provided much less material in the public realm on the role of the CE and the digital technologies in facilitating corporate approaches to sustainability. More generally, the authors offer some critical reflections on the selected companies' approaches to sustainability, the CE, and the digital technologies.

Keywords Sustainability · Circular economy · CE · Digital technologies · UK textile and clothing industry

2.1 Introduction and Background

The UK textile and clothing (T&C) industry has a global reach and embraces a range of elements, including the production of the raw materials, a variety of treatment and manufacturing processes, retailing and consumption, and all these elements face

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a variety of environmental and social challenges. The production of the raw materials, spinning them into fibres, weaving these fibres into fabrics and dyeing, for example, require large volumes of water, as well as chemicals, notably pesticides and insecticides. Widespread concerns have been expressed about working conditions, notably forced labour and modern slavery, in T&C manufacturing factories in retailers' supply chains. Here consumer demand for cheap clothes and fast fashion is seen to be driving the clothing retailers' business model, which is based on cheap labour and low prices. At the same time, western consumers' clothing shopping behaviour generates the emission of greenhouse gases, associated shopping journeys, and online shopping deliveries, and is more generally seen to be part of unsustainable patterns of consumption. In short, the transition to sustainable patterns of development within the T&C industry faces a variety of pressing public challenges, and according to DeSL (2022), a digital transformation solutions consultancy, "sustainability is no longer optional" in the "retail, fashion, apparel and footwear industries" (para. 14). A variety of approaches have been put forward to tackle the industry's sustainability challenges, including adopting a more circular business model and harnessing the digital technologies.

The T&C industry is complex and can be seen to include a number of interlinked elements, namely the production of materials, including cotton fibres, leather, fur and silk that form the primary units in cloth making the manufacture of men's, women's and children's apparel; and retailing. Within the UK, the retail element is arguably the most prominent. The retailing of clothes embraces a wide range of routes to market, including department stores, speciality stores, boutiques, discount stores, outlet stores, supermarkets, retail warehouses, online sales, and second-hand shops.

The T&C industry was a driving force in the UK's industrial revolution in the seventeenth and eighteenth centuries and a leader in world exports. It developed as a result of the demand for clothing for the country's rapid growing population. Before the eighteenth century, the T&C industry was essentially a domestic industry and had been undertaken by individual workers in their own homes. Initially the clothes produced from wool and flax were functional, but by the middle of the eighteenth century, increasingly skilled craftsmen and craftswomen were using cotton and linen to make more fashionable clothes, demanded by the more affluent sections of the population.

During the eighteenth century, a number of inventions and innovations, including the flying shuttle, the water frame, the spinning jenny, and the power loom, along with the harnessing of steam power, saw the textile industry transformed from a craft-based cottage industry to a highly mechanised one, centred on factories (or mills, as they were widely known) in Manchester and South Lancashire. Textile manufacture in the UK was at its height at the turn of the twentieth century, but declined during that century in the face of increasing competition from cheaper overseas producers and the growing importance of synthetic fibres, including rayon and nylon. In 2020, there were 8,245 manufacturers operating in the UK fashion and textile sector (ukft, 2021).

In this context, this chapter explores the T&C industry in the UK, and assesses how some of the industry's major players are publicly addressing sustainability. In doing so, it considers if, and how, the circular economy (CE) and digital technologies are playing a role in the transition to sustainability within the industry in the UK. More specifically it addresses the following inter-related research questions (RQs):

RQ1 How are the leading companies within the UK's T&C industry publicly communicating their transition to sustainability?
RQ2 In what ways are the UK T&C companies harnessing the CE to support this transition?
RQ3 What role are digital technologies playing in facilitating sustainability and the CE in UK T&C companies?

This chapter comprises five main sections. Following this introduction, the research method is briefly discussed in Sect. 2.2, based on a literature analysis of the available material provided by eight selected companies in the T&C industry in the UK. Section 2.3 then addresses the RQs, followed by a discussion Sect. 2.4, in which some of the key emergent themes are set out and examined. Finally, the concluding Sect. 2.5 provides a summary of the chapter and offers some thoughts on possible areas for future research.

2.2 Research Method

The research method employed in this study is inductive and qualitative, being founded on an interpretivist philosophy. Gill and Johnson (2002) concluded that such an approach is well-suited to exploratory research which aims to develop an explanation of the phenomenon being studied. There were four main phases to the research process (Fig. 2.1). First, a scoping literature review was undertaken to research key themes and develop the research questions noted above in Sect. 2.1. As observed by Hanneke et al. (2017), scoping reviews "are best employed when there is limited literature to inform the research question of interest" (p. 5), as was the case in this study. Various academic databases, including Google Scholar and Science Direct, were searched for relevant literature.

In phase 2 of the research, and in order to explore the RQs, leading companies in the T&C sector were identified for more detailed scrutiny. The top five textile manufacturing companies, namely Coats, MAF, Quantum Clothing Group, Karazeen Textile and Jimmy Choo, as listed by ZoomInfo (2023), and the top five clothing retailers, namely Next, J.D. Sports, Primark, Marks and Spencer (M&S), and Asda, as listed by Retail Economics (2023), were selected for investigation. The authors then chose a simple method for further enquiry, based on three sets of Internet searches, conducted on the Google search engine, in October 2023. These searches used the key terms "sustainability", "CE", and "digital technologies" in conjunction with the names of the top five textile manufacturing companies, and the top five clothing retailers.

