

Circular Economy Action Agenda

TEXTILES

In partnership with

**accenture**

CONTENTS

ACKNOWLEDGEMENTS..... 4

IN SUPPORT OF THE CIRCULAR ECONOMY ACTION AGENDA..... 6

FOREWORD..... 10

EXECUTIVE SUMMARY..... 12

ABOUT THE ACTION AGENDA..... 14

OBJECTIVES | What Do We Mean
by a Circular Economy for Textiles?..... 16

IMPACT | How Might a Circular Economy
for Textiles Affect People and Planet?..... 20

BARRIERS | What is Hindering the Transition
to a Circular Economy for Textiles?..... 24

ACTIONS | Where is Action Most Needed
for a Better and Faster Transition?..... 28

CONCLUSION..... 45

APPENDIX | Impact Assessment..... 46

ENDNOTES..... 51

REFERENCES..... 51



WHO WE ARE

PACE is a global community of leaders working together to accelerate the transition to a circular economy. We bring leaders together from across business, government and civil society to develop a collective agenda and drive ambitious action.





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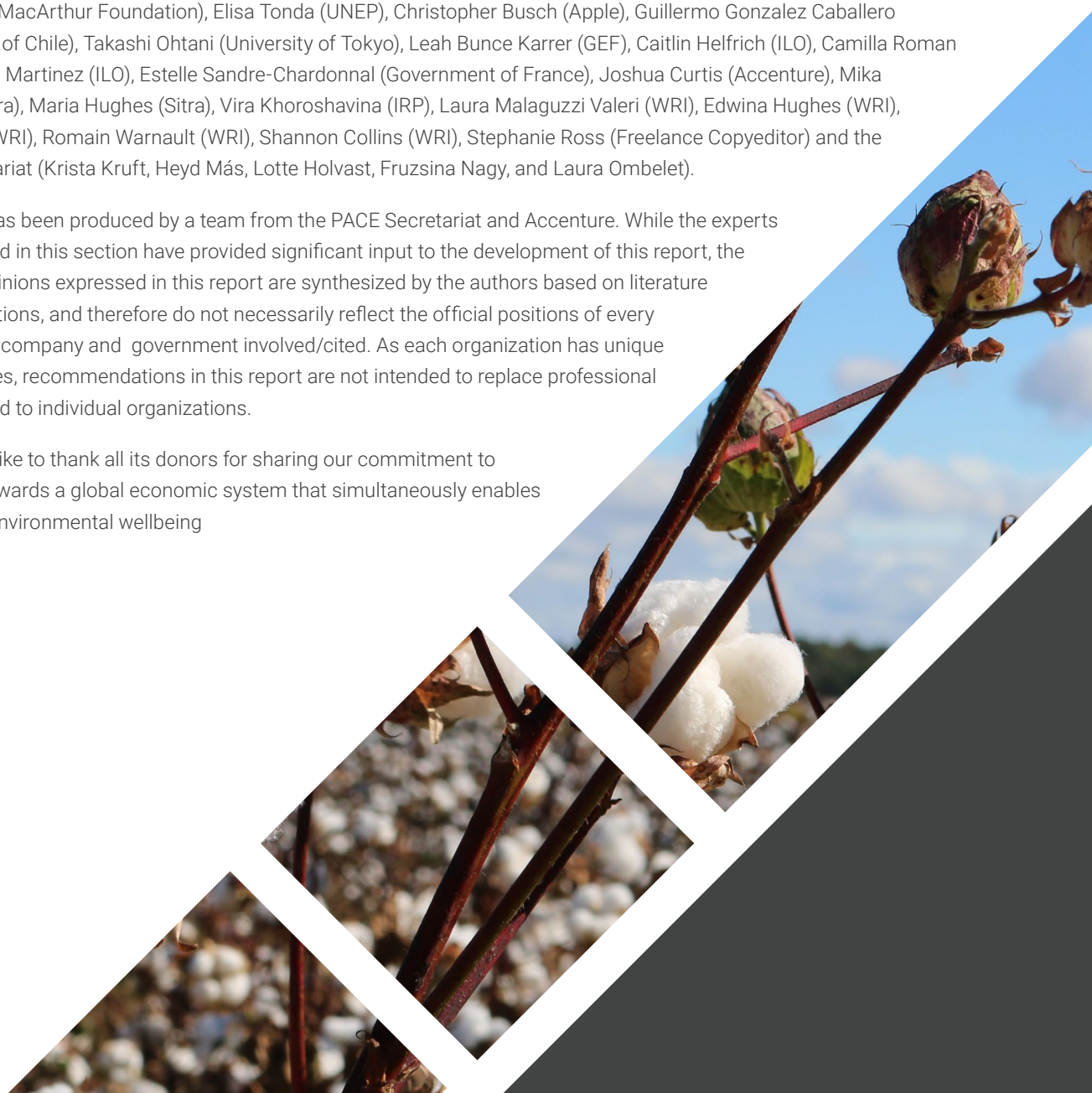
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PACE would like to thank all its donors for sharing our commitment to accelerate towards a global economic system that simultaneously enables human and environmental wellbeing



IN SUPPORT OF THE CIRCULAR ECONOMY ACTION AGENDA



INGER ANDERSEN | Executive Director, UN Environment Programme

"Scaling up circularity and sustainable consumption and production is essential to address the three planetary crises we are facing: the climate crisis, the biodiversity and nature crisis, and pollution and waste crisis. The calls-to-action should inspire and redirect the efforts of government, business and finance, and consumers, because at the end of the day, each and every one of us has the power and responsibility to contribute to the transition."



TIM BENTON | Research Director, Emerging Risks, and Director, Energy, Environment and Resources Programme, Chatham House

"An inclusive circular economy that promotes sustainability and decent work will help countries to build prosperous economies and just societies. The economic recovery from the COVID pandemic is an opportunity for governments to collaborate and accelerate this shift from linear to circular internationally."



MARTIJN LOPES CARDOZO | CEO, Circle Economy

"The CE Action Agenda delivers the necessary insights and a strong narrative for action within four areas where urgent change is needed. By enabling cross-sectoral partnerships to tackle these challenges, PACE is proving itself as a conducive change agent to help close the global circularity gap. We look forward to collaborating and delivering results within these key areas together."



FRANS VAN HOUTEN | CEO, Royal Philips

"Transitioning to a circular economy requires all of us to team up and commit to doing things fundamentally different. The PACE Action Agenda will help guide and drive circular ways of working across the board, changing how we create value without devastating environmental impact. I call on all leaders to join PACE and commit to adopt climate actions and prioritize circularity."



NAOKO ISHII | Executive Vice President and Director, Center for Global Commons, The University of Tokyo

"It is remarkable to see a number of global initiatives towards sustainability already ongoing in the fashion industry. Science-based information on where and how much environmental and social costs are borne along the entire value chain of fashion industry will be critical to further promote circularity in the fashion industry. I hope that this paper's action plan will help accelerate such a social transformation."



PETER LACY | Chief Responsibility Officer and Global Sustainability Services Lead, Accenture

"The circular economy offers an opportunity to unlock value and decouple growth from the use of scarce and harmful resources. This Action Agenda lays a foundation for the collaboration and innovation that is necessary to make production and consumption more sustainable for people and our planet. Now is the time to embrace end-to-end transformations that can create value while ensuring a more sustainable future."



DAME ELLEN MACARTHUR | Founder, Ellen MacArthur Foundation

"The circular economy is a solution framework that offers better growth while addressing the most pressing global challenges. The calls-to-action help reinforce the need for transformation of our most iconically linear value chains, towards an economy that eliminates waste, preserves the value of resources, and helps regenerate natural systems."



LLORENÇ MILÀ I CANALS | Head of Secretariat, Life Cycle Initiative (UNEP)

"The key for a transition to sustainable consumption and production patterns is anchored in the value chains – where circularity strategies are supported by strong life cycle thinking and assessment. We are proud to work with PACE partners in ensuring the calls-to-action address the key hotspots along these value chains' life cycle, to ensure we shift the needle on the planetary crises we face."



JANEZ POTOČNIK | Co-chair, International Resource Panel (UNEP)

"It was a pleasure to contribute to the development of the Action Agenda with our expertise in resource management issues. We are pleased with the clarity to which the reports have contributed. Now is the moment for stakeholders across all sectors to come together and pick up the calls to action."



STEVE SCHMIDA | Co-founder and Chief Innovation Officer, Resonance

"If we are to achieve the SDGs, circularity must be embedded into the very fabric of how industries and economies operate. The Circular Economy Action Agenda lays out a clear vision for how leaders from across business, government and civil society can partner together to drive sustainable, equitable action."



CAROLINA SCHMIDT | Minister of Environment, Chile

"We already know how the circular economy can make a key contribution to mitigate climate emissions. Now it's time to act. PACE's action agenda condenses and highlights the most urgent and effective pathways to unleash the transformation to a circular economy at a global level. Policy makers, scientists, businesses and citizens everywhere should put this powerful agenda into practice—today."



ANDREW STEER | President and CEO, World Resources Institute

"Circularity is the shape of the future. Shifting from the destructive take, make, waste model of the past is crucial if we are to achieve the SDGs. The new Circular Economy Action Agenda, which brings together insights from scientists, government officials, and business executives, presents a bold and clear way forward to a more sustainable approach that will benefit people and the planet."



MARIE FOSSUS STRANNEGÅRD | CEO, IVL Swedish Environmental Research Institute

"The Action Agenda is crucial reading for anyone working to improve social and environmental wellbeing through circular economy. We were glad to be part of the process to develop the reports and to be able to contribute with our decades of experience in translating environmental science into improvements in the society."





STIENTJE VAN VELDHOVEN | Minister for the Environment, The Netherlands

"The circular economy is our secret weapon for achieving our climate and sustainable development goals. PACE's Action Agenda demonstrates the need for a fundamental shift in the way we produce and consume. It contains concrete examples of a new economic reality taking shape. Let's use the Agenda to upscale cross-regional collaboration, build cross-sectoral partnerships and continue to build a circular world."



DOMINIC WAUGHRAY | Managing Director, Centre for Global Public Goods, World Economic Forum

"The twin crises of the pandemic and climate have underscored the need for more sustainable consumption and production. We must build on this momentum to forge new collaborations with policy makers, business leaders and consumers to ensure that resources are maximized, value chains are transformed and the circular transition can become a reality. The time is now."



MARINKE WIJNGAARD | Managing Director Circular Economy & Environment, TNO

"TNO is happy to be part of the PACE scientific community. We believe that through an integrated assessment of possible scenarios and through technological innovation we can find the right answer to every environmental question and make an accelerated transition to a circular economy feasible."





FOREWORD

We call on businesses, governments, and civil society leaders around the world to join us in raising the level of ambition to create a circular economy. Investing in a circular economy will be crucial to helping us realize the social, environmental, and economic benefits of the 2030 Agenda and the Paris Agreement, as well as to build a sustainable economic recovery from COVID-19.

This year over 200 circular economy experts from 100 businesses, governments and civil society organizations joined hands through PACE to develop the Circular Economy Action Agenda. The calls-to-action in the Agenda provide clear priorities for leaders around the world to join us in solving critical issues and taking advantage of open innovation opportunities.

Circular Action Means Impact. Embedding circular principles and goals across industries and governments' priorities will be crucial to reaching our 2050 net zero commitments. Changing the way we make and use products can contribute to addressing 45% of global greenhouse gas emissions, making a critical contribution to mitigating the impending climate crisis. Along the way, the widescale adoption of circular business models presents a US\$4.5 trillion economic opportunity.

Circular Action is Urgent. Our current economic system is based on linear principles of extracting natural resources, using them up, and creating huge volumes of waste. Our use of resources has tripled since 1970, and could double again by 2060 if we continue business as usual. Despite advances in technology, the growth rate in material consumption continues to increase faster than our population growth, with many social and environmental impacts resulting from inequities in consumption and production.

Not only is this linear model unsustainable, the economic impacts of COVID-19 have shown how vulnerable we are to economic shocks resulting from any disruption in the current flow of resources.

There is another way. By working towards a circular economy we can transition to a system that is designed to prevent waste and pollution, keep products and materials in use, and regenerate natural systems—leading to a more resilient economy.

Circular Action is Clear. While we have experienced an increase in interest in the circular economy, investments and scale are not happening fast enough. We believe that more alignment among leaders is required to show the way forward. These reports set out clear priorities for action in five critical focus areas—plastics, electronics, textiles, food, and capital equipment—providing important lessons that can be applied elsewhere.

There is much that can be done. Governments can set policy, companies can adapt their business models, the finance sector can invest, researchers can provide the scientific backing, and we can all do our part as individuals. But the biggest challenges mandate that we work together. That is why we join hands at PACE: creating the space for collaboration across sectors so that we can identify new solutions and scale up what works.

Join us as we take bold steps forward to create the better world we know is possible.



A handwritten signature in black ink that reads "D.B. +8".

David B. McGinty
Global Director, PACE





EXECUTIVE SUMMARY

The Circular Economy Action Agenda has been designed to accelerate the transition to a circular economy—and to a better future for people and nature. It transforms existing knowledge into a collective agenda that will inform and mobilize action.

Textiles have long been an integral part of our daily lives and society, providing employment for hundreds of millions of people and creating tremendous economic value. However, the industry's significant ecological footprint, as well as its health and social risks, have come under increasing scrutiny. There is urgent need for transformation.

How can circular strategies contribute? Three objectives have been formulated based on converging visions of a circular economy for textiles: inputs for textiles are safe and recycled or renewable; textiles are kept in use for longer; and textiles are recyclable and recycled at end-of-use.

The circular economy originated from using natural resources more efficiently and sustainably, yet its impact goes well beyond resource use. In addition to reducing chemical use and dependence on fossil resources, keeping textiles in use for longer and recycling more can bring clear benefits for climate change, human health, and biodiversity, by displacing parts of new production and the associated emissions and pollution. Shifting to safe inputs will protect the health of both workers and consumers, as well as helping preserve biodiversity.

There are also points of attention and knowledge gaps. Increasing renewable inputs for textiles may put more pressure on agriculture, competing for land with food production and forest protection. A transition to a circular economy for textiles is expected to shift employment in the value chain from upstream to mid- and downstream, therefore targeted efforts are needed to ensure the transition is just and inclusive. Furthermore, understanding of the economic impacts of the transition is still relatively limited and needs more quantitative research.

Despite the dire need and important opportunities, a circular transition of the textiles industry faces many barriers beyond the control of any individual stakeholder. From literature study and interviews carried out for this report, 14 key barriers have been identified that work collectively to slow progress towards a circular economy for textiles.

Building on the impact and barrier assessments, we put forward 10 calls-to-action. Each call-to-action is a priority where actions are most needed today, in order to overcome key barriers and to optimize the impact of the transition:

1. Incentivize and Support Design for Longevity and Recyclability
2. Produce Virgin Natural Fibers Sustainably, Including Land Use
3. Encourage the Market to Use Less Clothing, and for Longer
4. Guide and Support New Business Models for Environmental, Financial, and Social Triple-Win

5. Where Used Textiles Trade Occurs, Ensure Environmental and Socio-Economic Benefits
6. Strategically Plan Collection, Sorting, and Recycling Operations
7. Increase Efficiency and Quality in Textiles Sorting
8. Make Recycled Fibers Market Competitive
9. Integrate and Advance Decent Work in the Transition to a Circular Economy for Textiles
10. Investigate the Socio-Economic Impacts of a Circular Economy for Textiles

A variety of actions can be taken up by different stakeholders under each call-to-action. Some examples are given. We invite every changemaker to come up with ideas and initiatives to address these calls-to-action, adapting them to different contexts.





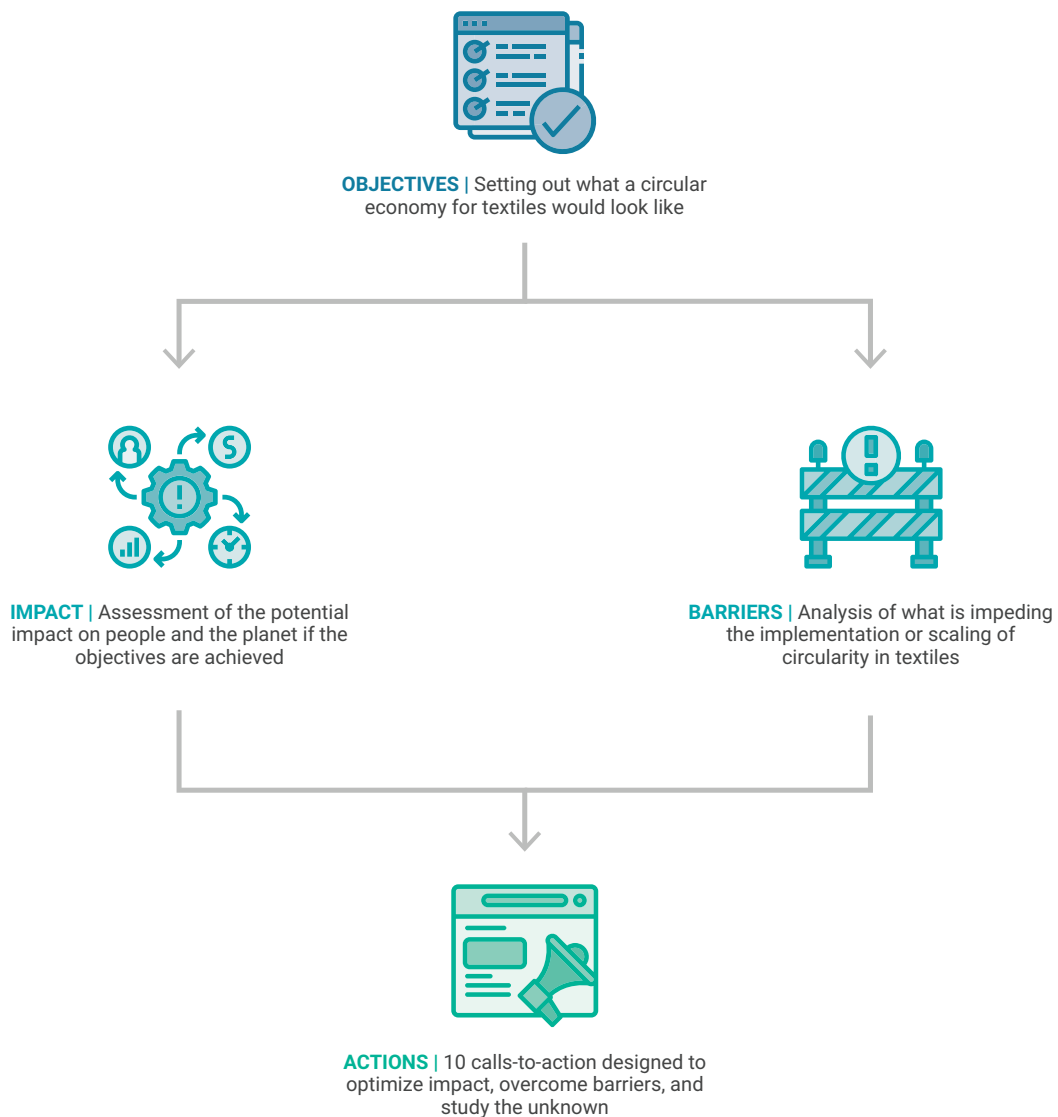
ABOUT THE ACTION AGENDA

The Circular Economy Action Agenda is designed as a rallying call for business, government, and civil society. It is currently made up of five publications: electronics, plastics, textiles, food, and capital equipment. The aim is to transform existing knowledge into a collective agenda that will inform and mobilize action within the PACE community and beyond.

Our economy has been highly successful in increasing productivity and elevating the living standards of parts of the population. In doing so, it has also created many challenges, both environmentally and socially. The need for solutions is more urgent than ever. A circular economy has been proposed as a way to address these challenges, with the ambition to harmonize economic and ecological goals.

Researchers have already documented the challenges from the textiles value chain today, the need for a transition to a circular economy, and the systemic change required for the transition.¹ This report builds on the existing literature to identify the actions needed for a better and faster transition to a circular economy for textiles. Each report has four main chapters: Objectives, Impact, Barriers, and Actions (see Figure 1).

FIGURE 1 • Structure of the Action Agenda Reports



How we Developed the Action Agenda

PACE brings leaders together from across sectors and industries to develop a collective agenda and drive ambitious action, creating a space for leaders to work in partnership and overcome challenges together. The Action Agenda is the result of collective efforts by working groups made up of representatives from business, government, civil society, finance, and research organizations, collaborating throughout 2020. In total, more than 200

experts from over 100 organizations have contributed via over 80 phone interviews, more than 20 group discussions and substantial written inputs. The reports try to integrate all insights, balance different viewpoints, and identify where further alignment is needed. We believe that this diversity of viewpoints is crucial for designing and realizing a better transition.



OBJECTIVES | What Do We Mean by a Circular Economy for Textiles?

We all desire and strive for a future of human and environmental wellbeing. The circular economy is a key path towards that future. This chapter explains how the community currently sees circular strategies being applied to textiles, and sets out three objectives.

Textiles have long been an integral part of our daily lives and society, with diverse applications ranging from clothing, interiors, and healthcare to industrial fabrics such as car upholstery. The clothing industry alone is valued at \$1.3 trillion dollars, employing more than 300 million people globally (Ellen MacArthur Foundation 2017). However, the environmental and socio-economic impacts of the textiles industry have been receiving increasing attention and scrutiny. The global apparel and footwear industries accounted for an estimated 8% of the world's greenhouse gas emissions in 2016, and climate impacts are projected to increase significantly if current trends continue (UN Environment Programme 2020). The textiles industry has a significant water footprint, consuming some 215 trillion liters of water per year (UN Environment Programme 2020), and polluting the water system with chemicals, detergents, and microfibers released in both production and use phases. The industry is further associated with land conversion and biodiversity loss, as well as health and social risks.

A transformation of the textiles industry is both urgently necessary and an opportunity-in-waiting. A transition to a circular economy is expected to unlock a \$560 billion economic opportunity in the fashion industry, by better capturing the value of underutilized and landfilled or incinerated clothes (Ellen MacArthur Foundation 2017). Progress across sectors is already underway, with business, civil society, and governments joining forces in various initiatives.² A common definition of a circular economy for textiles is being formulated in the community, represented by the recent launch of “Vision of a Circular Economy for Fashion” by the Ellen MacArthur Foundation (2020). Three circular objectives have been formulated, in line with existing vision statements, forming the basis of further analysis in this report:

1. Inputs for textiles are safe, recycled, or renewable
2. Textiles are kept in use for longer
3. Textiles are recyclable and recycled at end-of-use

1: INPUTS FOR TEXTILES ARE SAFE, RECYCLED, OR RENEWABLE

The first objective refers to moving to material inputs, including fibers and chemicals used in textiles production, that are (1) safe for both workers and consumers, and (2) either renewable (such as cotton or wood-based fiber sourced using sustainable agricultural practices) or recycled (either synthetic or natural fibers), or both (such as recycled plant-based fibers). The first element, safety, involves ensuring substances used in production don't pose health concerns for workers, and products don't pose the threat of releasing hazardous substances or microfibers throughout use. The second component sets out to reduce and eventually eliminate the use of virgin non-renewable resources.

PRODUCT SCOPE

This Action Agenda for Textiles focuses on plant-based, synthetic or blended fibers for apparel and interiors, including clothing and textiles used in homes, offices, and the hospitality sector. A particular emphasis is on clothing, as this constitutes over 60% of all textile use (Ellen MacArthur Foundation 2017). Animal-based materials such as wool, down, and leather are not the focus of this report, since they constitute a relatively small portion of total material use by the textiles industry. Nevertheless, they have significant circularity potential, and the report has included some leading practices as an inspiration.



2: TEXTILES ARE KEPT IN USE FOR LONGER

The second objective concerns the degree to which textile products, in particular clothing, are utilized. Underutilization can occur in a few different stages, for example, when items remain unsold in warehouses or stores, left unused in wardrobes, or are discarded by consumers while still in good condition. Therefore, this objective concerns both production and consumption. It means that 1) all products that are made are used, and excess stock is minimized and never destroyed; and 2) all products are used repeatedly and for long periods of time, instead of being left unused or thrown away prematurely.

3: TEXTILES ARE RECYCLABLE AND RECYCLED AT END-OF-USE

When textiles cannot be used or reused any longer, they should be collected and recycled. Upcycling should be prioritized over downcycling. Mechanical recycling is

currently the most common way of recycling textiles, where fabrics are deconstructed into fibers that can be used to make new yarn. Chemical recycling of textiles, though still under development, uses chemical processes to dissolve synthetic or natural fibers so they can be used as new feedstock. Increasing recycling rates will require change throughout the value chain: textiles must be designed to be easy to disassemble and recyclable in an economic way, consumers must dispose of them properly, and collection/sorting systems must effectively separate different textile waste streams to avoid cross-contamination in recycling and increase upcycling.

To achieve these three objectives, systemic change is needed across the whole value chain, from design, sourcing and manufacturing, to retail and consumption behavior, to collection, sorting and recycling. The needed systemic change has been discussed extensively in literature (such as Ellen MacArthur Foundation 2017; UNEP 2020).

FIGURE 2 • Major Challenges in the Textiles Value Chain Today and the Circular Objectives







IMPACT | How Might a Circular Economy for Textiles Affect People and Planet?

This chapter presents a literature-based assessment of how circular strategies may have an impact on the world, if achieved. Circularity alone cannot solve all today's problems. No solution alone can. It is therefore important to understand where circularity can deliver benefits, as well as areas that require attention or further research.

Circularity is not the end goal. It is, however, an important pathway contributing to the end goal, which is achieving greater human and planetary wellbeing—as described by the Sustainable Development Goals and the Paris Agreement. It is crucial to keep this north star in focus, and to steer the circular transition accordingly for a balanced, positive outcome.

The environmental and socio-economic impacts of the textiles industry today are already thoroughly documented in the literature (UNEP 2020; Ellen MacArthur Foundation 2017; Global Fashion Agenda and The Boston Consulting Group 2017; WRAP 2012). Major negative impacts include greenhouse gas emissions, pressure on land and water use, health hazards, lack of respect of and compliance with labor rights, and lost value at end-of-life. In this Action Agenda, we look to the future and ask the question: *if circular objectives are achieved, how might people and planet be affected?* It is important to understand where the circular economy can deliver benefits, as well as where points of attention and knowledge gaps exist.

Science-based, forward-looking impact assessment of increased circularity is still a relatively new field. As an initial step towards this understanding, the three objectives defined in the previous chapter were assessed by a group of scientific experts (see Appendix), based on existing literature along five impact categories:³

- ◆ **Resource use:** use of minerals and fossil resources.
- ◆ **Climate change:** greenhouse gas emissions from the value chain.
- ◆ **Human health and biodiversity:** largely as a consequence of land, water and chemical use, as well as air, water and soil pollution.
- ◆ **Economic wellbeing:** a broad category covering income, wealth, value added, and their distribution; trade, productivity, competitiveness, entrepreneurship, resilience, and investment.
- ◆ **Decent work:** a broad category that includes the promotion and realisation of standards and fundamental principles and rights at work, creating greater opportunities for women and men to decent employment and income, enhancing social protection, and strengthening social dialogue.⁴

The figures below give an impression of how each circular objective may affect the five impact categories: could it bring benefits, or trade-offs, or is it uncertain due to insufficient knowledge or evidence? A more detailed analysis can be found in the Appendix. It should be cautioned that impacts are almost always complex, with boundary conditions, caveats, and exceptions, and always evolving, e.g. as new technologies emerge. Therefore, these qualitative labels should never be seen as absolute or static.

Any complex transition comes with pros and cons. We should not be locked into inaction for fear of the risks and uncertainties. Quite the opposite; we should take proactive action to optimize the impact of a circular transition, including leveraging win-wins for maximum benefits, mitigating trade-offs and risks, and investigating the yet unknown.

FIGURE 3 • Expected Impact of Ensuring Inputs for Textiles are Safe and Recycled or Renewable

RESOURCE USE | Shifting from virgin cotton to recycled inputs may result in a lower resource use per kilogram of fiber (Global Fashion Agenda and The Boston Consulting Group 2017; van de Vreede and Sevenster 2010). The scale depends on technical advancement in the quality of recycled fibers. Shifting from synthetic to plant-based fibers (e.g. cotton or viscose) can reduce fossil resource use, but may increase land, water, fertilizer, and pesticide use (Global Fashion Agenda and The Boston Consulting Group 2017; Foster et al. 2013).

CLIMATE CHANGE | Shifting from high carbon footprint textile inputs (such as wool and leather) to recycled materials can reduce greenhouse gas emissions (Global Fashion Agenda and The Boston Consulting Group 2017; Shen, Worrell, and Patel 2012; van de Vreede and Sevenster 2010). Shifting from synthetic to plant-based fibers may lead to land conversion—where forests are cleared, greenhouse gas emissions may increase (Foster et al. 2013; Peltzer 2014); where wood-based fibers are grown on degraded cropland, it may help reduce greenhouse gas emissions by increasing soil carbon (Piemonte and Gironi 2011).

HUMAN HEALTH AND BIODIVERSITY | Moving to safe inputs will deliver benefits for health and biodiversity by eliminating toxic chemical use. The impacts of any new chemicals and materials introduced should be thoroughly investigated. Moving to renewable inputs may increase land, water, and pesticide use, exacerbating health and biodiversity concerns caused by (unsustainable) agriculture practices. Recycled fibers may contain unknown concentrations of hazardous substances and pose health risks (Patterson 2020).

ECONOMIC WELLBEING | There is still limited research on the overall economic impact of the textiles industry shifting from virgin inputs to recycled or renewable inputs. Transitioning from conventional natural fiber production to regenerative production methods may benefit farm economics (Sodjinou et al. 2015).

DECENT WORK | Moving to renewable inputs, especially if natural fibers are produced in a regenerative way, can lead to more jobs and increased economic independence of women (Bachmann 2012; Sodjinou et al. 2015). Moving to safe inputs can reduce exposure to toxic substances for workers (Schröder and Howarth 2019; Global Fashion Agenda and The Boston Consulting Group 2017). Actual impact will depend on the extent to which skills development measures, social protection and social dialogue are implemented (Global Fashion Agenda and The Boston Consulting Group 2017). More research is needed in this area.

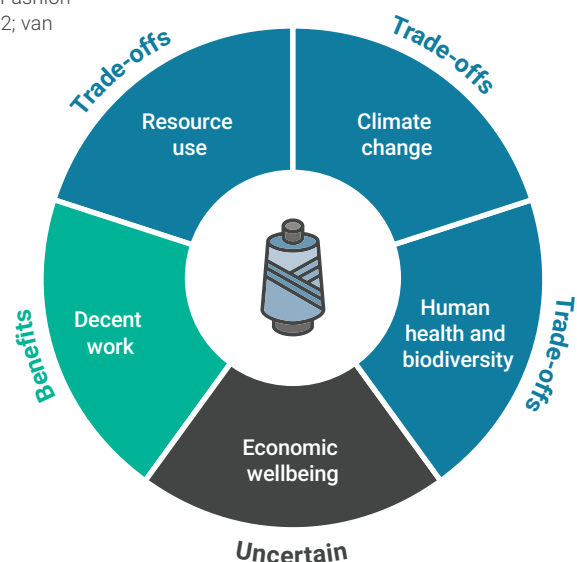


FIGURE 4 • Expected Impact of Keeping Textiles in Use for Longer

RESOURCE USE | If using textiles for longer displaces new production and consumption, then fossil resource and chemical use will be reduced (WRAP 2017). Benefits are expected to outweigh the resources involved in extra transport, cleaning, and handling.

CLIMATE CHANGE | Keeping textiles in use for longer will reduce greenhouse gas emissions if new production is displaced. A decrease in production will likely outweigh additional transport needs such as in used clothing exports, provided that the exported clothing gets re-used for a sufficiently long period (Sandin and Peters 2018).

HUMAN HEALTH AND BIODIVERSITY | The production phase of textiles accounts for most environmental and health hazards throughout the lifecycle (Ellen MacArthur Foundation 2017; Global Fashion Agenda and The Boston Consulting Group 2017). Therefore, keeping textiles in use for longer will benefit human health and biodiversity if it displaces new production.

ECONOMIC WELLBEING | The impact on the global economy can be complex and multifaceted. Keeping textiles in use for longer can deliver benefits in both household savings and government savings on externality costs (Global Fashion Agenda and The Boston Consulting Group 2017), as well as growth in local second-hand markets. On the other hand, the clothing manufacturing industry may see reduced revenue, and second-hand trading can suppress the textiles industry of importing countries (Katende-Magezi 2017). There is a lack of quantitative modeling research, particularly beyond the clothing industry.

DECENT WORK | Keeping textiles in use for longer will create new jobs in services and new business models, in proximity to the consumer (ILO 2019; Circle Economy 2020b). It may lead to some job losses in manufacturing, especially in low- and middle-income countries, where fast fashion has been a major employer of women (ILO 2019).

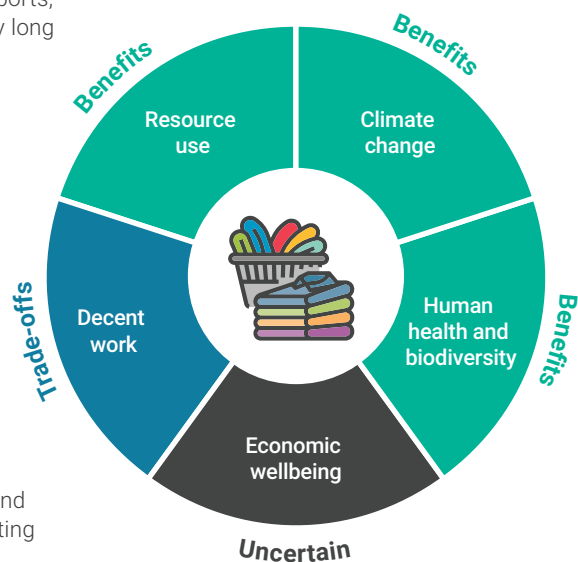


FIGURE 5 • Expected Impact of Ensuring Textiles are Recyclable and Recycled at End-of-Use

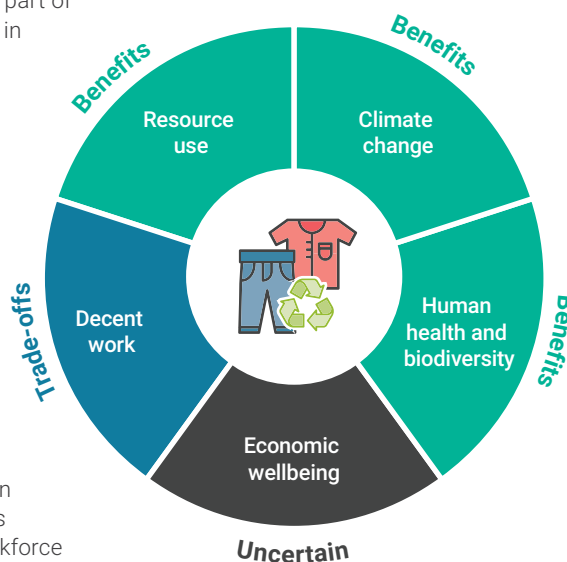
RESOURCE USE | Textiles recycling can reduce fossil resource and chemical use (in e.g. cotton farming), if it effectively replaces part of the virgin material inputs (Sandin and Peters 2018).

CLIMATE CHANGE | Textiles recycling in general is expected to reduce greenhouse gas emissions in production, if it effectively replaces part of virgin material inputs (Achim et al. 2020). Caution should be paid in the case of energy-intensive recycling technologies with high-carbon energy sources (Sandin and Peters 2018).

HUMAN HEALTH AND BIODIVERSITY | If increased recycling displaces virgin material input production, environmental and health hazards derived from the production of natural and synthetic fibers may be lowered (Global Fashion Agenda and The Boston Consulting Group 2017).

ECONOMIC WELLBEING | The economic impact of increased recycling on the whole textiles system, including on the upstream value chain (e.g. virgin material production), potential geographical redistribution of income, as well as externality cost savings, still needs to be investigated by quantitative modeling.

DECENT WORK | Textiles recycling may lead to some job losses in virgin natural fiber production, particularly in low-income countries where cotton cultivation employs significant segments of the workforce (World Wildlife Fund 2020). New jobs will be created in sorting, pre-processing, and recycling (Reuse 2015). These new jobs likely provide no direct replacement for farm job losses, since they tend to be based in urban areas, are less labor-intensive, and require different skills (Circle Economy 2020b). Furthermore, the working conditions of the jobs created should be further investigated.



“The Action Agenda by PACE helps create the systemic change needed for transitioning to a circular economy in key sectors. The calls-to-action provide us an opportunity to reach multiple goals, from our climate goals to halting biodiversity loss, reducing our overconsumption of resources, and increasing societal wellbeing, by transitioning to a circular economy.”

Mari Pantsar, Director, Sustainability Solutions, The Finnish Innovation Fund Sitra



BARRIERS | What is Hindering the Transition to a Circular Economy for Textiles?

This chapter analyzes what is currently impeding the implementation or scaling-up of circular strategies, considering all angles including policy, business models, finance, technology, information, culture, and behavior.

Transitioning to a circular economy for textiles is expected to generate economic value, on top of being an environmental necessity. Recycling textile waste materials is expected to enable a potential \$100 billion in value a year (Ellen MacArthur Foundation 2017). The value of the worldwide second-hand apparel market has grown from \$11 billion in 2011 to \$24 billion in 2018, and is projected to reach \$64 billion by 2024 (Shahbandeh 2020). The fashion rental business is projected to double in size from 2017 to 2023, to be worth \$1.9 billion globally (Fashion for Good and Accenture 2019).

A number of trends seem to be moving in the right direction. Consumers are increasingly conscious about a brand's purpose and the social and environmental impacts of their purchases. Accenture estimates that globally, about 50% of consumers believe providing credible "green" credentials, minimizing harm to the environment, and investing in sustainability makes a company more relevant and attractive (Accenture 2020). Alongside rising consumer interest, businesses are demonstrating increased interest in exploring new business models that promote circularity, with

a 2019 study finding 87% of clothing retailers were eager to trial resale models, and 61% wanted to test rental models (Ellen MacArthur Foundation 2020b). Textiles are receiving increasing attention in circular economy policies—the new EU Circular Economy Action Plan includes textiles as a key value chain under its policy framework (European Commission 2020a).

Despite the significant opportunities, the transition to a circular economy for textiles still faces many barriers beyond the control of any individual stakeholder. From the literature study (labeled as * in the References) and interviews, we have identified 14 key barriers that may work collectively to slow progress towards the objectives of a circular economy for textiles. There are links, connections, and overlaps between these, depending on the perspective of analysis. The goal is not to produce an exhaustive list of all barriers, but rather critical ones where collaborative action is needed to overcome them.

Cross-Cutting Barriers

Externalities are not accounted for – externalities are a consequence of an industrial activity that affect another party who did not choose to incur the cost or benefit, and can be negative or positive. Current price points of textiles products do not account for their negative externalities, including greenhouse gas emissions, health hazards, biodiversity loss, and land and water use. This puts products that reduce externalities (such as with increased circularity) while incurring higher costs in doing so, at a competitive disadvantage.

Lack of incentives to design for extended use life and recyclability – design decisions often fail to consider how a product can extend its use life, and how materials will be looped back into the economy at end-of-use. Adding these requirements into textile design may require investment, new collaborations, and higher costs, which are currently not rewarded by the market (e.g. through premium price points) or by policy (e.g. tax incentives). There needs to be an effective incentive mechanism for companies to initiate and sustain circular design changes (UNEP 2020).

Limited access to circular design know-how – designing for circularity requires new knowledge and design processes. Designers interested in circularity often do not have enough information to effectively implement in their work. With limited indicators around circular product

and process design, it is challenging to make informed operational decisions to maximize value and circularity simultaneously. Companies also tend to treat circular design and material innovations as proprietary knowledge, and are reluctant to share openly. Finally, there are often gaps in connecting complementary research, which inhibits and slows innovation.

Low-quality and low-durability garments are unsuitable for reuse and recycling – low-durability garments have a shorter lifespan, limiting use rates, and low-quality garments limit the possibility of recycling at end-of-use. Both are particularly common in “fast fashion”, which is often driven by low cost; though even at higher price points, garment durability also varies greatly by brand and manufacturer. Furthermore, the prevalence of low-price garments stimulates consumer behavior towards buying new and often, instead of repairing or buying second-hand.

Sustainability is not consumers’ most important purchasing decision driver – while there is increasing awareness of the environmental and social impact of consumption, research suggests that price and quality continue to be the most commonly considered factors when consumers make a purchasing decision (Accenture 2019). If a more sustainable product or business model has higher price points or function trade-off, or requires extra effort (e.g. bring back), market adoption is likely to be limited. Circular models may bring additional value to consumers in new ways, such as with increased access to or variety of clothing, but these elements are often overlooked or undervalued by customers who make “like-for-like” comparisons with linear models that typically do not involve these value drivers.

Barriers to moving to safe, recycled, or renewable inputs

High price sensitivity in fibers market – a major barrier to scaling recycled content in textiles is high price sensitivity for raw material inputs. Since fibers are at the beginning of the value chain, even a small price difference between virgin and recycled fibers has posed a significant barrier for brands to source recycled fibers. Coupled with low consumer willingness to pay a premium for sustainability, the relatively higher price for recycled fibers results in low market demand, and in turn, discourages scaling-up of recycling.

Barriers to keeping textiles in use for longer

Low emotional durability and short trend cycles

– clothing, particularly in “fast fashion”, is often characterized by low “emotional durability”, or the customer’s lack of attachment and desire to keep an item, and a culture of disposability, where items can easily be replaced. Similarly, the market is driven by short “trend” cycles where garments become obsolete and undesirable quickly, hampering the ability to reuse or resell items, as well as fueling a constant customer desire for newer, trendy items.

New business models often require higher costs and additional capabilities

– new business models that can increase product use rates, such as rental, subscription or re-commerce, may incur higher operational costs compared to the conventional sales business model. Such additional costs may include extra transport, cleaning, handling, and packaging. These business models may also require new capabilities in customer service, accounting, legal, and other business processes, which take time to develop or acquire.

Perceived financial risk – traditional financial assessment often sees the above-mentioned new business models as more risky, due to higher upfront investment, longer payback, asset-intensity, legal complexity, poorly understood residual value accounting, and lack of a proven track record. Therefore, it is often difficult for innovative companies and entrepreneurs to secure financing for such new business models.

Barriers to increasing recycling

Chemical additives can compromise the quality and safety of recycled output

– chemicals such as dyes, flame retardants, and coatings are prevalent in most textile products. Three thousand five hundred different substances have been identified in textile production (KEMI 2014). These additives not only pose a hazard in the production phase, they also add complexity to sorting and compromise the quality and safety of the recycled output.

Fiber blends are challenging to recycle – fabric with fiber blends provide extraordinary functionality for textile products, but are very difficult to recycle because they contain mixed fibers. The fiber blends need to be separated before entering mechanical recycling, and

separation is technically challenging, energy intensive, and costly. When unseparated textile blends enter mechanical recycling, the result is lower quality outputs.

Insufficient information for and from sorting – sorting is a critical step to provide high-purity inputs needed for high-quality recycling, especially for post-consumer textiles which are very heterogeneous. Currently, textiles sorting is done mostly manually, relying on the judgement of experienced workers. Labels are both impractical to serve as an information input for efficient sorting, and sometimes inaccurate. As a result, textiles sorting is costly, difficult to scale, prone to errors, and lacks quality assurance.

Low maturity of scalable high-quality recycling technology

– a major drawback of mechanical recycling, the dominant form of recycling technology for textiles, is that it shortens cotton fiber length, leading to low-value applications. Chemical recycling on the other hand promises virgin-quality fiber output that can theoretically be recycled infinitely. However, concerns have been raised about its high energy intensity. The European Union for example is yet to undertake an in-depth review of chemical recycling (Simon 2020). The uncertainty in policy direction discourages investment in research and development as well as scaled facilities, keeping chemical recycling at low technical and financial maturity. Although various innovative recycling technologies are being explored, their market maturity still remains low (UNEP 2020).

Underdeveloped collection, sorting, and recycling infrastructure globally

– although there are significant discrepancies in the formalization and development of infrastructure between countries (Ellen MacArthur Foundation 2020a), there is an overall insufficiency in textile collection, sorting, and recycling infrastructure globally. Infrastructure development is particularly challenging for post-consumer textiles, since they are from dispersed sources (which presents challenges for collection) and are highly heterogeneous in composition (which presents challenges for sorting). When not collected separately or sorted effectively, textiles waste often ends up in landfills and incineration plants in higher-income countries, and is subject to open dumping or open burning in lower-income countries.





ACTIONS | Where is Action Most Needed for a Better and Faster Transition?

Findings from the impact and barrier analysis are synthesized into 10 calls-to-action to overcome the barriers towards a circular economy for textiles, and to optimize impact by amplifying wins, mitigating trade-offs, and researching the yet unknown.

Building on the impact and barrier assessment presented in previous chapters, we put forward 10 calls-to-action for a better, just and faster transition to a circular economy for textiles. This is not a complete list of everything that needs to be done. Nor should the list stay static, as the world evolves rapidly. Instead, each call-to-action is an area where actions are most needed today, to overcome key barriers to a transition and to optimize impact. Under each call-to-action, a variety of actions can be taken up by different stakeholders.

Some examples are given in this report, though they are neither exhaustive nor prescriptive. We invite every changemaker to come up with ideas and initiatives to address these calls-to-action, adapting them to different contexts. A summary of how each stakeholder group (governments, businesses, civil society, finance, research organizations) can drive the change can be found at the end of this chapter.

CALL-TO-ACTION 1 |

Incentivize and Support Design for Longevity and Recyclability

Design is a critical starting point for the circular economy, in that it influences consumption patterns and dictates the resource intensity of production. Designing for longevity, both technically and emotionally, enables consumers to keep textile products in use for longer. Technical longevity can be achieved primarily through durability (e.g. using high-quality fibers) and repairability. Emotional longevity may be achieved through methods such as “timeless styles” or consumer involvement in design. Designing for recyclability (through e.g. safe materials, easy-to-disassemble, homogeneous fibers, as well as using recycled content, which will in turn contribute to improving recycling economics), enables resource recovery at end-of-use.

Design for longevity and recyclability may entail increased costs, such as higher material sourcing costs, more investment in research and development, and more quality assurance. Such efforts are currently not often rewarded by policies or the market—especially for products that do not fundamentally require high performance. There are also technical challenges in using recycled and recyclable materials, including compromised functionality (e.g. ability to stretch) or aesthetics (e.g. fit), contributing to circular criteria as a lower design priority for most, especially among small and medium-sized businesses with limited resources (UNEP 2020).

Governments can play a crucial role in stimulating design for circularity. Policies can mandate circular design, and ban problematic inputs such as hazardous chemicals or materials incompatible with large-scale recycling processes. Metrics, such as a minimum number of wears or washes to measure durability, can be used either as regulatory requirements, or as a basis for economic incentives such as procurement criteria, reward/penalty in taxation rates, or Extended Producer Responsibility (EPR) fees. These metrics can also be communicated to consumers, to influence purchasing decisions and therefore create market-based incentives (UNEP 2020). Actors across the value chain need to share knowledge around sustainable alternatives and cleaner production, and promote the skills and capacity needed for transition (UNEP 2020). Designers, recyclers, and researchers should work together to align product design and material innovation with existing and emerging recycling solutions.

This collaboration on design guidelines and solutions will be particularly important to facilitate adoption among small and medium-sized businesses with limited in-house resources.

WHERE CAN WE START:

- ◆ **Governments, businesses, and researchers can collaborate to develop and harmonize** metrics to measure textile products’ adherence to circular principles, as well as incentive mechanisms based on these metrics to stimulate circular design.
- ◆ **Businesses can use reliable metrics to inform consumers** and encourage responsible buying, similar to energy efficiency ratings currently used for home appliances.
- ◆ **Governments, businesses, and researchers can assess and implement product design standards**, such as the EU’s Ecodesign Directive that establishes requirements for businesses to adapt design and manufacturing practices to meet energy use, recyclability, waste, and water use standards.
- ◆ **Governments can include circularity in public procurement guidelines** to stimulate market demand and design change.
- ◆ **Governments can enact repairability requirements**, similar to the “right to repair” schemes for electronics proposed by the EU, requiring businesses to provide consumers with reasonable access to producer-supported repair of properly used products.
- ◆ **Civil society can work with researchers and businesses to identify and share best practices** around designing for longevity and repairability.
- ◆ **Financers can fund development of materials** that meet circular design requirements without functionality or aesthetic trade-offs.
- ◆ **Civil society and governments can work with businesses to measure, monitor, and track** textile design commitments.
- ◆ **Civil society can monitor the impact on accessibility of affordable fashion for mid-low-income citizens**, a potential trade-off if circular design standards increase product costs.

CALL-TO-ACTION 2 |

Produce Virgin Natural Fibers Sustainably, Including Land Use

Even with scaled recycling, it will be unrealistic for the textiles industry to use only recycled inputs in the foreseeable future, considering both current technology limitations and market growth (e.g. from increasing populations). Virgin materials will continue to be part of the equation to meet industry needs. Therefore, a push to decouple textile production from non-renewable inputs will mean an increasing demand for virgin plant-based fibers, such as cotton and wood. This will put more pressure on agriculture, competing for land with food production and forest protection, with the risk of further environmental degradation and biodiversity loss. Furthermore, growing environmental awareness has led to a growing demand for natural fibers produced by organic agriculture that uses less chemicals per hectare. However, organic farming may have a lower yield output and need more land to produce the same quantity of fibers (Foster et al. 2013).

Action should therefore focus on sustainable land use in virgin fiber production. This will start with investment in research and development, to develop scalable sustainable farming practices that are both regenerative and productive. Researchers can work with fiber producers to explore best practices, such as better genetic varieties of plants, crop rotation, nutrient monitoring, and improved irrigation systems (CottonWorks n.d.). Working closely with farmers to understand the practicality of such practices, as well as supporting farmers to benefit from the transition, will be critical for their scaled implementation. Civil society should encourage and support businesses in committing to sustainable land use, with consideration for the potential social and environmental externalities of shifting agricultural practices. Governments can reorient their policies to provide more incentives for sustainable production.

WHERE CAN WE START:

- ◆ **Researchers, civil society, and businesses can work together with the agricultural sector to identify best practices** of sustainable plant-based fiber production, and champion these examples for wider adoption.
- ◆ **Researchers and businesses can work with farmers to further develop and demonstrate** profit-enhancing regenerative agriculture practices; collaborating with other segments' agriculture, such as food production, to share and benefit from emerging progress on the common goal of improved land use.
- ◆ **Brands can require their supply chain to source sustainably produced plant-based fibers**, including land use considerations.
- ◆ **Finance, businesses, and governments can develop blended financing mechanisms** to develop sustainable farming solutions and support farmers to transition.
- ◆ **Civil society and businesses can raise consumer awareness** to drive market demand for more holistically sustainable products.
- ◆ **Governments** in plant-based fiber producing countries can work together with businesses to develop and enforce **sustainable production standards**.
- ◆ **Researchers and civil society can monitor and report the impacts of sustainable plant-based fiber expansion in key markets**, to increase understanding of emerging and/or potential externalities.



“As a wood-based textile fibers company, we are invested in sustainable production through improved productivity and use of alternative cellulosic feedstock. In the face of land use constraints and rising consumer demand, we firmly believe that fiber production and protection of natural forests can go hand-in-hand. We hope that the PACE Action Agenda will spur cross-sector collaboration and action to advance this goal.”

Felicia Tang, Head Communications & External Affairs, Viscose, RGE Group



PARTNERS IN ACTION | Circular Fibers

Pioneering Recycled Material Inputs

Austrian fiber manufacturer Lenzing Group boasts an 80-year history of fiber innovation. It uses wood and pulp from sustainably managed forests for the production of botanic fibers. The company has developed a pioneering upcycling process, the REFIBRA™ technology, which uses a substantial proportion of cotton scraps in addition to wood pulp. The resulting fiber, TENCEL™ x REFIBRA™, contains up to 30% recycled content without compromising softness, breathability, and strength. Lenzing's vision is to raise recycled content with significant post-consumer share of fibers produced with REFIBRA™ technology to 50% by 2024.

"Lenzing started focusing on resource-preserving production technologies at a time when sustainability was a concept rarely mentioned, let alone applied," says Stefan Doboczky, CEO of Lenzing Group. "Today we are proud to offer our partners a wide range of stunningly innovative, exciting fiber solutions." Thanks to the innovation and sustainability focus of the company, textile manufacturers and brands have the possibility of sourcing high-performing fiber material inputs for their products that are renewable, recycled, recyclable, and compostable.



PARTNERS IN ACTION | "On Course" Program

Enabling Brands to Innovate for Circularity

Designing and producing circular clothing requires an entirely new skillset from fashion brands and retailers. Circle Economy's "On Course" educational program aims to build organizations' capacity to achieve circularity in different aspects of their value chain, from product design to circular business models, through immersive live online or in-person workshops. Fashion and textiles businesses, as well as educational institutions, can learn which roles marketing, design, product development, sourcing, and sustainability teams play in the transition to a more circular textiles ecosystem.

"The circular economy marks an exciting opportunity for the apparel and footwear sector, but at the same time requires product departments to drastically change how they operate. We engaged with Circle Economy to gain new skills to navigate this change. The training was well-structured, theory and practice were rightly balanced, and it definitely helped us to think out of the box and integrate circular design into the creative process", is how Marianella Cervi, Sustainability & Responsibility EMEA at VF Corporation and participant of the programme describes her experience. The educational program is a great example of an initiative empowering clothing brands to valorise fashion waste by adopting circular strategies.

CALL-TO-ACTION 3 |

Encourage the market to use less clothing, and for longer

From 2000 to 2015 clothing production approximately doubled, while the average number of times a garment is worn before it ceases to be used has decreased by 36% (Ellen MacArthur Foundation 2017). It is estimated that each year people throw away clothes worth \$460 billion that they could continue to wear (Ellen MacArthur Foundation 2017). In the “fast fashion” trend, businesses release exponentially more styles with a shorter turnaround, tempting higher consumption with lower prices. Prolonging the use of textiles and addressing over-consumption have been identified as some of the most important strategies for reducing the environmental impacts of textiles (UNEP 2020). It should be recognized that in parts of the world where access to textiles is still limited, the priority should be to make clothing available and affordable to meet human needs. However, in high-consumption countries, consumers should be encouraged to not only choose more sustainable products, but also to consume less.

Shifting consumption involves buying less, buying second-hand, and keeping clothing in use for longer. To achieve this, it is important to share accurate and reliable product information with consumers, such as the origin of items, material and chemical content, and impact on people and the planet, to empower purchasing decisions (UNEP 2020). Businesses need to reimagine their product portfolios and business models, including offering products with emotional and technical longevity, slowing down fashion cycles, providing access to repair services, and improving the consumer experience of second-hand clothing. Governments need to provide enabling policies, such as lowering labor taxes, to make repairing and reuse more economically attractive.

WHERE CAN WE START:

- ◆ **Civil society can raise consumer awareness around the environmental and socio-economic impacts of fast fashion**, highlighting the significant externality costs of these low-priced items (e.g. resource use and labor practices).
- ◆ **Governments, businesses, and researchers can develop new product metrics** to communicate the most relevant/impactful product information to consumers (e.g. resource footprint of the product) and influence purchase decisions.
- ◆ **Researchers, businesses, and civil society can work together to better understand consumer behavior**; how to effectively nudge for change, design for emotional longevity, and improve experience of second-hand clothing.
- ◆ **Governments can assess policy options to make repair and reuse more economically attractive** for consumers, such as labor tax reductions.
- ◆ **Governments and research organizations can assess the effectiveness of policy measures** (and related economic and environmental impacts) to implement effective financial incentives for reuse models, specific to varying regions and current states.
- ◆ **Business and finance can increase investment in new business models**, such as repair services and second-hand platforms, with attractive value propositions to consumers (see also Call-to-Action 4).



“As we increase efficiency, we decrease cost and thus increase our consumption. There is even a name for this uncomfortable dilemma: the Jevons Paradox. Efficiency and technology will only help us if we pair them with a complete revisit of our habits of unchecked consumption and introduce new models of doing business to replace the old. Models that are compatible with staying within the resource boundaries of the planet.”

Kevin Moss, Global Director, Center for Sustainable Business, WRI

CALL-TO-ACTION 4 |

Guide and Support New Business Models for Environmental, Financial, and Social Triple-Win

New business models such as subscription, rental, and re-commerce hold significant potential as a pathway to achieve the circular objective of keeping products in use for longer. However, these business models are still facing many challenges to scale up and deliver real impact. On the environmental side, it is widely agreed that extending product use life can have broad environmental benefits for resource use, climate change, and human health and biodiversity—however, the extent of this benefit is heavily dependent on the displacement rate; that is, how much consumers are actually wearing the reused items in place of other potentially new items, as well as the environmental footprint of the reuse operations, such as increased transport and packaging. On the financial side, these business models often incur higher upfront investment and operational costs, including reverse logistics, customer platforms, expanded customer service, distribution channels, quality assurance, clothing cleaning, and repackaging. Understanding the social impacts of new business models is still just beginning.

The new business models need to achieve an environmental, financial, and social triple-win, to thrive, scale and contribute in a meaningful way towards the wellbeing of people and planet. Research organizations need to develop science-based tools to guide business model design and implementation for net positive environmental and social outcomes. Governments and finance need to provide policy and financial support to the new business models, based on metrics measuring their actual environmental and social impact. Civil society needs to mobilize business process innovation in for example accounting, legal, asset management and risk management to make these new business models more successful, as well as to make the new processes and tools readily available to businesses, especially small and medium-sized companies that may lack in-house resources.

WHERE CAN WE START:

- ◆ **Research organizations, businesses, governments, and finance can collaborate to develop metrics** to measure the environmental and social impacts of new business models.
- ◆ **Research organizations can develop science-based methodologies and tools** to guide new business model design, forecast their impacts and measure actual impacts, alongside the above-mentioned metrics.
- ◆ **Governments and finance can provide policy and financial support** to companies implementing new business models, based on their performance on the above-mentioned metrics.
- ◆ **Finance and government can evolve accounting methods and financing models** to provide a level playing field for new business models and increase their access to financing.
- ◆ **Civil society can mobilize and increase access to business process innovation**, especially for small and medium-sized companies.
- ◆ **Businesses, research organizations, and civil society can collaborate to share both success stories and learnings**, to advance triple-win business models in a pre-competitive environment.





PARTNERS IN ACTION | France's New EPR Scheme

Incentivizing Design for Circularity

Durable garments are a necessary prerequisite for a circular clothing economy where textiles are kept in use for longer, repaired when needed, and finally recycled. But the market demands of fast fashion have meant that textile companies may not always design their products for longevity. As a result, cheap, less durable fabrics are widespread on today's clothing market. The new French anti-waste law for a circular economy encourages more environmentally-friendly products through a financial reward/penalty system.

"Manufacturers who design products in a more ecological way benefit from lower contributions toward the management and treatment of the end-of-life of their products, while those who do not will see their contributions increase," explains Vincent Coissard, head of the Waste and Circular Economy Division at the French Ministry for the Ecological Transition. Circular criteria already exist in the Extended Producer Responsibility (EPR) scheme for clothing: garments that are more durable and use more recycled inputs receive a discount on the EPR fee. To make it more effective as an incentive, the new anti-waste law allows for an EPR contribution to form a significant percentage of the product price. France's new EPR scheme sets a landmark example in the textiles industry of how legislation may promote designing for circularity.



PARTNERS IN ACTION | A Marketplace for Luxury Goods

Democratizing Second-Hand Consumption

Buying and selling second-hand goods has become easier and safer through online marketplaces such as Vestiaire Collective. On the global platform, users can purchase items from private sellers and either have them directly shipped to their home or have the item transit through one of Vestiaire Collective's hubs for a real-life quality and authenticity check. This way, the platform successfully fights counterfeiting and creates the trust necessary to buy and sell luxury goods second-hand and online.

"By engaging our consumers to drastically change the way they consume fashion, we participate in the advent of a circular business model that has significant advantages in terms of sustainability," says Sophie Hersan, co-founder of Vestiaire Collective. Instead of sitting in a wardrobe for years, unworn pieces are now given a second or even third life." Online marketplaces such as Vestiaire Collective contribute to democratizing second-hand consumption, making a large quality offer accessible to a wide audience. Today, on average, 15,000 items are listed every day on the platform, which now provides more than two million curated pieces globally. Vestiaire Collective hosts a community of buyers and sellers across more than 100 countries in Europe, United States, Asia, and Australia.

CALL-TO-ACTION 5 |

Where Used Textiles Trade Occurs, Ensure Environmental and Socio-Economic Benefits

While some countries have high textile waste collection rates, a significant proportion (estimated to be around 70%) of textiles collected for reuse is sent overseas (Ellen MacArthur Foundation 2017). Used clothing represented over \$4.38 billion in trade in 2018 (OEC 2018; Ellen MacArthur Foundation 2017). When used textile products are actually reused, it delivers environmental benefits that outweigh the extra transport (Farrant, Olsen, and Wangel 2010). However, it is unclear how much imported used clothing is actually sold on local secondary markets instead of becoming waste. Since importing countries often lack infrastructure and systems for high-quality recycling or other environmentally sound waste management, textile waste usually gets downcycled or improperly disposed of (e.g. in open dumps or open burning), causing health and environmental hazards for the local community. On the socio-economical side, although used textiles provide affordable goods for low-income populations in the importing countries, they can also outcompete and suppress development of the local textile manufacturing industry, which has caused countries such as Rwanda to ban second-hand clothing imports in order to promote development of their own markets (John 2018).

Therefore, the used textiles trade should be managed with targeted efforts to ensure environmental benefits and help preserve local industries. Research and international organizations should provide guidelines for environmentally and socially responsible trade. Governments and businesses need to utilize these to ensure that importing countries have the capabilities to handle the level of imports without detriment to local markets, both from an adequate resale demand side as well as a recycling infrastructure side. Once countries have aligned on desired levels of import and export, actors also need to monitor uptake of reuse and recycling within countries to ensure externalities are appropriately identified and addressed. Actors should continuously seek to understand country-specific implications and adjust policy and practices to account for this.

WHERE CAN WE START:

- ◆ **Governments and businesses in current exporting countries can grow the local second-hand market and high-quality recycling**, to reduce the amount of used textiles traded.
- ◆ **International organizations and governments can collaborate to set up acceptance criteria for used textiles trading**, for example minimum quality, type of products that suit local market needs, as well as end-of-use management capacity such as collection, sorting, and high-quality recycling.
- ◆ **Businesses, governments, and finance can work on financing mechanisms for reuse, collection, sorting, and recycling operations in importing countries.**
- ◆ **Businesses can work with exporting and importing countries to expand resale channels**, identifying target markets and additional channels for unsold goods.
- ◆ **Businesses and civil society can help importing countries economically benefit from the trade**, for example by increasing the sourcing of recycled content from importing countries, creating more decent jobs in textiles reuse and recycling, and reversing trade flows by buying products from the local textiles industry.
- ◆ **Researchers and civil society can monitor the destiny of imported used textiles and associated externalities**, informing national and international policy decisions.

CALL-TO-ACTION 6 | Strategically Plan Collection, Sorting, and Recycling Operations

Recycling facilities entail large capital investments with a lock-in of decades and require economies of scale. Therefore, they need to be planned carefully with holistic considerations, both environmentally and economically. Ideally, the recycling location should be close to consumption centers to ensure sufficient inflow of high-quality products, and be close to manufacturing centers to ensure uptake of the recycled outputs. However, this can be challenging, as textile manufacturing centers and consumption centers are often geographically separate. Technology choices will also be crucial. The balance between mechanical and chemical recycling capacities needs to take into consideration both recycling economics and environmental footprint (e.g. greenhouse gas emissions from the recycling process), looking ahead at the decades to come. Collection and sorting, on the other hand, are fragmented and labor intensive operations—especially for post-consumer textiles, which are highly varied and dispersed.

Research organizations need to provide science-based advice on how sorting and recycling facilities should be planned, giving consideration to both current and future trends in technology, market needs, and policy. Governments need to provide clear guidance to steer private sector investment and instill confidence in return from these investments. Governments and businesses need to work together to develop blended finance models for such facilities and associated infrastructure. Inter-governmental organizations need to help different

nations coordinate their planning, and build systems to support responsible transboundary textile trade for recycling.

WHERE CAN WE START:

- ◆ **Businesses and governments can work together to scope regional collaborations** to develop sorting and recycling ecosystems, for example a regional hub or a more distributed value chain, planning a balanced mix of recycling technologies and infrastructure.
- ◆ **Research organizations can develop data and knowledge about the economic, environmental, and social impacts of different global/local recycling models** to inform strategic decision-making.
- ◆ **Research organizations and governments can advance textile tracking systems to better inform planning**, for example, tracking volume of textile waste generated and additional variables such as fiber composition that may impact infrastructure needs.
- ◆ **Businesses, governments, and finance can work out blended financing models** for textile collection, sorting, and recycling infrastructure.
- ◆ **Businesses and governments can connect fragmented collection, sorting, and recycling systems**, to improve efficiencies, scale best practice, and achieve economy of scale.



“Collaboration is imperative for a cohesive and deliverable plan for collection, sorting, and recycling. Actions from one part of the chain alone are likely to be in vain. Textiles need to be designed and made for recyclability as much as recycling technologies need to accommodate design needs. Focused dialogue between businesses in all parts of the value chain, government, NGOs, and academia can help to make that happen.”

David Rogers, Head of International Resource Management, WRAP

CALL-TO-ACTION 7 |

Increase Efficiency and Quality in Textiles Sorting

Sorting is a key step in the circular economy for textiles, since the quality and safety of textiles recycling output strongly depends on its feedstock. Mixed inputs will compromise the quality of recycled fibers, while unknown chemical additives may cause recycled fibers to contain hazardous substances. Current textiles sorting relies largely on the tactile judgement of experienced workers. Physical labels, designed to share product information with consumers, are usually not practical as an information source in sorting, and actually pollute the feedstock for recycling (Circle Economy 2020a). As a result, textiles sorting is labor intensive, costly, and inaccurate. It is difficult to measure and assure the quality of sorting output, and to share that information with the recycler.

Improving the efficiency and quality of sorting is crucial for textiles recycling. Technology will likely play a critical role, developing new and better ways to share information across the value chain, such as using radio-frequency identification (RFID), e-ink tagging, and blockchain. Businesses need to make sure that the right product information is available to relevant actors in the value chain. Standards can be developed for “label” requirements (either physical or digital) to ensure it contains relevant and accurate information. Quality standards can be established for sorting outputs. Advances in sensor-based sorting may reduce or even eliminate dependence on material information shared from the upstream value chain, significantly automating the sorting process and reducing costs.

WHERE CAN WE START:

- ◆ **Research organizations and finance can develop technologies** for digitally sharing product information and/or for automated, sensor-based sorting.
- ◆ **Civil society can convene brands, sorters, and recyclers to develop industrial standards** on labelling requirements, to make sure relevant and accurate information can be shared across the value chain, in the right format.
- ◆ **Civil society can convene sorters and recyclers to develop quality standards** for textiles sorting outputs.
- ◆ **Business and finance can pilot and scale new technologies** to improve textiles sorting.



CALL-TO-ACTION 8 | Make Recycled Fibers Market Competitive

In order to truly scale-up textiles recycling, recycled fibers must be able to compete with virgin fibers on quality (such as length, strength, uniformity, and color grade), safety (abiding to health and safety regulations, including for chemical additives as seen in the EU's REACH (European Commission 2020b)), price, and supply capacity. Only when recycled fibers are market competitive can businesses adopt them on a significant scale, and in turn further stimulate the development of recycled material supply chains. Currently, most recycled fibers have either degraded quality and are downcycled for lower-value applications such as stuffing, or have higher prices compared to virgin fibers—even a small premium has proven to be a significant barrier for market adoption.

All stakeholder groups need to work together to improve the market competitiveness of recycled fibers, from both supply side and demand side. Several other calls-to-action, including design for recyclability, increasing sorting efficiency, and strategically planning recycling infrastructure, are all important for making recycled fibers more market competitive. Furthermore, innovation in recycling technology to increase output quality and reduce costs needs to be accelerated. Quality and safety standards will help increase market confidence in recycled fibers. On the demand side, increased sourcing of recycled fibers is crucial. Brands, as well as governments (as a large textiles product buyer), have a critical role to play here. Civil society can raise consumer awareness for more acceptance of and preference for products with recycled content. Governments can also use other policy instruments to help create a favorable environment for recycled fibers.

WHERE CAN WE START:

- ◆ **Research organizations and financers can accelerate research and development** in high-quality and cost-effective textile sorting and recycling technologies.
- ◆ **Governments can develop and enforce quality and safety standards** for sorting and recycled textiles outputs.
- ◆ **Brands can commit to sourcing recycled content** and work proactively to achieve the commitments.
- ◆ **Civil society and businesses can raise consumer awareness** of textile products with recycled content for more acceptance and preference in purchasing decisions.
- ◆ **Governments can include textiles with recycled content in public procurement guidelines.**
- ◆ **Civil society can convene value chain actors and foster collaboration to improve recycling economics**, with shared responsibilities and benefits across the value chain.
- ◆ **Governments and researchers can evaluate policy instruments**, such as EPR (Extended Producer Responsibility) schemes, mandating recycled content, tax benefits for producing/sourcing recycled fibers, or externality fees for non-renewable virgin fiber.





PARTNERS IN ACTION | Down Recycling Project

Spearheading Product-to-Product Recycling

Global casual apparel brand UNIQLO was among the first clothing brands to take back used items. Over the past few years UNIQLO started setting up collection points in their stores, where customers could drop off lightly-used clothing. From here, clothing is sorted, and depending on its condition, reused or recycled. Together with the United Nations Refugee Agency and other NGOs, needs-appropriate clothing is delivered to refugee camps around the world. Clothes that cannot be reused are recycled into sound-absorbing material or fuel.

The company has made a further leap forward. In 2020, UNIQLO launched its Down Recycling Project, a great example of product-to-product recycling. Thanks to innovative technology developed together with world-leading fiber and textile manufacturer Toray, all down and feathers used in new products now come from down jackets collected from customers. Customers are invited to be a part of the recycling process by exchanging used UNIQLO down items for in-store vouchers.



PARTNERS IN ACTION | Circular Fashion Partnership

Turning Fashion Waste Into New Products

In a linear fashion economy, vast amounts of clothing are wasted before even reaching the consumer. Only 1% of fashion waste generated during production or as a consequence of excess stock is currently being recycled. The Circular Fashion Partnership aims to increase this rate by working with fashion brands, factories, and recycling facilities to capture fashion waste and return it to the production cycle.

"It is estimated that around 400,000 tonnes of post-production textile waste are produced annually in Bangladesh," says Holly Syrett, Senior Sustainability Manager at Global Fashion Agenda. "This waste represents a significant economic opportunity that can be captured when factories set up in-house segregation and there's streamlined handling and traceability to recycling." The Circular Fashion Partnership aims to establish a circular supply chain in textile manufacturing countries, starting in Bangladesh and potentially expanding to Vietnam and Indonesia. Participating brands, manufacturers, and recyclers collaborate to transition to mutually beneficial circular business models. Together, the network is working to create a replicable Playbook for Circularity in Fashion. H&M Group, Peak Performance, Bestseller, OVS, Bershka and Pull & Bear are among the first participants of the initiative, which is facilitated by Global Fashion Agenda with Reverse Resources, BGMEA and P4G. The partnership is currently open to join, and there is no cost for participation.

CALL-TO-ACTION 9 |

Integrate and Advance Decent Work in the Transition to a Circular Economy for Textiles

A transition to a circular economy for textiles is expected to have a complex impact on employment in the value chain: increased recycling may reduce demand for virgin fibers and related production jobs, while shifting to regenerative farming will likely create more employment. Some jobs may be lost in manufacturing, while new jobs will be created in repair, resale, sorting, pre-processing, and recycling—skills development will be crucial. The transition provides the potential for higher quality jobs, especially for informal workers. It will not happen automatically though—targeted efforts are needed from governments, companies, and workers' organizations.

For the transition to be effective and socially inclusive, decent work must be integrated from the beginning, in line with the ILO *Guidelines for a Just Transition*, and in consultation with employers' associations and workers' organizations (ILO 2015). Those whose jobs and income may be affected need to be included in social dialogue early on. Governments and philanthropic organizations need to provide resources for re- and upskilling programs, to help workers develop the skills needed in new formal jobs of the circular value chain. Additionally, to avoid exploitation, when taking measures to ensure decent work governments and businesses should work to ensure changes are made across the industry (Drew et al. 2020). Further research is needed to understand the potential magnitude of the impact, as well as its effects on the various dimensions of decent work, including enterprise development, labor protection, social protection, and rights at work.

WHERE CAN WE START:

- ◆ **Governments have the duty to adopt, implement, and enforce labor laws and regulations** to ensure that the fundamental principles and rights at work and ratified international labor conventions protect and apply to all workers engaged in the textiles value chain, and to create an enabling environment for social dialogue.
- ◆ **Governments, employers', and workers' organizations can support the formalization of enterprises and create an enabling environment** to provide sustainable services in textiles repair, resale, and recycling.
- ◆ **Brands can monitor their supply chains for better working conditions**, and help enforce compliance with safety and other labor regulations.
- ◆ **Governments, civil society, employers', and workers' organizations can develop decent work programs** to protect the health and safety of textile workers throughout the value chain, extend the coverage of social protection, invest in up- and reskilling programs, and in particular support informal workers to transition into formal employment.
- ◆ **Governments, with the support of research organizations, employers' and workers' organizations, and NGOs, can collect data and improve knowledge about labor conditions** in the textiles value chain, and the opportunities and implications of a transition to a circular economy.



