Royal College of Art
& Innovate UK KTN / Made Smarter

Reshoring UK Garment Manufacturing with Automation

Recommendations for Government

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Executive summary

The fashion manufacturing sector in the UK urgently needs to modernise, optimising production and supply chains to meet net-zero and global sustainability challenges. Government support is perceived to be lacking and many of the Alliance Report (2015) recommendations, although accepted, lacked long-term implementation and sustained investment.

This report closes the gap in the recommendations enabling the crucial triangulation of manufacturing, automation and design to support an industry of the future.

This report maps a supporting structure for the development of agile, small scale, re-shored garment manufacturing systems, the design of new business models and a newly trained, highly skilled workforce. Focussing on two key areas, technology and education, the report synthesises steps for Government-backed action to avoid further market failure and recommends areas for investment to support the levelling up agenda.

UK fashion manufacturers are currently unaware of the potential for new robotic and automated systems to address the severe sustainability problems generated by fashion manufacturing. This is predominantly the result of underinvestment in what could otherwise be a zero-carbon industry focussing on high value, low volume manufacturing.

Firms cannot compete with high volume production in Europe and Asia yet the Covid Pandemic and Brexit have shown the potential for the UK to re-shore garment manufacturing and engage with Industry 4.0+.

Open access labs, Living Labs and networked, collaborative manufacturing models could provide the up-skilling needed to meet the challenges of a future-facing industry. UK multi-faculty universities need to accept the challenge of redesigning education that is fit for purpose for fashion design graduates.

The recommendations listed below support the main ask of the report - that large-scale financial support from Government and the private sector be made available to deliver a fashion manufacturing industry fit for the C21st.

- A FORUM of stakeholders with access to Government
- Development of an Industry Roadmap
- Development of a lobbying strategy
- Policy inclusion
- Evolved fashion design training with UK Universities
- Dedicated large scale funding from UKRI, Government and Industry.
- Living Lab incubator for prototype micro-factories
- Developing open access labs for tooling and materials development

Introduction

Research funded by RKEI Strategic Priorities Fund and The Royal College of Art, working in collaboration with the Innovate UK KTN / Made Smarter programme, has investigated ways to optimise UK fashion manufacturing.

A series of three workshops was convened, using a purposive sampling frame, along with snowballing recruitment through word of mouth, to bring together 60 UK based fashion manufacturers, innovative micro designer/manufacturers, academics, NGOs and other stakeholders. The workshops facilitated discussions to gather expert perspectives on how new technologies and industry 4.0+ in the UK manufacturing base might enable the reshoring of garment manufacturing to the UK. Discussions also focussed on the impact of automation on manufacturing and design jobs and how to develop a skilled workforce to utilise new technologies. The workshops directly address stakeholders' perceptions of the impact delivered by the Alliance Report [1] recommendations which relate to the fashion industry. A follow-up questionnaire was circulated to attendees to invite further comments. All data collected was anonymised and qualitatively analysed to create a coherent, consensus-driven strategy route map for the development of UK fashion manufacturing.

The fundamental question we wanted to answer was:

> **How is it possible to enable the small scale and micro UK fashion designer/manufacturer industry to reap the many benefits of agile tooling through robotics & automation?**

The UK's fashion industry has an international reputation for creative design and contributes £32.3billion to the UK economy [2]. As researchers and educators we understand how UK fashion design training encourages graduates to set up their own micro-businesses. Many UK micro fashion designer/manufacturers have told us they aspire to using digital and robotic technologies, an imperative as they see it, for the future success of the industry.

1. http://www.ltma.co.uk/wp-content/uploads/2017/05/The-Final-Alliance-Project-Report-Oct-2012-to-May-2017.pdf
2. https://www.standard.co.uk/insider/fashion/uk-fashion-industry-ps32-billion-uk-economy-british-fashion-council-caroline-rush-a3934781.html

"In the world of denim, technical equipment such as laser etching and ozone washing is digital and semi-automated. We need investment to have such machines available in the UK."

"I think one of the big issues we face is access to certain manufacturing tools beyond what you would find in a standard studio... the manufacturing system assumes that designers don't need to see and touch equipment."

The fashion garment design and manufacturing sector in the UK is an industry which is understood to be at a tipping point, either towards collapse or revitalisation. The most forward-thinking designer-led micro and SME businesses shared with us how they are already reshoring, shortening supply chains and producing locally.

"We believe that to make low-volume manufacturing work (financially and sustainably) you need to put the designer in the centre of a very integrated design and manufacturing process and really leverage digital design and manufacturing tools. You need to integrate a lot of processes and use digital tools and automation. You can't have one person dedicated to one specific task, you need skilled people that can do multiple tasks."

Designing and incorporating small scale, highly versatile robotic and digital processes could, they claim, provide a boost for the UK manufacturing economy.

"Small companies can deliver a lot of ROI as they are driven to find solutions that work and that they can use in their own commercial setting and therefore they represent a very good value proposition."

"I would like to see smaller machinery adapted to small and medium scale manufacture."

These businesses suggest that investing in the future of the industry is vital particularly when we train so many fashion designers in UK universities.

"Digital pattern making tools have been really wonderful for product development, rapid visualisation... it's made the process really, really quick. But we are hitting a bit of a wall when it comes to taking that into manufacture. Where it's speeded up the process of product development it hasn't necessarily changed anything for manufacturing."

Micro and small firms are experiencing the huge challenges of integrating automation into a highly creative sector, but also understanding the rewards

to be gained from modernising and upskilling.

> **"I would give the designer access to as much software as possible, and then let them have access to digital/ automation manufacturing tools to test ideas. Designers are incredibly driven people and they will create amazing new and interesting things if given the tools to do so and it will push the industry forward."**

In a recorded address to the GREAT Fashion For Climate Action showcase at COP26, the UK's Prime Minister finally recognised the importance of the fashion industry and its role in innovation for change[3]. Currently, UK garment manufacturing can not, and in the workshops it was argued, should not, compete with Europe and Asia where fully automated robotic microfactory units for fashion garment prototyping and production are already in development. Full scale, high volume, fully automated factory units for fashion manufacture[4] and 'factory in a box' technologies already exist[5].

The UK can position itself in a different way, participants claimed. Instead of low value, high volume manufacturing the UK can develop high value, low volume production that recognises the vital contribution a skilled workforce can bring to the process of garment manufacture in a holistic and transformative approach to industry and upskilling.

The international fashion industry has suffered catastrophically due to the current health pandemic with most participants seeing this as an opportunity to reconfigure manufacture for more sustainable, digitally enhanced, flexible, collaborative and resilient designer-led business models. In a UK context, where micro luxury producers are the norm, our participants also asserted that linked micro clusters of fashion producers was a desirable model for on demand making.

> **"We know we won't be making large volumes, so the biggest re-imagining we have for fashion manufacturing is for flexibility."**

They recognised a future for micro and SME businesses where they might support R&D for larger brands, as labs or attached to universities, as 'Learning Factories'. The UK's world leading engineering sectors, particularly in aerospace and automotive, with their high value, bespoke production units, strong lobbying groups and access to government funding were proposed as providing blueprints as to how UK garment design and manufacturing businesses could thrive.

3. https://www.britishfashioncouncil.co.uk/bbc news/4588/GREAT-Fashion-for-Climate-Action-at-COP26
4. http://softwearautomation.com/products
5. https://t.co/KphYe7xRZb

Theme 1

Technology

Challenges, Threats and Risks

The existing technology level of UK fashion manufacturing businesses was widely regarded as significantly lower than European and Asian competitors, with evidence from workshop participants suggesting it is 'twenty years behind'.

> **"The UK fashion industry is still in the [first] Industrial Revolution compared to Asian countries! We need to bring in better machines to start, so that the UK industry can catch up and then become pioneers of future automation."**

They recognised that in the context of massively offshored production technology, investment and capacity in UK manufacturing for this sector has been overlooked.

> **"We need to accept that the UK is a developed country with a cost of living that makes re-shoring manufacturing using traditional manufacturing approaches impossible."**

They often were unaware of new robotics and automation developments in international garment production and therefore found it difficult to conceive of how new technologies could enhance their businesses.

It was reported that an increasing supply chain vulnerability, combined with increasing wages and standards of living in key manufacturing nations has meant that an era of cheap imported goods has come to an end. Firms report struggling to access funding for technology where they see the potential to re-invigorate the industry from the ground up and introduce new paradigms.

“Our business would instantly benefit from better access to 3D cutting tools. We currently cut everything in-house by hand despite having all the software capabilities to cut digitally. It doesn’t make financial sense to outsource the cutting because the only solution to outsourcing is hand-cutting and each style is low volume. Therefore we have a very inefficient work-around (of doing it in-house) so we can produce products that are financially viable in a timely manner.”

“The future of smart textile manufacture relies heavily on a change of attitude towards the fashion and textile industry.”

Many young businesses told us they are already investing in agile, multipurpose technologies and are generally self-taught.

Barriers to adoption

Workshop participants told us

— The problems of garment manufacturing in the UK require sustained attention from policymakers, stakeholders and gatekeepers.

“We need to stop thinking of manufacturing as the unloved, bit in the middle of the process, that we reluctantly engage with... until we stop treating it as a standalone activity, done by someone else, we won’t fix the problem.”

— Small firms are hacking existing technologies and investing when they can but are not being seen as a viable market by machinery and tooling producers. Or as a viable investment / lending opportunity.

— Garment development software funding is not accessible to micro design/manufacturers without support.

“I’ve had real problems translating 3D patterns. In the UK I found that there was reluctance to take on new processes from major companies. In the end, I was forced to work with a smaller, more expensive, but forward-looking unit in Italy. Here I find there’s a very rigid mindset and a lack of computational integration.”

— Staff training and resources to employ skilled operators is too expensive for micro firms.

“I’ve been looking at digital solutions but the up-front costs are huge. Plus the cost of a trained operator. I would love it if the government were to say there is money to invest to automate your cutting or to digitise your patterns.”

— Because of the small scale of innovative businesses, business owners are often unable or unwilling to take time away from their primary focus to contribute to discussion, R&D or to complete surveys, questionnaires etc. meaning research is sometimes limited.
— The garment manufacturing industries lack an effective voice to lobby for change.

“Investment in Green-tech is focused on energy, security, aerospace and fashion is seen as risk.”

— Too many self-appointed fashion industry gatekeepers do not understand manufacturing.
— Creative Industries will not achieve traction for fashion in Creative Industries Clusters Project 2 (if funded) unless the focus is on fabrication that is a combination of designer and engineering expertise.

Solutions recommended by participants included

— Recommendations of the Alliance Report (2014) should be implemented in full.
— Learning from cross-over technologies from other industries i.e. combining automation, co-botics and digital twinning for lean manufacturing to enhance UK production alongside the use of AI.
— Pooling and sharing of resources and collaborative working, linking with agile micro producers for place based whole supply chains.

“Connection between designers and manufacturers is essential for the sector to grow, but it has to be facilitated by a public body. Somewhere central to access resources and business support to help understand how to upgrade and develop your business to be more efficient. This kind of information needs to be easily available if fashion is to be taken seriously! It could also create a collective network to group manufacturers together and offer financial, technical and ethical support.”

— Umbrella organisations - collaboration and support of smaller businesses by larger ones including creative factory spaces where micro brands also have opportunities to develop e.g. Kering Group France/ Comme des Garçons/ LVMH.

“Micro-manufacturing hubs in the UK with the ability to connect with other overseas producers. These hubs multi-task and are flexible to serve growing brands.”

— Existing eco-factories and incubator hubs in the UK and internationally used as a blueprint to introduce principles of automation and robotics.

“Connect and incentivize engagement with the established industry as well as new technologies in the field of production.”

“We have to get some responsive, smaller hubs in the UK to enable the growth of new brands.“

— Incubator hubs should be funded within UK universities in collaboration with UK manufacturing industry (not necessarily Fashion/Textiles).

“Financial support has a massive impact on a company’s bottom line and makes a very big difference. I think paying companies to take part in “Live Research” could be a very interesting proposal.“

— More support and funding from the government creating connections between companies and machine technology developers and investment in developing new equipment.

Theme 2

Education

Challenges, Threats and Risks

Traditionally focused on training students in conceptualising, designing and making of their own collections, few undergraduate and postgraduate fashion courses in the UK have significantly evolved over the past 25 years. However, some are increasingly successful in training students to interrogate and enter a world of advanced manufacturing.

> **"If I was charged with finding ways to re-shore UK production I would be looking at ways of integrating design and manufacturing processes (people, skills and tech) and what digital and automation technologies can be used to transform the way we think about designing and making."**

Most of our participants were UK trained and recognise that many fashion design students are self-taught in the use of digital tools, but still need access to leading manufacturing systems and technologies in order to have a better understanding of what already exists and how it might be adapted to their needs as they become small firms.

> **"Traditional forms of manufacturing aren't really suitable for digital design practises. It feels like going backwards! 3D seems to be difficult for UK manufacturers to understand and you need to work with them to develop new processes."**

Students are finally being equipped to address societal and environmental concerns in the rigorously informed way demanded by consumers and of our participants themselves.

A lack of understanding of international manufacturing capabilities, and potentials to innovate in fabrication, tooling and systems design, has hampered the development of the UK fashion industry and education. However, a new generation of thought leaders/designers has been slowly emerging through UK design schools, with a combined skill-set of designer-led innovation, underpinned with a critical approach to new technology and a desire to understand new engineering, digital and scientific paradigms.

> **"I would love for there to be more value for businesses to connect with education/academic institutions - we need to incentivise investment of time/experience to a new generation of makers, designers, thinkers."**

Our participants recognised that current and future students will need to continue to break through the boundaries of existing "siloed" training structures and that much UK fashion design training risks being of little value, to industry and to the graduate in terms of employability, unless significant changes are made. Participants reflected on the need for fashion design pedagogy to address an understanding of manufacturing, and future opportunities which could be realised through more collaboration with science and engineering disciplines.

> **"We practice what we like to call "Live Research". It means we are actively implementing new technologies whilst also running our business commercially. I would never discourage pure research in an academic setting but I would like to see more research taking place that was tested in a commercial setting as well. I think this could be a very fascinating approach to take in fashion and design."**

Barriers to adoption

Participants proposed

— The UK government's education policy is focused on STEM subjects but it was argued it should allow for interdisciplinarity which covers STEM through STEAM to SHAPE pedagogies.

— Industry jobs are perceived to be low tech/menial/unskilled - the perception of industry is that it is still dirty, dark and dangerous.

"We personally don't use the term factory because of the negative connotations! We need to glamourise manufacturing so that graduates are open to manufacturing as much as they are open to design roles! We need the media to support the publicity of manufacturing... something to show the public the engineering behind a really beautiful garment!"

— There are strong gatekeepers to traditional and non-material/de-materialised pedagogies in design. One ignores sustainability, the other imagines non-manufacture as a viable sustainable option.

Solutions

Participants suggested

— Students need to understand manufacturing as vital *information.*

> **"I think networking events (educational, workshop, social etc) are a really good/accessible way to cross-pollinate. Very broad term 'events', but getting people together, in workspaces, to talk/share/collaborate."**

— Living Labs supported by universities with industry and government funding to explore robotics, digital interfaces, desktop factories as already exist in European universities.

— Government support for the development of an advanced manufacturing sector and the reshoring of UK manufacturing industry. UK fashion education can then rise to meet this challenge.

> **"Government schemes should finance manufacturer training in new 3D garment prototyping softwares... there could be a business grant including money to hire someone with 3D skills."**

— Industry collaborations can enable better design training: incubator hubs should be funded within UK universities in collaboration with UK industry.

> **"I would also think about paying small business to take part in other research activities, as they can offer a very good insight into the barrier of adopting new approaches."**

— The role of the university will be to provide space for establishing meta knowledge, criticism and reflection through academic research channels.

— Develop expertise in circular systems/ support for business model innovation.

Recommendations

— A **FORUM** to continue to build stakeholder communities.
— Facilitated **Open access labs** as an introduction and exposure to the potentials of robotics, automated digital processes and AI.
— Funding for a longer **roadmapping** process to develop alternative structures.
— Develop a **lobbying strategy for policy inclusion** with existing stakeholders. Engage with local and regional government, NGOs, trade bodies, and academia.
— Dedicated large scale **funding for innovations in tooling and supply chain development** from government and private sector, including crossover technologies from food processing, automotive and aerospace industries.
— Develop **new pedagogic strategies for designers** introducing students to state of the industry manufacturing processes, with potential for funded visits or UK based machinery and tools fairs.

"The government needs to support trade shows and networks!"

— **Dedicated funding for universities** to carry out transdisciplinary **research into** new business and policy models, new tooling and lifecycle analysis through **Living Labs**.

The future work programme led by Prof Susan Postlethwaite, Manchester Metropolitan University, with the support of KTN will focus on the development of a stakeholder FORUM involving designers, academics, engineers, social scientists, manufacturers, fashion industry experts and economists to develop a roadmap for the future of the UK fashion manufacturing industry **with Government**. Introducing stakeholders to the potentials of robotics, co-botics and new technologies to enhance business capabilities through hands-on experience facilitated by KTN will be the next step. Funding and support will be sought from UKRI and partners beyond the fashion manufacturing sector to set up a Living Lab to develop a prototype micro-factory.

Appendix

Acknowledgements

The workshops have been made possible with policy-focused funding from RKEI Strategic Priorities Fund and in-kind funding from Innovate UK KTN / Made Smarter.

This report will be made available to stakeholders across manufacturing, design and academic communities as a first step in our ambition to design a road map towards reinvigorating and reshoring UK fashion manufacture.

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Data

Round 1 Micro and SME designer businesses.
Round 2 Manufacturers, NGO's, academics/economists
Round 3 Designers return to the conversation
with other stakeholders.
Add to appendix Attendee breakdown
60 attendees across 3 workshops.

(11) Innovative micros - 18.33% SMEs.
Small and medium-size: Small business: fewer than 50 employees, turnover under €10 million
(11) Industry experts/ consultants - 14%
(15) SME Designer manufacturers - 28% SMEs Small and medium-size: Small business: fewer than 50 employees, turnover under €10 million. Medium business: fewer than 250 employees, turnover under €50 million
(7) Academics - 11.67%
(7) NGOs - 11.67%
(9) Other - 15 %

Information shared with participants

The Alliance Project (TAP), based at the Greater Manchester Combined Authority (GMCA, formerly New Economy), was established to examine the potential for repatriating textiles manufacturing to the UK. The project was commissioned by Lord David Alliance and the GMCA, with the support of Government through the Department for Business, Innovation and Skills. TAP led an extensive study in 2013/14 which identified significant market opportunities, and identified a range of recommendations to enable industry to capitalise on growth in UK manufactured products. Government accepted the report in full, and asked the Alliance Project to continue work on four key areas: skills, investment, innovation, and reconnecting supply and demand.
http://www.ltma.co.uk/wp-content/uploads/2017/05/The-Final-Alliance-Project-Report-Oct-2012-to-May-2017.pdf

The Environmental Audit Committee Fixing Fashion Report: Clothing Consumption and Sustainability
https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/1952/full-report.html

The Ten Point Plan for a Green Industrial Revolution
https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution

Levelling Up Fund, Prospectus
https://www.gov.uk/government/publications/levelling-up-fund-prospectus

UK Shared Prosperity Fund, Briefing Paper
https://commonslibrary.parliament.uk/research-briefings/cbp-8527/

Stakeholder list

Prosper Design Consultancy

Fashionworks

British Fashion Council

UKFT

Roberts | Wood

Bombyx PLM

Barrie Knitwear Ltd

The Sustainable Sequin Company

Johnstons of Elgin

OSD Ltd

Three By One Europe

Dumonk

TEIJA

Making for Change

Kalopsia Collective

New Guards Group

Aurélie Fontan Studio

Unmade

THE SAMPLING studio

Tamayo

White Weft

HEWITT HERITAGE FABRICS LTD

Make it British Ltd

Lee Hurst

Twelve Oaks Software Ltd

MAES London

Lenzing Fibers

Ester Kubisz

MAES London

UKFT Scotland

Lueder LTD

CONGREGATIONdesign

PVH. Corp

Digitoile

Creative Apparel

Jan Miller Consultancy

Lunia Oliver

AVYN

Johnstons of Elgin

Galaxius Systems Ltd

The Outdoor Industry Compass

ENDRIME / Denim History

B Fashion Studio

Pneuma Etherwear

Fashion Revolution

Fashion for Good

University of Strathclyde

Royal College of Art

Nottingham Trent University

London College Of Fashion

University of the Arts London

UCL

University of Edinburgh

The Swedish School of Textiles

Högskolan I Borås

University of Manchester

Birmingham Business School