The search revealed that of the selected ten companies, five companies (Coats, Next, JD Sports, Primark, and Asda) posted dedicated sustainability reports (or

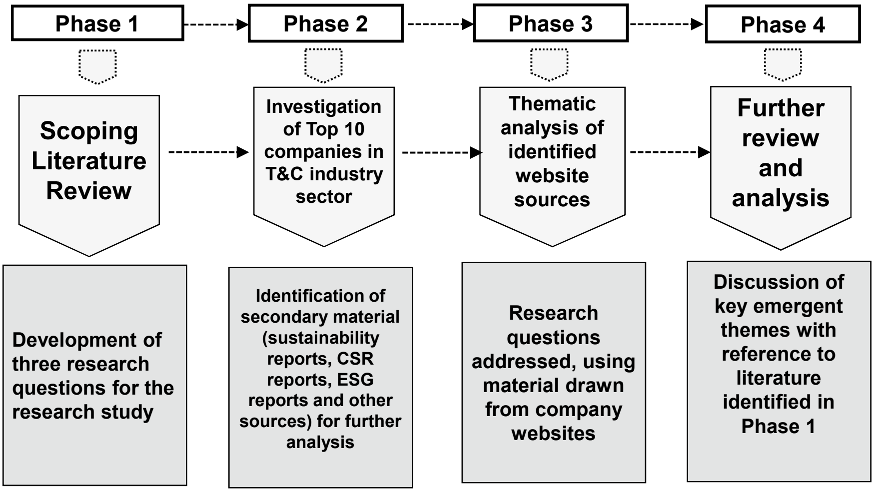

Fig. 2.1 The four phases in the research process

Corporate Social Responsibility reports or Environmental, Social and Governance reports, or Integrated Annual Reports which embraced sustainability), and that a further three companies (Quantum Clothing Company, Jimmy Choo, and M&S) posted information on their approach to sustainability on their websites. The investigation therefore focused on these eight companies. Further, while only Coats had posted specific information on its approach to the CE, the sustainability reports posted by Jimmy Choo, Next, JD Sports, Primark, and M&S included some material on circularity, and while Asda's sustainability report did not mention the CE explicitly, it did include material on recycling. Only three of the selected companies posted material on how the digital technologies were harnessed to promote sustainability. Phase 3 of the research analysed this material to directly address the three RQs set out in Phase 1. Then, in Phase 4, further analysis identified additional perspectives for review and discussion. The empirical material on which this chapter is based was drawn from the corporate reports and information generated by these searches. Pen pictures of the selected companies are provided below.

Coats is a UK based multinational thread manufacturing company, and was founded in Paisley, Scotland in 1755, has operations across 50 countries and employs 17,000 people. The company works with 30,000 apparel and footwear manufacturers and 4,000 retailers and its products are sold in over 100 countries. The Quantum Clothing Company manufactures and supplies clothing and apparel, particularly women's lingerie, sports and shapewear products, to a number of European retail companies. The company, founded in 2000, has its Head Office in the UK and owns manufacturing sites in Sri Lanka and Cambodia, employing 5,000 employees. Jimmy Choo, founded in 1996 but acquired by Capri Holdings in 2006, is a luxury UK fashion company.

Next is a multinational UK clothing and footwear retailer, originally founded in 1864. The company trades from some 700 stores, of which 500 are in the UK, where it is the country's largest clothing retailer, with a further 200 in mainland Europe, Asia and the Middle East. JD Sports is a UK sports omnichannel fashion retailer, founded in 1981. The company trades from 3,400 stores principally in the UK, but also in mainland Europe, North America, and the Asia Pacific region. Primark is a leading clothing international retailer, founded by Associated British Foods in 1969, and has over 400 outlets across Europe and the US. The retailer's products include menswear, womenswear, and children's wear, and the company has some 70,000 employees. Marks and Spencer is a UK multinational retailer, established in 1894. The company's product range includes, clothing, food, and household goods. Asda is a UK supermarket retailer founded in Yorkshire in 1965, it trades from over 600 locations within the UK, and the company's product range includes food, general merchandise and clothing. The George at Asda brand is one of the UKs leading clothing brands, and is available within the company's stores and in some locations in free standing outlets.

The chapter draws extensively on quotations from the selected T&C companies' websites, and the aim here was to explore how the selected companies publicly expressed, and looked to evidence, their approaches to sustainability, the CE, and the digital technologies. Here, the authors were of the opinion that an important way of capturing such approaches was to cite the companies' own words, not least in that such citations could convey corporate authenticity, and offer greater depth of understanding.

2.3 Findings

2.3.1 How Are the Leading Companies Within the UK's T&C Industry Publicly Communicating Their Transition to Sustainability? (RQ1)

The sustainability reports and information posted by the selected UK T&C companies varied in their detail and content, but rather than looking to describe each company's approach to sustainability in detail, the authors looked to identify, and draw out, a number of interlinked general themes to provide a narrative account to capture how the companies were addressing sustainability. These are: strategic corporate commitment; climate change and greenhouse gas emissions; energy efficiency; materials; water; biodiversity; waste; responsible sourcing and supply chains; human rights and modern slavery; health and safety at work; diversity, equity and inclusion; links with communities; and the United Nations Sustainable Development Goals (SDGs).

Strategic corporate commitment was articulated in a variety of ways. In his introduction to Primark's "Sustainability and Ethics Report 2021/22" (Primark, 2023), Paul Marchant, the company's Chief Executive Officer, claimed: