



mistra
future
fashion



sustainable fashion research agenda

-future directions arising from the mistra future fashion research programme

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Edition: Only available as PDF for individual printing

ISBN: 978-91-89049-51-2

Mistra Future Fashion report number: 2019:17

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Lindholmspiren 7 A, 417 56 Göteborg

www.ri.se

images: Unsplash

Layout: Malin Viola Wennberg

A Mistra Future Fashion Report

Mistra Future Fashion is a cross-disciplinary research program, initiated and primarily funded by Mistra. It holds a total budget of SEK 110 millions and stretches over 8 years, from 2011 to 2019. It is hosted by RISE in collaboration with 15 research partners and involves more than 50 industry partners.

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The Swedish Foundation for
Strategic Environmental Research

preface

The current fashion system, which includes the textiles industry, is complex. The recognition of socio-cultural and psychological motivations behind acquisition, use, maintenance, disposal - as well as design, branding and production - is imperative in order to address environmental issues at scale. Future research should develop better systems for the sector, but also needs to examine the dominant 'volume growth logic' and envisage fashion with reduced absolute use of resources.

The Board of Mistra Future Fashion, through Nick Morley
August 2019

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1. introduction

This paper was produced by the programme board of Mistra Future Fashion (MFF). It is the result of eight years of monitoring this research programme which has taken a systemic approach to sustainable fashion, including consumption, production, design and recycling of clothing. It sets out research ideas that have been generated by the programme, and areas that require further exploration. It is necessarily incomplete and subjective, depending in part on the personal interests of board members.

The sources used include presentations by MFF researchers, research papers and a board workshop on future research topics. We have used the theme headings of the research programme as a structure for our thoughts.

1.1. the scope of sustainable fashion research

In order to meet the complexity of how the fashion sector can move to sustainability, there is a need for further integrated transdisciplinary research. Fashion cannot be reduced to purely material considerations, which can be technical in nature, nor to a single focus on one stage in the lifecycle. Fashion involves complex decision making by many stakeholders, including end users in terms of how, when and where to procure, use, maintain and dispose of clothing. This decision making is necessarily linked to design.

As we have learned from the MFF programme, where it took a long time to achieve a good understanding between researchers from different areas, we really want to emphasise the need to give transdisciplinary research sufficient time to mature, including the need for physical meetings to establish greater understanding. This is also an insight from other Mistra programmes. Prioritising transdisciplinarity is important because cooperation between researchers from different areas, as well as with industry and governance, has proved to give fantastic results, and also creates a foundation for well anchored advice to industry and to governance organisations. Findings of such research have proven relevant to other sectors of industry, not just to fashion.

The scope of sustainable fashion research should include policy making: examples include the encouragement of reuse and recycling through extended producer responsibility, or the creation of financial incentives to use recycled materials.

The role of leadership and gender are also internationally important areas in sustainable fashion. Most of those taking key decisions in the fashion sector, either as company leaders or as creative or design directors, are not involved in sustainability initiatives. They are also mainly men, whereas most of those involved in sustainability are women. This is internationally true, and not a Swedish situation. It should be noted that alongside gender imbalances, it is imperative that intersectionality more broadly is taken account in future fashion and sustainability pursuits.

The profile and appeal of fashion holds the tantalising potential to encourage people into more sustainable patterns of living. Whereas, at the same time, the size and environmental profile of the sector means it is both a huge challenge but also has enormous potential for improvement. This potential will only be realised through sustained and coordinated efforts and it is therefore critical that future research is linked to education and learning.

Industrial partnerships should include the supply chain, particularly with fibre production and dyeing and finishing, which are environmental hotspots. This can be challenging in countries where the supply chain has been hollowed out and relocated offshore in developing countries with poor communication and infrastructure. Future fashion and sustainability research needs to consider social justice on the global scale, including working livelihoods of communities and individuals in sites of production.



2. supply chain

The current dominant supply chain model based around offshore manufacture is increasingly seen as being broken from a social and environmental perspective. The auditing-compliance approach does not work; consumed volumes of clothing and hence environmental impact are growing and increasing volumes of clothing are pushed upon consumers through sales and aggressive pricing. Arguably, overproduction is leading to overconsumption.

Research challenges include new supply chain models and their enabling technologies that prevent over-production, pull clothing from suppliers rather than push it upon consumers.

These research challenges can be combined with and enabled by current research into the digitally-enhanced supply chain management that encompasses digital sampling, customisation, fit enhancement, 3D printing, 3D knitting, digital printing, automated production and other Industry 4.0 issues.

Microplastics is a fast-evolving but young area of research which means that sustainability strategies are often not clear or are contested. The research agenda in microfibres is likewise enormous, and so we touch on only those topics arising from MFF research. Preliminary MFF research has shown that there are production approaches such as ultrasonic cutting that can substantially reduce microfibre shedding.

Follow on research should address how we can build in resistance to microfibre shedding through the way we make clothes.

Microfibre generation introduces an additional criteria in sustainability assessment of fibres and processes. How does this new criteria affect sustainability choices and trade-offs?

Company strategies are often to increase the amount of “sustainable materials” in their products. This choice is nuanced by moral and ethical decisions on sustainability criteria. MFF’s research has shown that variation in environmental impact within fibre types is usually greater than the impact between fibres. It is not the choice of material, but how that material has been made that is most important in selecting “sustainable materials”. All materials can be the sustainable choice if used appropriately. This both gives designers greater moral freedom to select materials, but creates the problem of measuring environmental impacts along actual supply chains rather than relying on proxies or general data on materials and assuming that these are valid for all manufacturers.

supply chain research challenges include:

- Identifying which materials are good for what purposes; labelling, tagging and the collection and presentation of actual environmental information associated with individual products.
- With respect to reuse and recycling, transparency and traceability is required regarding the material content. Technological innovations and the incorporation of ‘big-data’ will be essential in this endeavour.
- We do not need a greater number of innovative fibre types (although innovation is always welcome), but rather improved manufacturing processes and better energy mix (without fossil fuels) within the production line.
- Circularity and/or the full life cycle perspective needs to be integrated into supply chain organisation.
- Policy tools for supply chains that require further research include taxation, demanding declarations, CE marking and Product Environmental Footprinting.



3. design

Latter research in MFF has focused on the different speeds with which clothing passes through our current fashion system, and defines appropriate circular strategies aligned to these different speed contexts. Each type of apparel and cycle-speed requires different strategies, in terms of material specification, style, finish, production techniques and recovery methods.

The board identifies that a next important step is to investigate how the specific proposed design strategies align with the actual, and presumably diverse patterns of use, and how they can be integrated into different business models. How can we design fashion which fits into sustainable circular systems even if they are used in totally different and often unpredictable ways?

particularly important design research questions are:

- How can these design strategies (on cycling/different speeds) be used in industry's decision making?
- To what extent current infrastructure and legal frameworks support the full potential benefit of the strategies.
- How design strategies and processes can be further developed to support different technical circumstances, business and working models which acknowledge fashion outside of the current industry context.
- How design methods can be used to make communication across key stakeholders more effective. Specifically, communication to and dialogue with end users to achieve alignment of design and end of life strategies with actual usage.
- How the effects of design for circularity can be comprehensively assessed, in order to identify and mitigate rebound effects.
- How the role of the fashion and textile designer can be developed with these circularity strategies in mind.
- Identifying the best usage for particular material innovations, based on scientific modelling, since blanket approaches may be counter-productive.

The board recommends that future research integrates design lessons from Mistra Future Fashion with other pioneering research going on with this remit. For example, into localism, industry 4.0 and zero waste.



4. purchase and use

MFF research has shown that people with style-orientation, that is using clothing to express their individuality, have greater well-being than those with fashion-orientation, that is using clothing for social signalling and inclusion. Materialistic values, a focus on possession of goods, can lead to an erosion of wellbeing. The research has also pointed to the importance of individual goal setting, feedback, as well as peer systems in the implementation of more sustainable fashion practices.

The board suggests further development of the style and fashion orientation approach and its implications for business models such as rental and resale. Research should also be directed to how the fashion system can support confidence and social integration without purchases of fashion. Here, it is important to note that not all fashion is mediated by the fashion industry. Fashion is also about making, customising, social events etc. There should be exploration of how, for example, maker movements, mending, individual upcycling/remaking, craftivism, may be vehicles to decouple fashion experience from material throughput.

approaches for further development for purchase and use of fashion

- Adoption of more sustainable fashion practices can be explored with consumers through approaches such as gamification.
- Consumers are generally sceptical about messages from companies (“they only want to sell to me”), even companies wanting to do the right thing. Consumers generally trust influencers more, demonstrating the need for a third, more neutral party.
- Regular communication to a mass market audience is not appropriate when engagement between people is needed for such a complex and nuanced message.
- A change of mindset is required within companies in order to engage with the agenda of making less whilst increasing profit. Ways into this issue include the reduction of over production and the move to a system where consumers pull products from the supply chain, rather than have them pushed at them, often through substantial discounting.
- The change of purchasing channels by consumers requires further research, for example by examining the ecommerce system using LCA, including actual purchasing behaviour and the issue of returns.



5. reuse and recycling

One of the most exciting and positive changes in fashion has been the mainstreaming of commercial reuse operations. Whereas previously reuse was solely done informally or via thrift shops, a new generation of commercial reuse operations is emerging, both in the physical environment and on-line. Reuse can be direct or can involve some measure of product modification or transformation.

Policy making has an important role in order to increase reuse and recycling rates and to provide assist market development for recycled feedstocks.

reuse

- MFF research has shown that economic actors involved with reuse believe that a greater number and degree of incentives is required, including policy changes, in order to make a significant change to clothing reuse in Sweden.
- Research challenges include the greater understanding of cultural, social and economic and environmental issues around the reuse, reinvention and remanufacturing of clothing; the definition and evaluation of new policy measures to encourage reuse.

recycling

- MFF research on recycling has focused on chemical recycling, particularly that of blends of cotton and polyester. The influence of finishing chemicals and dyes has been evaluated and the potential for their removal. Early stage work on elastane blends has been carried out and also on disruptive approaches such as reversible dyeing and printing.
- Further development of the Blend Re:Wind process and other competitive processes are required to take them to commercialisation and then to scale. Continuing research is required into biological recycling processes for difficult materials such as elastane.
- Despite chemical methods of recycling becoming more advanced, the use of blends is becoming more widespread. For example, denim jeans used to be 100% cotton. Now a high proportion will contain elastane for comfort, and some will contain polyester for cheapness or nylon for durability.
- Hence materials substitution research is required into materials that fulfil the same functions as elastane, nylon and other blend materials but can be separated easily or recycled using cellulosic or polyester chemistry.
- With the establishment of pilot closed loop recycling methods processing hundreds or thousands of tonnes of fibre, options require research into the scaling of recycling to be significant compared to the 100m tonnes of virgin fibre produced each year. This includes examining recycling into other industries (composites, chemicals) and the replacement of bulk feedstocks such as wood cellulose, and the required industry and trading infrastructure.



Mistra Future Fashion is a research program that focuses on how to turn today's fashion industry and consumer habits toward sustainable fashion and behavior. Guided by the principles of the circular economy model, the program operates cross disciplinary and involves 60+ partners from the fashion ecosystem. Its unique system perspective combines new methods for design, production, use and recycling with relevant aspects such as new business models, policies, consumer science, life-cycle-assessments, system analysis, chemistry, engineering etc.

MISTRA is the initiator and primary funder covering the years 2011-2019. It is hosted by RISE Research Institutes of Sweden in collaboration with 15 research partners.

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