UK TEXTILES MANUFACTURING:

OPPORTUNITIES AND CHALLENGES FOR THE UK AND MIDLANDS

IPRC
The Industrial Policy
Research Centre

Loughborough
University

mtc
Manufacturing
Technology Centre

CATAPULT
High Value Manufacturing

CONTENTS

FOREWORD

A lack of understanding of international manufacturing capabilities and the potential to innovate in fabrication and tooling has hampered the development of the UK textiles industry. The best way to achieve its sustainability goals within Industry 4.0 is to modernise beyond current international manufacturing standards, developing new technologies and upskilling workforces. The environmental challenges include the demand for net zero emissions in manufacturing and distribution by 2050, the need to minimise extraction of raw materials, and reducing the amount of textiles that are sent to landfill. These challenges could be addressed by developing new agile tooling and digital technologies such as microfactories.

The future of manufacturing can be more flexible and need not necessarily be tied to major cities, which will help to shorten supply chains and lead to more localised production for local markets. Many recent fashion industry reports have focused on the circular economy and sustainability concerning textiles or retail, but the modernisation of garment manufacturing is largely considered to be beyond the remit of the reporting [1].

Gatekeepers and lobbyists to the industry have not had a significant impact on government thinking because they don't understand the necessity to overhaul production capabilities. UK garment manufacture is perceived to be at least 20 years behind global competitors. Producing less at a higher quality should become the norm, but it will not be cheap, and there will be a need to continue to explain to the UK public the true cost of garment production. Some of this cost can be ameliorated by adopting lean manufacturing systems or pull-based supply chains, with on-demand models of production. De-risking innovation for the fashion industry will mean leveraging other industries' technologies and trends, and sectors such as food production, automotive, and aerospace, could provide models of bespoke systems.

The so-called microfactory prototypes that already exist often rely on mass customisation rather than new designs to engage consumers where they specify colours, prints, logos, embroideries etc. This is an approach that often adds to the complexity of disassembly and recycling, and usually the proliferation of low-value products. These systems can offer body scanning for fit, but the size and fit preference is a very complex area, as witnessed in the volume of returns when consumers purchase clothing online.

The UK trains world class fashion designers and has world class engineering and technology businesses which could support a new approach to fashion design and manufacture. To create this vision, designers and engineers will need transdisciplinary training, aimed at developing an understanding of manufacturing, as a fundamental skillset.

1 https://s3-eu-west-1.amazonaws.com/ukft/wp-content/uploads/2018/05/13115441/Repatriation-of-UK-textile-manufacture-The-Alliance-Project-Report.pdf

https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/1952/report-summary.html

https://bftt.org.uk/wp-content/uploads/2021/08/BFTT_Mapping-the-UK-Fashion-Textiles-and-Technology-Ecosystem_2021.pdf./

https://9dbc3c3f-8613-4a49-a8bb-a21c9f908f3d.usrfiles.com/ugd/9dbc3c_1be38405ba924d3d9418d641354cf249.pdf

https://ellenmacarthurfoundation.org/topics/fashion/overview

https://instituteofpositivefashion.com/Circular-Fashion-Ecosystem

Adding a design plus engineering perspective will have a disruptive influence on the way that business for fashion design is done. There needs to be a cultural shift for new technology interventions to be fully embraced. A STEAM+D model - that is, science, technology engineering, art, and maths, including D, the design element - has the potential to ensure a resilient economy in the longer term.

Designers' bench and desktop factory technologies - pattern cutting tools that enable digital development of pattern files that can be sent to producers via digital networks - have seen significant research by micro businesses in the UK in recent years. In the past, these tools, developed by large-scale international engineering firms wanting market dominance, were not accurate enough to produce well-fitting, high quality garments. The tools supported manufacturers where speed over pattern accuracy had become the dominant economic factor. Work to try and get digital systems to "speak to each other" is desperately needed.

There has been a lack of investment in the fashion manufacturing sector in the UK, which means the tooling available has not evolved to enable collaborative relationships between designer and robotic functions (robotics), which might include stitching, cutting, and finishing. If robots were able to perform sampling and prototyping tasks in collaboration with human operators, could they then store information for production? What if these robotic systems could be autonomous, when necessary, miniaturised, and self-assembling? Industry 4.0 and 5.0 economic theories see the central role of the skilled worker as pivotal to policies surrounding the future of work.

Most of the innovation in the fashion sector has come in high volume, low-value production, where repetitive and highly automated tasks are undertaken by machines with minders/operators. From a human perspective, this work, whilst a long way from the dark, dangerous, and dirty image of manufacturing still held by the British public, is rapid, repetitive, and dull. The deskilling of the workforce is clear, and even design skills risk becoming redundant. Technical textiles manipulated in these automated systems can

be seen to be driving the simplicity of garment shape and construction. Data-driven high volume production and economies of scale will mean fewer choices for consumers. Conversely, the development of disruptive technologies like 3D weave and knit for micro-production and zero waste manufacture will mean close co-operation between designers, engineers, yarn producers, textile technologists and consumers, which could revolutionise garment production and on-demand manufacturing.

For micro and SME fashion designers and manufacturers in the UK, finding the tools that meet their manufacturing needs has been very problematic. They are hacking technologies and repurposing them. Speed is not a necessity, but precision, a small machine footprint, versatility, and agility are valued. Emerging processes in chemical engineering and material science are being focused on reusing, repairing, and remanufacturing, and micro and SME businesses are producing and using mono fibre garment components, including finishes and trims, designed for ease of disassembly and recycling.

New tools are needed to support and facilitate this culture of repair and reuse. Making the business case for integrating automation into a highly creative sector, with the need for very high levels of agility in production processes, is a barrier that requires research in collaboration with all stakeholders. Concrete policy initiatives to enable the fashion manufacturing sector to thrive, for example, a new national industrial strategy, with full engagement from central and local government, is necessary for much-needed change.

Susan Postlethwaite
Professor of Fashion Technologies, Manchester Metropolitan University
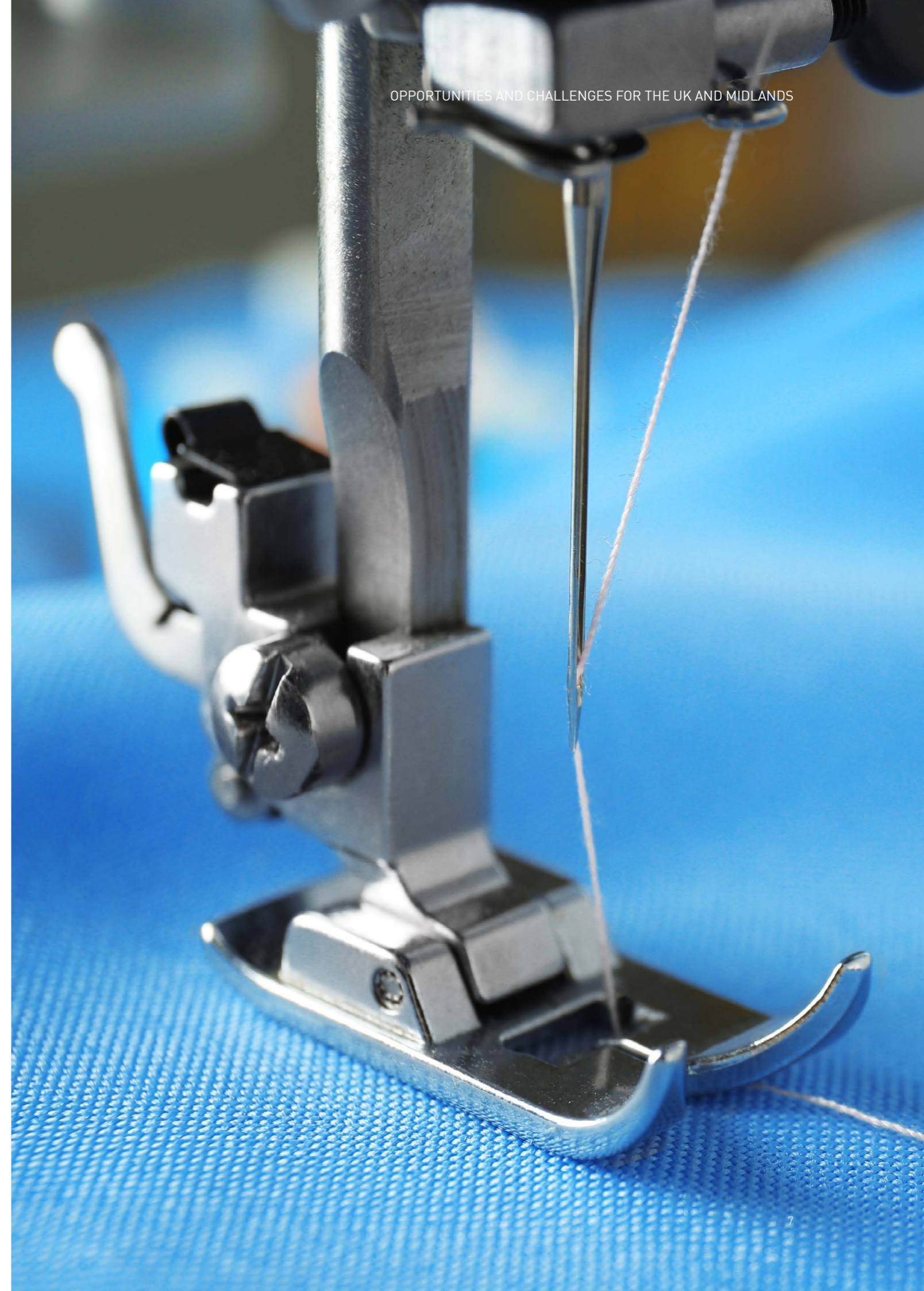
EXECUTIVE SUMMARY

Manufacturing plays a vital role within the UK and is a key driver in the development of strong local economies. In recent decades, the UK textiles and fashion industry has been in a slow decline, finding itself unable to compete with the growth of the 'fast fashion' culture and the use of cheap labour and materials from overseas. For the UK to revitalise its clothing and textiles industry, there are several barriers to entry that need to be overcome, including consumer shopping habits and the reliance on other countries for manufacturing. By taking advantage of the recent changes worldwide due to the pandemic, Brexit, and the advent of new technologies such as Industry 4.0, several opportunities arise which can restore the UK's rich heritage in the textile sector.

The purpose of this paper is to set out the current state of UK textiles and clothing manufacturing. It explains the global context of the UK industry, and the current policy and regulatory environment in which it operates. It presents several opportunities for companies within the supply chain, with a specific focus on how manufacturers can contribute. Some of the key points identified are:

- Garment manufacturing in the UK has not fared well since at least the early 2000s. Many manufacturers found themselves unable to compete with the relatively low cost base of rivals based in China and South Asia, while at the same time consumer demand for increasingly cheap and disposable 'fast fashion' soared. Starved of investment, many UK manufacturing facilities were unable to compete and closed.

- The industry is expected to undergo profound reshaping in response to disruptive events including the digital revolution, the 2008 financial crisis, Brexit, the pandemic, and the climate crisis. This reshaping will undoubtedly challenge the manufacturing sector, but also bring with it exciting opportunities.

- Companies who can pivot between sectors gain access to several opportunities, including the acceleration of the development of new technology, leading to more effective decision making and better business success. Transferrable skills relevant to new textiles and clothing (T&C) manufacturing, and new working practices which can improve efficiency, save time and reduce costs.

- Embracing a more circular economy and reshoring manufacturing is a key strategy to eliminate waste in the textiles and fashion industry. It can also provide benefits from reduced logistics time and cost for materials. The faster turnaround between order and delivery allows more agility in response to fluctuating demand.

- There is a lack of understanding within the textiles community of how new technologies such as automation and robotics can support manufacturing, and due to limited grants and funding, the adoption of this technology has been lacking.

- New manufacturing processes such as computerised systems, customisation, automation, and smart factories, can help to unlock the potential of the UK textiles and clothing industry, allowing highly skilled workers to complete tasks which need highly skilled human engagement, whilst robots carry out repetitive and resource-intensive work.

- A coordinated approach to skills and training is needed. A new environment is required for the training of workers which focuses on linking new industry practices, like the use of robotics and automation, to mature and pre-established skills in which the UK has a wealth of experience.

From the review of the current capabilities and future opportunities, several recommendations have been proposed so that the UK can take advantage of the openings presented within the sector, and create a more resilient and sustainable supply chain:

RECOMMENDATION 1

The UK textiles industry, with input from academia, industry, and government, needs to come together to create a coordinated and targeted policy framework, supported by a detailed action plan specifically focusing on manufacturing. This should be in line with the UK's Net Zero Strategy: Build Back Greener, as well as policies such as the 25 Year Environment Plan, which mandates the improvement of resource efficiency and the reduction of waste through the development of a circular economy.

RECOMMENDATION 2

There needs to be an urgent shift to demand-led manufacturing, where production is based on actual demand and not just forecasts. Currently retail is demand-led in the sense of cheap products, but manufacturing is not. This misalignment causes acute pain for manufacturers. The adoption of new technologies and Industry 4.0 principles have the potential to enable more data-driven manufacturing, less resource-intensive recycling methods, and more agile and reactive production lines.

RECOMMENDATION 3

Consumer education should be addressed, providing information to help consumers understand the damage and repercussions that fast fashion is having on the industry and the environment. Increasing the emphasis that consumers place on ethical standards and sustainability, as well as the reuse and recycling of garments, is vital to ensuring that shopping habits change to more sustainable practices.

RECOMMENDATION 4

Embracing a more circular economy and reshoring the manufacture of garments needs to be prioritised. This will allow the UK to eliminate waste in the textiles industry by increasing the reuse of resources and designing garments for extended use and recycling, rather than for one-off use and disposal. It can also provide benefits from reduced logistics time. The faster turnaround between order and delivery allows more agility in response to fluctuating demand and consumers' growing interest in a more distinctive fashion. This all contributes to reaching the net zero target for UK manufacturing.

RECOMMENDATION 5

Sector-specific regional development should be increased, providing support focused specifically on micro/SMEs. The UK, and the Midlands specifically, has a wealth of smaller businesses that work within, and in adjacent sectors to, textiles. Providing these companies with spaces to share cross-sector knowledge, access equipment outside of their current budget, and opportunities to work collaboratively with reduced risk, can enable a healthier environment for growth.

RECOMMENDATION 6

Increased access to finance and investment should be made available. Weak access to debt and equity finance is a well-documented problem for SMEs, and within the textiles industry it has led to low adoption of new technologies, increasing pressure on the workforce and over-reliance on outdated methods and machinery. Government-funded institutions with a specific focus on the textiles and fashion industry can allow companies to make lower-risk investments to enable increased productivity, more agility within their manufacturing, and workers to focus more on high value-add activities rather than menial, resource-intensive jobs.

RECOMMENDATION 7

A coordinated approach to skills and training is needed. With the advent of digital technologies and a shift to a more circular economy, a new environment is required for the training of workers to re-establish pattern cutting skills married to robotics and digital technologies (beyond the desire for market dominance of existing digital pattern making systems) for a newly skilled workforce able to compete with international markets. Soft skills also require further development to make the transition to more efficient ways of working, coupled with a shift in mindset, with sustainability, recycling, and environmental impact all key considerations from design through to final sale.

INTRODUCTION

Recent reports of the textiles and clothing industry explore its decline within the UK, and set out opportunities for the transformation of an industry with a highly globalised supply chain. Several key concerns emerge: the climate crisis and net zero is one, the fragility of global supply chains in a post-Brexit and post-pandemic world is another, and the urgent need to align the sector with rapidly changing consumer behaviour and preferences a third. There are of course more.

Despite the abundance of careful analysis, the status of textile and clothing manufacturing has been somewhat glossed over. The financial and environmental sustainability of manufacturing is critically dependent on shifting away from wasteful fast fashion-led overproduction, to truly demand-driven manufacturing based on new digital technologies and manufacturing processes.

A manufacturing focus is important for the Midlands given the concentration of clothing manufacturers based in the region, and the industry's contribution to local GDP and employment. The decline of UK manufacturing for the past few decades has led to a massive decline across more deprived regions. The textiles industry has historically been a key contributor to the Midlands'

manufacturing sector, and increased employment and investment in both the clothing and textiles sector, as well as in Midlands' manufacturing, can help to create a disproportional benefit to regions outside of the South East, allowing for regeneration and levelling up.

Additionally, the pandemic has exposed weaknesses in supply chains across a huge number of sectors, not just within the UK but worldwide. This has led to regions and companies recognising the urgent need to improve resilience within our supply chains, with one of the key solutions being the reshoring of overseas manufacturing facilities.

The purpose of this paper is to paint a picture of the current state of the UK textiles industry, and how it fits into the world market. The approach taken is to look to the future, exploring ways in which the UK can take advantage of the ever-changing political and technological landscape, restore the UK clothing and textiles industry, and provide resilience within the supply chain moving forward.

GLOBAL CONTEXT

The textiles and clothing (T&C) industry is a key industrial sector in many economies. The labour (rather than capital) intensive nature of the industry [2] means that it makes an important contribution to employment in both low wage developing countries and economically deprived regions of developed economies, for example, the European Union (EU).

Import quotas and other restrictive trade practices have been used to protect domestic T&C markets by developed nations and regions such as the USA and EU for well over 50 years. The global structure of the T&C industry has been strongly influenced by the differential implementation of quotas based on the country and/or product category, which have caused serious distortions [3]. For example, binding quotas caused economies including Hong Kong and Taiwan - which traditionally exported textiles to the USA and EU - to adopt alternative business models and to subcontract garment assembly to countries with unused export quotas, for example, Bangladesh and Vietnam.

Specialised production activities take place in locations with comparative advantages, for example, labour costs and overheads. Purchasing practices that pursue the cheapest price prevail, and the throwaway fashion culture has driven down prices at the factory gate and undermined profitability. Supply chain relationships have become transactional, and as the volume of the product has experienced rapid growth over recent decades, the profitability of T&C businesses has shrunk, while the environmental impact has increased.

The UK T&C industry, in particular manufacturing, lost out from globalisation and the sector has declined. Already an established trend, the decline was exacerbated by the 2008 financial crisis, Brexit and the pandemic. Overproduction resulted in extensive discounting, and before the pandemic, only 60% of garments were sold at full price, with the remainder discounted or destroyed. The pandemic devastated demand and further exaggerated pre-existing problems for T&C manufacturing. Because excess inventories were mainly held in the fashion retail segment, the manufacturing segment bore a disproportionate share of the pain, as orders with suppliers were cancelled by retailers unwilling to add further to their excess inventory in the face of unmanageable uncertainty around future demand. The vulnerability of supply chains built on a purely transactional foundation was exposed by the pandemic, and the revival of the T&C industry must be based on a demand-led, flexible model, which can respond rapidly to customer demand rather than by fixed seasonal collections.

Identifiable trends in customer behaviour and preferences have emerged over recent decades. Demand for cheaper goods increased dramatically and resulted in diminished quality. A culture of disposal resulted in customers buying frequently and cheaply with no expectation of longevity. At the extreme, consumers have expected to wear garments only once before discarding them, a trend fuelled by the ubiquity of social media platforms like Instagram.

The 'fast fashion' culture, where fashion is seen as a perishable good, requires substantial energy and other resources in manufacturing and generates significant waste. Recent research by First Mile - A UK environmental business focused on recycling and waste management - shows that 350,000 tonnes of wearable clothes are put into landfills every year in the UK. The waste embodied in the T&C industry has become increasingly unacceptable to consumers who are increasingly environmentally aware and willing to abandon brands that do not reflect their values.

Changing consumer sentiment gives rise to several emergent trends which raise opportunities for T&C manufacturers to innovate. For example, consumer demand for more individualised fashion offers the prospect of late-stage customisation, requiring textile and digital technologies capable of producing small scale runs with shorter lead times. Similarly, forecasting and interpreting consumer preferences using artificial intelligence (AI) and data-driven design support consumer preferences.

This adds to the complexity when we consider the end of life for the product, making disassembly and recycling more difficult, as well as resale and proliferation of the product. The potential for consumer dissatisfaction post purchase, due to the addition of personation and alterations, could also increase the amount of discarded clothing in this co-design scenario.

2   WTO Secretariat (2004) Nordas, H. The Global Textile and Clothing Industry post the Agreement on Textiles and Clothing
     https://www.researchgate.net/figure/The-cost-structure-of-the-textile-industry-selected-countries-2001-per-cent-of-gross
     _tbl2_255601778

3   WTO Secretariat (2004) Nordas, H. The Global Textile and Clothing Industry post the Agreement on T&C https://www.researchgate.
     net/figure/The-cost-structure-of-the-textile-industry-selected-countries-2001-per-cent-of-gross_tbl2_255601778

POLICY AND REGULATORY ENVIRONMENT

Regulation of the T&C industry, separate to general legislation around, for example, health and safety at work and minimum wage standards, is relatively sparse. The two main areas of regulation and policy environment that the UK T&C industry operates in are derived from both EU and UK jurisdictions: fabric composition and naming, and sustainability and environmental impact. Several documents set out policy frameworks and positions taken by UK institutions.

Regulation on fibre names and related labelling and marking of the fibre composition of textile is derived from EU legislation (Regulation (EU) No 1007/2011) [4]. The Regulation has been in force for around 10 years, and in the intervening period, little additional legislation specific to the T&C industry has been introduced at the EU level, although the rising importance of technical textiles may prompt regulatory reform. UK legislation in this area is similar to the EU as a consequence of its membership within the EU until recent times.

Regulation and policy relating to sustainability and environmental impact of the UK T&C industry have diverged from the EU framework recently, as a result of the legislative and policy changes introduced post-Brexit, driven in part by the UK's leadership of COP 26.

The key UK policy, Net Zero Strategy: Build Back Greener [5] (2021) (NZS) articulates a long-term plan for the UK's transition to net zero over 30 years. With a focus on decarbonisation, rather than a more general focus on sustainability which would capture, for example, water use and waste, the NZS identifies an average expected emissions reduction for the industrial sector of 63% - 76% by 2035 compared to 1990. The NZS sets out the tools that are expected to deliver net zero, including increased resource and energy efficiency, material substitution and fuel switching.

Given the dominance of micro and SMEs in the UK T&C industry, achieving this level of emissions reduction is likely to be a major challenge, particularly in the light of anecdotal evidence suggesting that net zero is not currently a focus for many SMEs and that securing funds for investment is often problematic for small companies. Therefore, it may be reasonable to expect emissions reductions for all but the largest firms in the T&C industry to be second-order effects, derived from, for example, the decarbonisation of the power system by 2035, the development of a robust hydrogen economy, and mandated energy efficiency standards in commercial buildings.

However, the NZS includes an ongoing assessment of fiscal and non-fiscal policy options to minimise the use of virgin resources, as well as the removal of barriers for SMEs to access energy efficiency measures and meet regulatory standards. The adoption of such policy options would suggest a more active role for SMEs in pursuit of net zero.

On wider environmental policy, the key policy is the 2018 25 Year Environment Plan [6] which mandates the improvement of resource efficiency and the reduction of waste through the development of a circular economy. The environmental impact of the transformation of the T&C industry is potentially large given its scale.

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:02011R1007-20130701&from=EN

[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/Net Zero-strategy-beis.pdf

[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

Active engagement with the objectives set out in these policy documents presents real opportunities for the UK T&C industry and manufacturing in particular. Technologies that may support the net zero transition include demand-side flexibility enabled by smart meters, particularly when combined with automation. A 2021 publication by the Industrial Policy Research Centre - Loughborough University [7], on robotics and automation, highlights some of the benefits of automation, but also notes that adoption of robotics and automation by UK firms lags significantly behind other countries. Similarly, in terms of resource efficiency and material substitution, new technologies for recycling, reuse, and remanufacturing, can keep products and materials in circulation for longer, which in turn reduces emissions from industrial processes.

The industry is responding to policy goals with enthusiasm. Indeed, in some respects, the industry is ahead of the policy. For example, a decade ago the UK sustainability charity WRAP set out to help the industry reduce the environmental cost of clothing and textiles, leading the development and implementation of the Sustainable Clothing Action Plan (SCAP), which ran from 2012 to 2020. This highly collaborative initiative gained widespread support from the industry and covered seven key areas, from the measurement of the environmental impact of all products to influencing consumer behaviour and reducing the impact of manufacturing processes. The results of the SCAP are impressive. Against a 2012 baseline, the carbon, water, and waste

footprints of signatories were reduced by 21.6%, 18.2%, and 2.1% respectively, and clothing in household waste was down by 4%. The average carbon emissions reductions set out in the NZS remain challenging, but the sector has already developed a set of tools and a mindset to accelerate progress towards this and other goals.

Building on the success of the SCAP, WRAP is now leading on Textiles 2030: UK Sustainable Textiles Action Plan, which identifies the next challenges and activities required to introduce pervasive circular use of materials. The transformation of the fashion industry into a global circular fashion economy is the ambitious goal of the Textiles Action Network [8]. Textile 2030 aligns its goals with those of the Paris Agreement and achieving net zero by 2050, and at the time of writing [9], Textiles 2030 is supported by 25 brands and retailers, 42 reuse and recycling organisations, and 38 affiliates including the British Retail Consortium, the British Fashion Council and the UKFT, as well as several universities and other organisations.

UK consumers buy more clothes per capita than any other European country, and the UK burns or buries 300,000 tonnes of used clothes each year. However, there are signs that consumer sentiment is changing, which is important because the consumer will play an important role in leading change. IPSOS Review of 2021 [10] reveals that 70% of respondents to their 2021 global surveys tend to buy brands that reflect their values, and the Co-op Ethical

Consumerism Report 2021 [11] showed that consumer expenditure on ethical personal products, including fashion, more than doubled between 2010 and 2020, with growth of over 16% between 2019-2020 alone. Both support WRAP's CEO Marcus Gover's argument that T&C businesses have made the reduction of environmental impact and working towards net zero core to their business models [12] in response to increased consumer demand for more sustainable clothing and fashion.

The UN's Global Impact Initiative addresses sustainability on a wider, global scale, with its 17 Sustainability Development Goals (SDGs) which aim to be integrated into businesses across all sectors. Of the 17 goals, all are relevant to the textiles industry, and Goal 17, 'Partnerships for the goals', encourages collaboration to achieve sustainability across the supply chain. Goals 8, 9, 10, 12 & 13 also directly involve themselves in the textiles industry, promoting a decent work environment with prospects for growth and innovation across the industry, from manufacturing practices and equipment, to materials and produced goods.

7 https://www.the-mtc.org/media/bdba0ls0/automation-and-robotics-research-paper-a4-pages.pdf

8 https://wrap.org.uk/taking-action/textiles/textiles-action-network

9 https://wrap.org.uk/taking-action/textiles/initiatives/textiles-2030/whos-signed-transform-uk-textiles

10 https://www.ipsos.com/sites/default/files/ct/publication/documents/2021-12/Year-In-Review-2021.pdf

11 https://assets.ctfassets.net/5ywmq66472jr/3kwPOTPk1xuAUGpJmyLEdM/1249d071ea404f526041af2fdd1e86f8/COP58366
   _Ethical_Consumerism_Report_Final.pdf

12 https://www.ukft.org/textiles-2030-roadmap-circularity-pathway/

STRUCTURE OF THE TEXTILE AND CLOTHING INDUSTRY

Key stages in T&C production include product design, materials production, manufacturing, and wholesale and retail sales, each with its own diverse supply chains. Myriad other sectors supply intermediate goods and services to T&C manufacturers, for example, digital technology providers, robotics manufacturers and logistics companies. The supply chain is therefore both broad and deep, or to put it another way, complex. Figure 1 illustrates a simplified version of the textile manufacturing process which captures key sub-sectors.

Traditionally, supply chains may be split into two general product streams, functional products and innovative products. Functional products are generally mass-produced and are not seasonal,

meaning they do not require redesigning more than twice per year, for example, some underwear or socks. Innovative products are more fluid and are likely to be refreshed every few months with a new function or design, for example, fashion items such as jackets.

However, the industry is expected to undergo profound reshaping in response to disruptive events including the digital revolution, the 2008 financial crisis, Brexit, the pandemic, and the climate crisis. This reshaping will undoubtedly challenge the manufacturing sector, but also bring with it exciting opportunities.
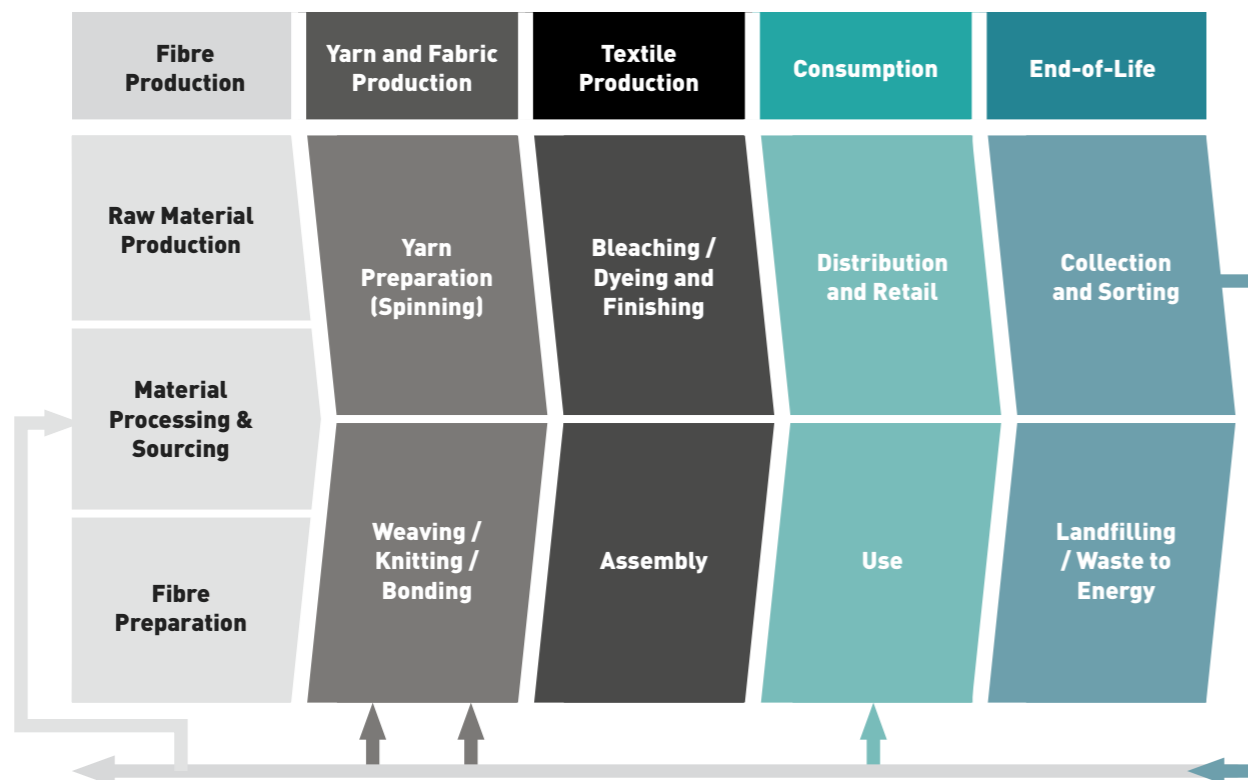
Fibre Production	Yarn and Fabric Production	Textile Production	Consumption	End-of-Life
Raw Material Production	Yarn Preparation (Spinning)	Bleaching / Dyeing and Finishing	Distribution and Retail	Collection and Sorting
Material Processing & Sourcing				
Fibre Preparation	Weaving / Knitting / Bonding	Assembly	Use	Landfilling / Waste to Energy

Figure 1: Textile Manufacturing Value Chain [13]

13 https://www.oneplanetnetwork.org/sites/default/files/unep_sustainability_and_circularity_textile_value_chain_1.pdf)

TEXTILES MARKET OVERVIEW

The UK is a relatively small player in textiles production In the EU context. Italy and Germany are the largest textiles producers by a considerable margin, and the largest three producers (Italy, Germany and France) accounted for around 60% of total EU production valued at around €12 billion in 2019 [14], while in the same year the UK was the sixth largest producer, with around €600 million production value.

In terms of manufacturing as a whole, the UK is the ninth largest manufacturing nation in the world [15], and UKFT reports that in 2020, the UK produced £9.1 billion worth of products and exported around £3 billion of textiles [16]. Despite these large numbers, over 90% of the fashion and textile products bought on the UK's high streets are imported, and imports account for a rising proportion of UK production.

Garment manufacturing in the UK has not fared well since at least the early 2000s. Many manufacturers found themselves unable to compete with the relatively low cost base of rivals based in China and South Asia, while at the same time consumer demand for increasingly cheap and disposable 'fast fashion' soared. Starved of investment, many UK manufacturing facilities were unable to compete and closed.

As with the EU, the UK T&C industry is almost completely dominated by micro (0-9 employees) and SMEs (10-249 employees), which account for around 89% and 11% of companies respectively. Of these, 33% are textiles companies, and 67% are clothing producers.

Textile and garment manufacturing in the UK has a strong heritage that differs by region. Specialisms in particular distinctive products, for example, Scottish cashmere and tartan, are well known. Historically, Midlands towns and cities have played important roles in manufacturing in general, and, in particular, the textiles industry. For example, ribbon weaving was Coventry's main industry from the early 1700s to the 1860s, employing around half the population. Similarly, Nottingham has a long history in lace making, and by the 1840s was exporting its lace internationally.

Office for National Statistics (ONS) data for firms [17] in fashion and textiles manufacturing reveals some important features of the industry in the Midlands region (Figure 2 - Figure 4). Figure 2 shows that the East Midlands is second only to London in terms of the number of enterprises engaged in fashion and textile manufacture. The number of firms engaged in T&C manufacture in the East and West Midlands combined, which approximates that in London, suggests the potential for a sectoral network or cluster.
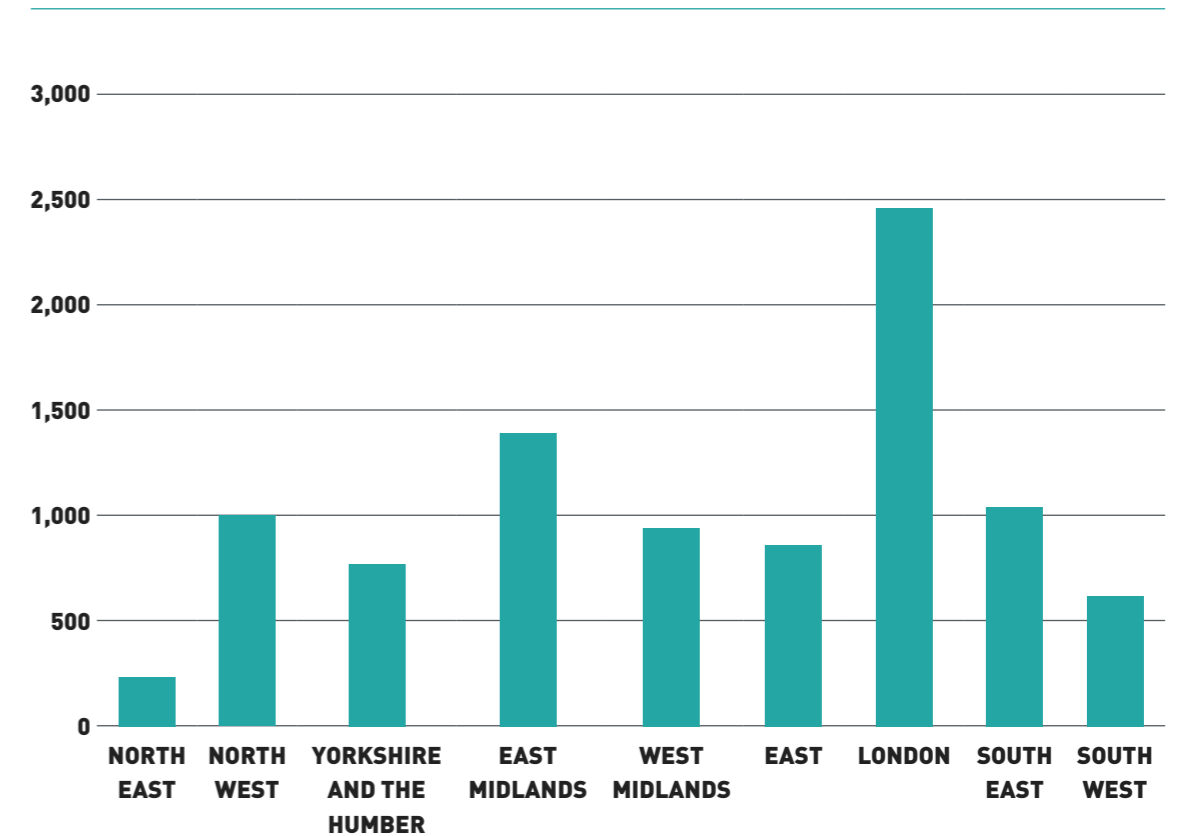

Figure 2: Number of Enterprises Engaged in Fashion And Textile Manufacture In The Year To March 2020

With regards to employment, the East Midlands has the greatest absolute number of employees working in fashion and textile manufacture, which is almost double that of London (Figure 3). Employment in the sector in the East and West Midlands combined is very significant. This suggests both a pool of expertise, and potentially a vulnerability. It has been reported that the average age of employees in the UK T&C industry is over 50, and more people are leaving the industry than joining it. The well-documented manufacturing skills shortage may therefore be expected to have a disproportionately severe impact on combined Midlands T&C manufacturing.
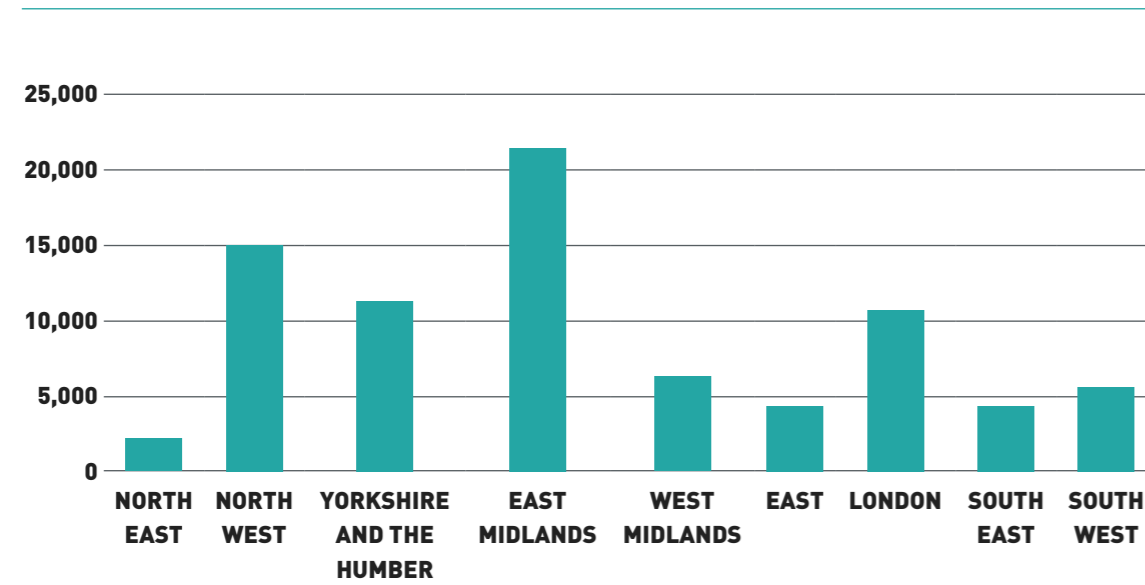
14 https://s3-eu-west-1.amazonaws.com/ukft/wp-content/uploads/2018/05/16125453/Euratex-Technical-Textiles-stats-2019.pdf

15 https://www.themanufacturer.com/uk-manufacturing-statistics/

16 https://www.ukft.org/business-advice/industry-reports-and-stats/

17 VAT and/or PAYE based firms engaged in fashion and textile manufacture, 2020 data ONS

Figure 3: Number of Employees in Fashion and Textile Manufacture in the Year to March 2020

Figure 4: Turnover (£'000s) of Enterprises in Fashion and Textile Manufacture in the Year to March 2020

In terms of turnover, the East Midlands region is second only to London and marginally ahead of the North West region (Figure 4). Although this suggests that the region is particularly susceptible to adverse effects of both Brexit and the COVID-19 pandemic, combined with the number of enterprises and employees in the T&C industry, it also demonstrates regional strength and potential opportunity.
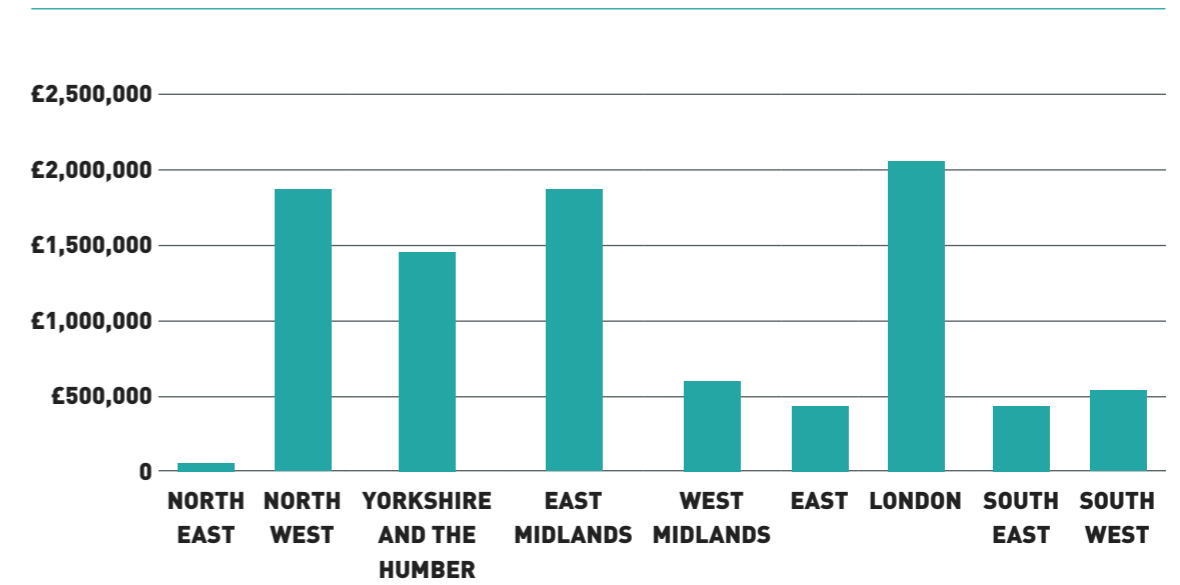
An industry structure strongly dominated by small firms suggests acute challenges for ambitious businesses wishing to expand and adopt new and emerging manufacturing technologies and processes. Weak access to debt and equity finance is a well-documented problem for SMEs, as are access to specialist business knowledge, access to international markets, and IP protection. These and other barriers partially explain the observed slow adoption of new technologies within and between textile manufacturers, and an over-reliance on outdated methods and machinery. Despite these challenges, small firms are often free of the cultural and historical drag that large corporations may experience, so are potentially flexible and agile in the face of changing patterns of consumer demand and fast-paced technological change.

The structure of T&C manufacturing implies both challenges and opportunities which are relatively well understood. The challenge for policymakers is to adopt a sector-specific approach that minimises the challenges, while releasing the potential of UK manufacturers.

Getting the policy framework right is particularly important for the Midlands given the strength of garment manufacturing in the region. In 2020, 645 East Midlands garment manufacturing companies turned over £430 million and employed over 8,500 people, while in the West Midlands 280 firms turned over £88 million and employed over 1,200 people [18]. Realising the potential of Midlands garment manufacturing could be transformational.

In addition to garment manufacturing, the Midlands has expertise in the relatively high added-value sub-sectors of technical textiles and materials for the aerospace and automotive industries and is home to over 17% of the UK's materials composites companies [19]. Technical and industrial textiles manufacturing is a growth market, and in the Midlands combined there are 60 firms in this sub-sector, which turnover around £150 million and employ 1,500 people. Again, this is a strong base for innovation and growth.

[18] ONS 2020 data - source

[19] https://ualresearchonline.arts.ac.uk/id/eprint/17172/1/BFTT_Mapping-the-UK-Fashion-Textiles-and-Technology-Ecosystem_2021.pdf

SKILLS AND TRAINING

The UK has acknowledged strengths in fashion and textile design, with some of the most highly regarded and high profile design schools in the world based in cities including London and Manchester, training internationally sought-after graduates. More generally the pipeline of workers for the T&C industry appears strong, with over 4,800 people studying a textiles course at a UK university each year [20], in addition to students following vocational training such as apprenticeships and T-levels launched in 2020.

To date, automation has been focused on high volume manufacturing systems that require relatively limited skills, outside of the ability to pay attention to detail, and the aptitude to operate, control, and manage equipment. This has led to a loss of skills and a downward spiral of interest in a career in manufacturing, which is compounded by the ageing workforce and more people leaving the sector than joining it.

Most manufacturers in the textiles and fashion industry report insufficiently skilled workers to fill existing job vacancies. A large majority report unfilled machinist vacancies and that Brexit has constrained their ability to recruit for these positions, as EU workers have returned to their home nations in response to the pandemic and Brexit, but have not returned in commensurate numbers [21]. The skills shortage is a constraint on growth, but also a motivation for manufacturers to evaluate their future needs and develop a concrete skills action plan. Calls for better-skilled school and college leavers are common, and there is a raft of training programmes either recently launched or under development. For example, the Textile Centre of Excellence in Huddersfield has researched companies' awareness of issues around Industry 4.0 and sustainable manufacturing. Demand for an initial set of one-day workshops was strong,

and they are currently drawing up plans for longer courses. Similarly, the Future Fashion Factory held a series of half-day Industry 4.0 Workshops in autumn 2021.

The combination of workforce attrition, the poor record of attracting young people to the sector, and the lead time inherent in training, means that manufacturers may need to prioritise re-training the existing workforce to perform quite different roles.

UKFT argues that the lack of young people entering the workforce is linked to a widespread and negative perception of the roles available in the industry, but other factors are likely to be in play. For example, the dominance of micro companies and SMEs which often necessarily focus on day-to-day operational issues and may have limited resources to invest in training, or for that matter, strategy. The former reliance of the industry on often highly skilled EU workers before Brexit, many of whom have left the UK workforce, compounds the problem.

Against this backdrop, T&C manufacturing in the future will demand a broad range of skills as technological advances embodied in, for example, Industry 4.0, present new opportunities as manufacturers respond to the fast-paced change in patterns of consumer demand and the retail environment.

The widening skills gap, in particular in technology and making skills, is well documented [22] [23], and several initiatives have emerged seeking to rectify the problem. For example, UKFT coordinates skills and training, collaborates with employers and other stakeholders to identify skills requirements for the future, and sets out apprenticeship standards to deliver a pipeline of skilled careers which appeal to younger workers [24]. Among the stakeholders UKFT works with is the Textile Centre of Excellence in Huddersfield, a not-for-profit private business

offering a range of quality assured flexible training programmes spanning all levels, from pre-entry traineeships to foundation degree equivalent programmes.

The Fashion Technology Academy [25] is an apparel manufacturing academy offering qualifications from levels 1 to 5, alongside the opportunity to gain exposure to the 'Best of British' manufacturing skills in a factory and fashion studio. In 2021, the FTA opened new campuses, including one in Leicester.

Although training provision appears to be improving, seizing the opportunities for growth associated with the transition to a circular textiles economy and the digital transformation in fashion retailing is likely to require a new mindset. The training environment must link skills like pattern cutting and machining with those in, for example, robotics and artificial intelligence.

Non-technical skills are also in demand, according to the Business of Fashion, Textiles and Technology Creative Research & Development Partnership (BFTT CRDP) [26], which argues that the ethical and sustainable development of the sector requires the development of soft skills. These include business development, the ability to collaborate, and leadership skills, as well as a stronger focus on diversity and inclusivity. While the focus of this paper is manufacturing, the development of the sector depends on a holistic approach that reflects the breadth of opportunities open to the industry.

20 https://www.ukft.org/british-textiles-in-numbers/ - :~:text=The UK's textile manufacturing sector,luxurious tweeds and distinctive tartans.

21 Reference from earlier draft – X party cttee

22 https://www.drapersonline.com/insight/analysis/how-ukft-is-minding-the-skills-gap

23 Harris, J., Begum, L., & Vecchi, A., 2021, Business of Fashion, Textiles & Technology: Mapping the UK Fashion, Textiles and Technology Ecosystem, University of the Arts London.

24 https://www.drapersonline.com/insight/analysis/how-ukft-is-minding-the-skills-gap

25 Fashion Technology Academy

26 https://bftt.org.uk/wp-content/uploads/2021/08/BFTT_Summary-Report_Mapping-the-UK-Fashion-Textiles-and-Technology-Ecosystem_2021.pdf

OPPORTUNITIES FOR THE SUPPLY CHAIN AND MANUFACTURERS

PIVOTING BETWEEN SECTORS

Digital transformation is profoundly altering how goods are manufactured and sold, and at the same time increasing opportunities for supply chain crossover as firms identify opportunities to enter new markets. The breadth of the T&C supply chain suggests that the industry offers potential for firms from a wide range of sectors, ranging from electrical engineering to business to design, particularly in the Midlands, which is a region known for its manufacturing expertise.

The Midlands Manufacturing Resilience Commission (MMRC) report, *Manufacturing Resilience* [27], argues that pivoting between sectors requires confidence, leadership, and explicit attention to collaborative engagement, possibly at the sectoral level. The sheer number of businesses active in T&C manufacturing in the region suggests the potential for the development of an active Midlands T&C manufacturing ecosystem, which may serve to attract businesses from a range of other sectors.

Cross-sector collaboration has been shown to accelerate the development of new technology, leading to more effective decision making and better business success. Transferrable skills relevant to a new T&C manufacturing reality include electrical science in smart materials, mathematics in the design of woven fabrics, chemistry in the dyeing processes, and mechanical, electrical, and other engineering skills within the production environment.

The Midlands has strength in medical technologies, technical and smart textiles, as well as more traditional T&C manufacturing, which offers numerous opportunities for businesses to establish themselves or expand into new areas.

For example, Nottingham-based company Footfalls and Heartbeats [28] has developed a revolutionary manufacturing process that allows the control and manipulation of both yarn-to-yarn interaction and the movement of micro-mechanical structures that form the basics of knitted fabrics. Its textile sensing technology has multiple potential applications, including integration into compression bandages used to treat chronic leg ulcers, ambulatory monitoring of ECG signals, and the measurement of mechanical stress in composite structures, for example, wind turbine blades.

Opportunities for pivoting between sectors are also generated by shifts in consumer sentiment, for example, the increasing emphasis consumers place on ethical standards and sustainability. Time and again poor working practices have exposed garment workers to terrible working conditions and shockingly low wages. Since the 2013 Rana Plaza disaster in Bangladesh, where at least 1132 people were killed and at least 2,500 injured, more than 109 accidents have taken place, including 35 textile factory incidents [29].

Poor working conditions are not confined to developing economies. In the Midlands, a scandal was exposed in 2020 by a Sunday Times investigation into conditions across the supply chain of one of the UK's leading fashion retailers. An independent review identified issues including identity verification, recording of hours, payment of wages, health and safety violations and instances of potential fraud relating to the COVID-19 furlough scheme [30], although the review found that breaches were not deliberate.

Poor or exploitative practices are increasingly unacceptable to consumers concerned with social justice and the human rights records of the brands they buy from. Generation Z consumers accounted for 40% of global fashion consumers in 2020, and in a McKinsey 2021 survey, 66% would stop or significantly reduce shopping at a brand not treating its own or suppliers', including manufacturers', employees fairly [31]. This is a strong motivation for change.

The requirement for T&C manufacturers to urgently address these challenges and show that they operate in a way that respects people, communities, and the planet [32] has shone a spotlight on transparency and traceability. This in turn is an opportunity for technology firms to work with the T&C industry.

For example, Segura Systems, based in the Midlands, was launched in 2015 to meet demand from suppliers for ethical, sustainable, and compliant multi-tiered supply chains. Segura now works with companies across the globe including leading UK high street brands. The ability to track products through the supply chain supports customers' confidence that the product they are purchasing has the expected provenance and helps to avoid unregulated subcontracting. In capturing detailed information, computerised systems are capable of supporting the reputations of large and small businesses, and the more widely used it is, the more effective it becomes.

27 https://online.flippingbook.com/view/310835/

28 Footfalls and Heartbeats Ltd.

29 https://www.ilo.org/global/topics/geip/WCMS_614394/lang--en/index.htm

30 The Times, Boohoo: fashion giant faces 'slavery' investigation

31 McKinsey, The State of Fashion 2021

32 Co-oP Ethical Consumerism Report 2021

RESHORING PRODUCTION

Reshoring (or on-shoring) occurs when a company returns a previously off-shored process or function to the company's country of origin. Given the highly globalised nature of the industry, and the growing emphasis on creating more streamlined, shorter, and more transparent supply chains, there is, in theory, considerable scope for reshoring among UK T&C manufacturers.

It was argued that global trade policy has strongly influenced global supply chains and that the UK struggles to compete economically with countries such as China when it comes to the manufacture of low value-added functional products, due to large differences in the cost base on wages and environmental standards. Although the efficiencies offered by the widespread adoption of robotics and automation may go some way to mitigate stark cost differences, in low value-added product spaces the significant capital investment required makes the economics look challenging, suggesting that the potential for reshoring functional products may be relatively limited.

The story around the potential for reshoring innovative and high value-added product manufacturing is different. The value of reshoring supply chains for innovative products lies in flexibility, logistics, and sustainability. Manufacturers of products that undergo regular re-design benefit from short (UK-based) supply chains, with reduced travel time and costs for materials and both supply and delivery to the home market. Faster turnaround times between order and delivery mean improved ability to respond to fluctuating demand and consumers' growing interest in more distinctive fashion.

The dominance of potentially agile micro and SMEs in the UK industry may be a strength here. For the Midlands, the relatively high density of businesses manufacturing both garments and more specialist technical and smart textiles is encouraging, possibly arguing for the deliberate development of a cluster. The reshoring process can reduce products' carbon footprints, which will align manufacturing businesses with consumers and wider societal and governmental interest in, and commitment to, environmental protection and contributing to the net zero targets for UK manufacturing.

An interesting concept for the development of agile micro and SMEs within the UK is using umbrella organisations. A recent report by the Royal College of Art and Innovation UK, 'Reshoring UK Garment Manufacture with Automation', discussed the concept of using these umbrella organisations, which essentially provide smaller businesses with creative factory spaces where micro brands also have opportunities to develop, as well as acting as a communication point for the transfer of knowledge and information. Examples of this have been seen in France, with the likes of Kering managing the development of a series of renowned houses in fashion, leather goods, jewellery, and watches. As well as managing the companies, Kering is also responsible for its sustainability agenda, publishing roadmaps on creating more sustainable and responsible products.

The previously mentioned MMRC is an ongoing body of work, created to collate thoughts from across industry, academia and other regional bodies concerning the Midlands manufacturing sectors' reaction to the pandemic. Within this, Katherine O'Driscoll, Director of KO Inc Ltd., made the point that: "In the fashion market, a third of clothing is sold at ticket price, a third is heavily discounted and a third is sent to waste. This is because the total volume for a season needs to be ordered en-masse to facilitate transportation time from the low-cost supplier. Even so, it is still more cost-effective to procure this way than to source locally."

To address this, more work needs to be done to contribute to the concept of total value UK, where the supply of materials and products is local, spurring more regional employment for the area, in turn reducing the reliance on long-haul logistics and reducing the overall carbon footprint. This also leads to greater flexibility and agility within the industry, as lead times are much shorter, and stocking of items can be for weeks in advance as opposed to months. Another significant benefit lies in the reduction in waste through just in time supply, leaving less unsold stock. Looking at a total value proposition rather than the lowest cost proposition would be a significant step forward.

CIRCULAR ECONOMY

Garment manufacturing volumes are growing by 2.7% per year, while less than 1% of garments are recycled into new garments [33]. The 'fast fashion' business models that have become pervasive since the 1980s are unsustainable. They generate excessive waste in production, lead to overstocking and destruction of excess stocks, and result in over-consumption of cheap clothing made from mixed fibres that cannot be recycled or repaired [34]. UK consumers buy more clothes per person than those in any other European country, and around 300,000 tonnes of the UK's textile waste is sent to landfills or incinerators every year.

Professor Tim Cooper [35] argues that sustainable fashion requires the development of business models and practices that encourage consumers to demand higher quality clothes that are made to last, rather than cheap throwaway ones. Or to put it another way, to transition from a linear economy model to a circular economy model.

The circular fashion economy creates value through garments that are rented, resold, repaired, and remade. A single garment creates value repeatedly, which is in strong contrast with fast fashion and which requires profound changes to every aspect of fashion manufacturing. For example, clothing that is to be rented out or resold needs to be durable, while remaking requires products to be designed and manufactured so that components can be reused, recycled, or remade. At each stage, logistical considerations are important and differ from the fast fashion system.

The scale of the environmental impact of the T&C industry means that it bears considerable responsibility for implementing change and contributing to the NZS, and numerous initiatives are underway. Creating a circular fashion economy is a major workstream at the Ellen MacArthur Foundation (the Foundation) [36].

The Foundation sets out a vision of a circular fashion economy that goes beyond simply reducing the impact of current industry practices, but which addresses causes of climate change, biodiversity and pollution while supporting growth. The key principles underlying the circular economy vision are to eliminate waste and pollution, keep products and materials in use, and regenerate natural systems. Translating those principles to fashion requires that products are used more, are made to be made again, and are made from inputs that are safe and recycled or renewable. The Foundation's vision offers these as "targets to innovate towards" [37], highlighting the collective nature of the challenge and injecting a sense of agency into all parts of the supply chain.

The circular fashion economy has broad implications for textile manufacturers. In the 'use more' category, new business models must be developed focusing on rental, which requires durable and repairable products. The new business models must assume that all products made are used, eliminating the practice of destroying excess inventory. 'Made to be made again' means actively designing and making products that can be disassembled to be reused, remade, and recycled and finally after maximum use, safely composted. Packaging must be minimised and made from materials that are also reusable, recyclable, or compostable. The 'made from safe and recycled or renewable inputs' category means that processes, inputs, and products do not damage the health of people or ecosystems; resources are effectively and efficiently used, and production as a whole is fully decoupled from the use of finite resources. Each one of these has profound implications for how manufacturers operate currently, and how they should aim to operate in the future.

The fundamental difficulty of providing a universally acknowledged definition of the term 'sustainability' is significant. Sustainable may mean anything, from a small reduction in energy consumption to a fully net zero process, and the lack of clarity has led to concerns that unscrupulous firms may take advantage of the uncertainty to mislead consumers about their true environmental credentials, a process known as 'greenwashing'. Against this backdrop, the Foundation's vision provides robust definitions of terms like durability, reuse, and recycling. This is important because a clear definition supports accountability and transparency across and along supply chains and sets out clear standards for all actors, while diminishing the opportunity for greenwashing.

The challenges embodied in scaling up circularity in the fashion industry are formidable. Among the most significant are improved durability and recyclability, and the complexity of logistic services able to cope with, for example, the repeated rental of clothing, which requires not only delivery and collection to and from consumers, but cleaning. For manufacturers, the challenges will affect almost every aspect of their business.

Circularity is a huge business opportunity. Consumers are rapidly becoming more conscious of sustainability, and civic society is gearing up with the emergence of repair cafes on a global scale. In the UK, popular television programmes like the BBC's Great British Sewing Bee and ITV's Mary's Bottom Line presented by Mary Portas are just two examples of how consumers are being educated on the textiles industry. Momentum is building, but the transformation to a circular fashion economy will depend on collaboration between consumers, the industry, investors, and policymakers.

33 McKinsey 2021 The State of Fashion 2021

34 House of Commons Environmental Audit Committee (2019) Fixing Fashion: clothing consumption and sustainability

35 Professor Tim Cooper, Nottingham Trent University, evidence to the House of Commons Environmental Audit Committee (2019) report (ibid)

36 https://ellenmacarthurfoundation.org/topics/fashion/overview

37 Ellen MacArthur Foundation (2020) Vision of a circular economy for fashion, p.2

MANUFACTURING PROCESSES

T&C manufacturing in the UK faces multiple challenges: Brexit and trade policy, COVID-19, changing consumer behaviour and the climate crisis, to name a few. Although production has declined over recent years, the industry still makes an important contribution to GDP and employment in the UK, and in particular in the Midlands. Industry 4.0 and the so-called 'digital revolution' have the potential to reverse the decline and transform T&C manufacturing.

Production processes used by UK T&C manufacturers are generally relatively traditional, since many have been slow to adopt innovative processes and new machinery used elsewhere in the world. Significant opportunities now exist for UK manufacturers with the appetite and confidence to take advantage of the productivity gains from advances in data collection, sensors, robotics and automation, and new technologies including 3D printing. Adoption of rapidly developing new technologies will enable new processes and give manufacturers relying on established manufacturing methods an enhanced ability to meet the demands of current and future consumers.

Opportunities related to the circular economy and sustainable business models are good examples: existing manufacturing processes may not be compatible with net zero and circular economy models. New business models which focus on rental, resale, or repair, and which support circular fashion, could shape a manufacturing sector which is radically different from the one reliant on disposable fashion business models. Technology is advancing at a startling rate, and many technologies which are widely used in other sectors can transform T&C manufacturing.

COMPUTERISED SYSTEMS

Computer-Aided Design/Computer-Aided Manufacture (CAD/CAM) software is used to visualise designs and control manufacturing processes, increasing efficiency by saving time and reducing waste. One of the key barriers to the adoption of CAD/CAM is the challenge in raising finance and attracting investment, which is commonly experienced by micro companies and SMEs which dominate the sector. A further barrier is an absence of technical skills in the existing workforce and, at present, a weak pipeline of qualified workers.

Computers controlling processes such as roller printing, laser cutting, and embroidery may be fully automated, which significantly increases the efficiency and consistency of production. Computerisation is also a gateway for the introduction of machinery and processes used in other manufacturing sectors, such as robotics, with the potential for smart factories and automated manufacturing processes, though small firms face similar barriers to the adoption of these technologies.

CUSTOMISATION AND AUTOMATION

The concept of customisation is not new. However, innovative techniques using new technologies are increasingly common, and demand for customised products is increasing rapidly. For example, 3D visualisation software combined with automated tailoring can produce custom fitting garments. Similarly, customised printing of garments is also possible.

RECYCLING

Initiatives like the WRAP-led SCAP and Textiles 2030, and the Ellen MacArthur Foundation circular fashion model, emphasise the important role of recycling in moving towards a circular fashion economy. Resources that are reprocessed and used in new products, components, and materials decouple production from resource use, providing opportunities to generate revenue without further depleting virgin resources. However, recycling is not a panacea.

The recycling of garments involves sorting, which is often still undertaken manually and is highly resource-intensive, reducing its commercial appeal. Mechanical recycling involves textiles being broken down and then remade, though recycling mixed fibre materials is challenging and resource-intensive, so may not be economically or practically viable. Similarly, products with buttons and zips are more complicated to deconstruct. Fibres may be damaged in the mechanical recycling processes, resulting in poorer quality reformed fabrics and yarn. Recycled fibres often need to be mixed with a given proportion of virgin fibres to improve the quality.

Chemical recycling can produce high quality regenerated fibres, though the process is not used on an industry-wide scale as yet. In Asia, polyester fabrics are chemically recycled on a commercial basis, and processes to recycle cotton are at the laboratory stage. But chemical recycling uses concentrated chemicals with the potential to harm human and ecosystem health and requires homogenous source fibres, which limits the supply of feedstock materials.

There have been numerous reports of the failings in chemical recycling, particularly in plastics. In a 2022 article by Judith Enck and Jan Dell for 'The Atlantic', titled 'Plastic Recycling Doesn't Work and Will Never Work', the limited evidence that plastics can ever be 'sustainable' is highlighted. This is, in part, due to the wide range of complex mixtures of polymers used in plastic production, making it almost impossible to efficiently break down the material into its individual monomer forms. One of the only true recyclable products are the bodies of plastic bottles, due to their simple polymer structure. In addition to this, the toxic emissions produced from this process could cause new harm to our environment, climate, and health.

SMART FACTORIES

Smart factories use technologies including production line sensors, in-process data collection, and digital control of manufacturing systems. Sustainability can be improved by waste reduction, greater efficiency achieved through data management and analysis, and quality improved by automatic fault identification. Given the rapid rate of technology advancement, there are multiple opportunities for the transformation of the sector by the adoption of technologies embodied in Industry 4.0. The T&C manufacturing industry must get to grips with the opportunities that Industry 4.0 offers them to regain a competitive edge.

UK manufacturers have for years lagged behind rivals like Germany and Italy in terms of technology adoption, and the capacity of SMEs to integrate new technologies is weak [38]. Recent research suggests that although SMEs in the creative industries have a higher than average appetite for external finance to support growth, a majority agree that growth is restricted by a lack of access to finance [39]. In addition to undermining productivity, this places
UK-based T&C manufacturers at a significant disadvantage when it comes to responding to the challenges facing the fashion and textiles industry, and to seizing the opportunities offered by the digital revolution.

Access to both public and private finance is a significant barrier to technology adoption, particularly for micro and SMEs, and there is anecdotal evidence from Leicestershire that companies find just buying replacement machinery difficult. Structural failures in financial markets restrict access to both debt and equity finance to micro businesses and SMEs, stifling growth and productivity improvement.

Practical challenges to technology adoption include the difficulty of installing new machinery whilst simultaneously maintaining a sound production line, dispatching orders, and billing customers. Adopting new processes to replace long-established methods requires a new mindset and change of culture, as well as new skills. As the previously referenced M2R 'Manufacturing Confidence' report explains, concerning pivoting from other sectors, change is difficult and requires confident leadership. Confidence may be in short supply when textiles manufacturers see risk in every direction they look.

Government-funded institutions including local enterprise partnerships (LEP) support business development, innovation, and growth. For example, the Midlands Engine Investment Fund (MEIF) is a collaboration between the Midlands Engine, local LEPs and the British Business Bank, which provides commercially focused finance through small business loans, debt finance, proof of concept and equity finance funds to smaller businesses. Welcome though the MEIF is, the scale of investment required demands a much more comprehensive solution to systemic barriers to growth.

38 B. van Ark, A. J. Venables, (2020) A concerted effort to tackle the UK productivity puzzle. The Productivity Institute working paper No.001.

39 UAL https://ualresearchonline.arts.ac.uk/id/eprint/17172/1/BFTT_Mapping-the-UK-Fashion-Textiles-and-Technology-Ecosystem_2021.pdf

RESEARCH AND DEVELOPMENT

The T&C sector invests an impressive 5% of turnover in research and development (R&D) which is high relative to the UK average of 1.7% [40]. R&D investment creates growth opportunities and improves productivity. Investment in R&D is essential if the T&C manufacturing sector is to meet the challenges it faces as discussed earlier in this report.

Investment in R&D is a key driver of productivity growth and is essential if the sector is to reverse its decline. The industry needs to; understand how AI, data analytics and data-driven design tools can improve decision making and reduce long lead times associated with new product design and manufacture; use R&D to develop new recycling technologies and processes on the path to a circular fashion economy; and focus on areas like advanced materials, medical textiles, composites, and smart textiles. R&D is not limited to technical areas. The development of the new business models that can deliver the circular fashion economy, including learning how to influence older consumers to adopt circularity, will be based on research too. [41]

The Midlands Manufacturing Resilience Commission (MMRC) report, *Manufacturing Resilience,* shows that per capita, public investment in R&D is lowest in the East and West Midlands compared to all regions. If the Midlands is to be rebranded as the innovation region, then public investment in T&C manufacturing, a key source of income and employment in the region, must be increased.

40 House of Commons Library https://commonslibrary.parliament.uk/research-briefings/sn04223/

41 For a comprehensive report on R&D in the Textiles industry see UAL
    https://ualresearchonline.arts.ac.uk/id/eprint/17172/1/BFTT_Mapping-the-UK-Fashion-Textiles-and-Technology-Ecosystem_2021.pdf

CONCLUSION AND RECOMMENDATIONS

2020 has been described as "the year in which everything changed" [42] for the fashion industry. Considering the long-term decline of textile and clothing manufacturing in the UK, this is quite a statement. Garment manufacturing in the UK has not fared well since at least the early 2000s, with manufacturers finding themselves unable to compete with the relatively low cost base of rivals based in China and South Asia, while at the same time consumer demand for increasingly cheap and disposable 'fast fashion' has soared. In addition to this, textiles and clothing manufacturers face immense challenges adapting to a changing world post-pandemic and post-Brexit, where the imperative to transition rapidly to net zero and address a disproportionately large environmental footprint of textiles and clothing manufacturing is overwhelming.

A historic lack of understanding of international manufacturing capabilities, and the potential to innovate in fabrication and tooling, has hampered the development of the UK fashion industry. More recently though, the industry is expected to undergo profound reshaping in response to disruptive events including the digital revolution, the 2008 financial crisis, Brexit, the pandemic, and the climate crisis. This reshaping will undoubtedly challenge the manufacturing sector, but also bring with it exciting opportunities. For the UK's garment manufacturing industry to begin to re-establish itself as a key asset for the UK, there has to be a shift in both consumer purchasing patterns, as well as how the industry operates, and how it is supported by the government.

Pivoting between sectors provides a huge opportunity for the industry, with cross-sector collaboration allowing for the accelerated development of new technology, leading to more effective decision making and better business success. In addition to this, the adoption of Industry 4.0 principles and investment in robotics and automation can lead to more effective use of data, less resource-intensive recycling methods, as well as allowing highly skilled textiles workers to make better use of their time, reducing menial work. The reshoring of manufacturing to the UK also presents a wealth of opportunities, where leveraging more local employment can reduce the reliance on long-haul logistics and the overall carbon footprint, improve flexibility and agility within the industry, as well as reduce waste through just in time supply.

Within this paper, several topics have been discussed, exploring some of the opportunities and challenges faced both worldwide and within the UK clothing and textiles industry. The recommendations that follow apply to all stakeholders including government, technology providers, research and educational establishments, the finance community, and, not least, manufacturers, and are intended to guide relevant policy and future initiatives.

RECOMMENDATION 1
The UK textiles industry, with input from academia, industry, and government, needs to come together to create a coordinated and targeted policy framework, supported by a detailed action plan specifically focusing on manufacturing. This should be in line with the UK's Net Zero Strategy: Build Back Greener, as well as policies such as the 25 Year Environment Plan, which mandates the improvement of resource efficiency and the reduction of waste through the development of a circular economy.

RECOMMENDATION 2
There needs to be an urgent shift to demand-led manufacturing, where production is based on actual demand and not just forecasts. Currently retail is demand-led in the sense of cheap products, but manufacturing is not. This misalignment causes acute pain for manufacturers. The adoption of new technologies and Industry 4.0 principles have the potential to enable more data-driven manufacturing, less resource-intensive recycling methods, and more agile and reactive production lines.

RECOMMENDATION 3
Consumer education should be addressed, providing information to help consumers understand the damage and repercussions that fast fashion is having on the industry and the environment. Increasing the emphasis that consumers place on ethical standards and sustainability, as well as the reuse and recycling of garments, is vital to ensuring that shopping habits change to more sustainable practices.

RECOMMENDATION 4
Embracing a more circular economy and reshoring the manufacture of garments needs to be prioritised. This will allow the UK to eliminate waste in the textiles industry by increasing the reuse of resources and designing garments for extended use and recycling, rather than for one-off use and disposal. It can also provide benefits from reduced logistics time. The faster turnaround between order and delivery allows more agility in response to fluctuating demand and consumers' growing interest in a more distinctive fashion. This all contributes to reaching the net zero target for UK manufacturing.

RECOMMENDATION 5
Sector-specific regional development should be increased, providing support focused specifically on micro/SMEs. The UK, and the Midlands specifically, has a wealth of smaller businesses that work within, and in adjacent sectors to, textiles. Providing these companies with spaces to share cross-sector knowledge, access equipment outside of their current budget, and opportunities to work collaboratively with reduced risk, can enable a healthier environment for growth.

RECOMMENDATION 6
Increased access to finance and investment should be made available. Weak access to debt and equity finance is a well-documented problem for SMEs, and within the textiles industry it has led to low adoption of new technologies, increasing pressure on the workforce and over-reliance on outdated methods and machinery. Government-funded institutions with a specific focus on the textiles industry can allow companies to make lower-risk investments to enable increased productivity, more agility within their manufacturing, and workers to focus more on high value-add activities rather than menial, resource-intensive jobs.

RECOMMENDATION 7
A coordinated approach to skills and training is needed. With the advent of digital technologies and a shift to a more circular economy, a new environment is required for the training of workers to help maintain the skillsets which are already established in the UK. For example, by linking new industry practices like robotics and automation to pattern cutting. Soft skills also require further development to make the transition to more efficient ways of working, coupled with a shift in mindset with sustainability, recycling, and environmental impact all key considerations from design through to final sale.

42 McKinsey 2021 The State of Fashion 2021. p.10.

ACKNOWLEDGEMENTS

With thanks to all who contributed to this report.

UK TEXTILES MANUFACTURING:
**OPPORTUNITIES AND CHALLENGES
FOR THE UK AND MIDLANDS**

CONTACT

E: iprc@lboro.ac.uk
T: +44 (0)2476 647595

lboro.ac.uk/research/iprc

@IPRC_Lboro