“Just transition to circular economy should be one where people are guaranteed dignity, security, and equal opportunities. This can only be achieved through addressing and integrating decent work policies in the circular economy. It requires a joint effort by governments, employers and workers, and their representatives, in devising social protection, skills training and upgrading, and employment policies to support workers particularly affected by the transition, and in promoting an enabling environment for sustainable enterprises.”

Alette van Leur, Director of the Sectoral Policies Department, ILO

CALL-TO-ACTION 10 |

Investigate the Socio-Economic Impacts of a Circular Economy for Textiles

A transition to a circular economy for textiles has been suggested as bringing economic benefits including material cost savings, more resilience to raw material price volatility, new revenue streams, and overall income growth of the value chain (Ellen MacArthur Foundation 2017). Circular business models are projected to help textiles companies mitigate the profitability risk by about 3% by 2030 (Global Fashion Agenda and The Boston Consulting Group 2017). Other literature suggests the impact on the global economy can be complex and multifaceted. For example, the clothing manufacturing industry may see reduced revenue, and second-hand trading can suppress the textile industry in importing countries (Katende-Magezi 2017).

To date, there is still no quantitative macroeconomic modeling on increased circularity in textiles to thoroughly understand and underpin potential effects. Total system costs and gains of the transition, as well as its distribution across different geographies, value chains and stakeholder groups, is still unclear. New research, especially quantitative modeling, is needed to bridge this critical knowledge gap. This understanding will be crucial to motivate broader engagement of governments and businesses from different parts of the world in the transition, and to take proper actions to optimize global economic impacts.

WHERE CAN WE START:

- ◆ **Research organizations can conduct science-based analysis of socio-economic impacts of a circular economy for textiles**, including a variety of indicators at different levels (macro/meso/micro), concerning different stakeholder groups, and for different countries.
- ◆ **Governments, businesses, and civil society** can collaborate with researchers by collecting and providing data needed for such quantitative studies.
- ◆ **Government and civil society can finance such economic studies.**
- ◆ **Governments, research organizations, and civil society can develop metrics** to measure and monitor the socio-economic impacts of a transition to the circular economy for textiles.
- ◆ Based on the outcome of the studies, **governments and researchers can develop policy interventions** to capture and amplify socio-economic benefits, as well as to mitigate against trade-offs or risks of a circular economy for textiles.



How Can I Drive the Change?

GOVERNMENTS

Governments can drive the transition towards a circular economy for textiles by creating a business environment in which negative externalities are internalized, thereby aligning economic incentives with positive environmental and social outcomes. This can include:

- ◆ Develop and harmonize indicators to measure textile products' adherence to circular principles. Set balanced targets.
- ◆ Provide policy stimulation for the uptake of circular design, repair, reuse, recycling, and sourcing of recycled content.
- ◆ Set up and enforce standards for sustainable plant-based fiber production.
- ◆ Install and implement guidelines for used textiles trading, such as acceptance criteria.
- ◆ Plan and (co-)invest in collection, sorting, and recycling infrastructure. Modulate technology mix and capacity.
- ◆ Implement and enforce adequate legal frameworks for decent work, including support for the integration of informal workers.

BUSINESSES

The critical actions of businesses will depend on their position in the value chain. Here are a few starting points where businesses can take the lead:

- ◆ **Fiber producers** can commit to circularity at the leadership level; eliminate hazardous inputs; increase sourcing of recycled feedstock; develop productive and regenerative farming practices for plant-based fiber; integrate recyclability in design decisions; and collaborate with recyclers.
- ◆ **Brands** can commit to circularity at the leadership level; increase sourcing of fabrics with recycled content or from sustainably produced virgin fibers; integrate longevity and recyclability in design decisions; slow down fashion cycles; evolve value propositions and improve consumer experience with new business models that encourage longer use; finance collection/sorting/recycling; and extend supply chain auditing to downstream partners to advance decent work.

- ◆ Major **users** of textiles, such as the hospitality industry, can increase sourcing of products designed for circularity, and collaborate in developing B2B collection systems.
- ◆ Used textiles **traders** can expand resale channels for unsold goods; and set up reverse trade flows such as recycled fibers and local textile products.
- ◆ Collaborating with other value chain actors, **sorters and recyclers** can co-develop standards and certification for secondary materials; help product designers better understand how to design for recyclability; identify innovation opportunities in sorting and recycling technologies; and integrate informal workers in the development of professional collection, sorting, and recycling infrastructure.

CIVIL SOCIETY

Organizations across the spectrum of civil society can spur action in a multitude of ways. Key actions include:

- ◆ Convene cross-sectoral, multinational stakeholders to develop and implement coordinated circular transition strategies and measures.
- ◆ Coordinate the development of standards in, for example, circularity definitions, metrics, quality and safety of sorting and recycling outputs, and certification.
- ◆ Identify and share best practices in e.g. circular design, sustainable fiber production, new business models, sorting and recycling technologies.
- ◆ Raise awareness on the environmental, social, and health impacts of the textiles lifecycle, in particular fast fashion. Nudge consumer behavior change in purchasing decisions.
- ◆ Provide guidelines for environmentally and socially responsible trade of used textiles. Monitor progress.
- ◆ Elevate and connect circularity of textiles with broader transformations such as the SDGs and the Paris Accord.
- ◆ Collect data and improve knowledge about labor conditions in the textiles value chain, and implications of higher circularity across the supply chain, in order to advance decent work in the transition.



In addition, workers' organizations can:

- ◆ Play an active role in the formulation, implementation and monitoring of circular economy policies, ensuring decent work and social inclusion are integral part.
- ◆ Advocate for the respect of international labour standards and help devising skills development and social protection programmes to ensure a just transition to circular economy.
- ◆ Raise awareness and help understand the impacts of transition to circular economy models on employment, working conditions and social dialogue.

FINANCE

Significant investments are required to scale the transition to a circular economy. Different types of financial organizations can play different roles in enabling the change:

- ◆ Coalitions of banks, private investors, and foundations can develop innovative financing mechanisms to unlock capital for investment in the action agenda across value chains, from agriculture transitions and new material development to high-quality, cost-effective sorting and recycling.
- ◆ Development banks can provide seed funding to support the establishment of textiles sorting and recycling infrastructure in developing countries, especially major importers of used textiles.
- ◆ Asset managers and impact investors can support access to capital for private sector investments in clean technologies and circular business models via dedicated funds.

- ◆ Risk managers can adopt a longer-term perspective and price-in e.g. resilience of business models and value chains, as well as increased health and productivity of agricultural lands.
- ◆ Financial advisors can support companies to develop green bonds for investment in products or services with higher circularity, taking into consideration their actual environmental and social impacts.

RESEARCH

Research organizations are critical for continuing to develop the knowledge base to guide and support the complex and interdependent transition to a circular economy in textiles, including:

- ◆ Advance understanding of the socio-economic impacts of transition towards a circular economy for textiles.
- ◆ Monitor and evaluate the environmental and socio-economic impact of the transition, especially the used textiles trade and the shift from synthetic to plant-based fibers (if any).
- ◆ Translate scientific findings into advice, such as decision support for material/product design, business models and policies, to balance and optimize impacts over the lifecycle.
- ◆ Understand behavior and change management. Develop effective strategies for both consumer behavior and organizational change.
- ◆ Develop innovations in areas such as productive and regenerative plant-based fiber production, high-quality and cost-effective sorting and recycling.
- ◆ Develop metrics to measure impact and progress.



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CONCLUSION

A circular economy is a key component of the much-needed transformation of the textiles industry towards sustainable development. In a circular economy for textiles, inputs are safe and recycled or renewable; products are kept in use for longer; and products are recyclable and recycled at end-of-use.

In the transition to a circular economy for textiles, **let's keep aligned to the north stars** of greater human and planetary wellbeing. Circularity is not the end goal in itself, but an important means towards the end goal, a global economic system that enables human and environmental wellbeing. A circular economy for textiles can have profound effects across resource use, climate change, human health, biodiversity, economic wellbeing, and decent work outcomes. Actions are needed to remove barriers and amplify the benefits, as well as to mitigate potential trade-offs—such as integrating decent work to ensure the transition is just and inclusive. **Let's be guided by science**, to develop holistic indicators and set balanced targets, which are crucial to design the transition, monitor the progress and evaluate the impact, in alignment with the north stars.

The transition path to a circular economy is challenged by barriers, many beyond the control of any individual stakeholder. Governments, businesses, civil society, finance institutions, research organizations—**let's team up** to take actions to move the needle. Each of us has a role to play in the calls-to-action, and there are specific actions that we can already take up today. Many leaders across the PACE community and beyond are already taking action. **Let's take ownership** and do what we can to drive the change. The PACE Secretariat looks forward to hearing from and working with you, to map progress, co-create actions, build new partnerships, demonstrate best practices, share learnings, and drive new commitments throughout the year and beyond to drive textiles system change at scale.

Let's get to work!

APPENDIX | Impact Assessment

This appendix provides more details of the Impact Assessment, synthesized based on inputs from Joke Dufourmont (Circle Economy), Natalia Papú Carrone (Circle Economy), Maria Beatriz Mello da Cunha (ILO), Margherita Licata (ILO), Hettie Boonman (TNO), Elmer Rietveld (TNO), Ton Bastein (TNO), Deborah Drew (WRI), Sam Gillick-Daniels (WRAP), Gustav Sandin Albertsson (IVL), Cecilia Johannesson (IVL), Patrick Schröder (Chatham House), and several other working group members.

Inputs for textiles are safe, recycled, or renewable

RESOURCE USE

The impacts on resource use of the move to safe and recycled or renewable inputs are uncertain, and depend on the specific materials involved. Shifting from virgin cotton to recycled inputs, such as recycled polyester, or other renewable inputs, such as viscose or lyocell, may result in a lower resource use per kilogram of fiber (for full comparison see Global Fashion Agenda and The Boston Consulting Group 2017; or van de Vreede and Sevenster 2010). It should be noted that the scaling of such shift still faces technical challenges including quality and properties of recycled fibers.

The impacts of shifting from fossil resource inputs to renewable ones (e.g. cellulose-based fibers) can be complex (Global Fashion Agenda and The Boston Consulting Group 2017). While fossil resource use can be reduced, increasing renewable inputs may increase land, water, fertilizer, and pesticide use, especially if unsustainable agriculture practices are used. If regenerative approaches to renewable fiber production are implemented, pesticide and water use per hectare may be reduced compared to conventional methods (Peltzer 2014). On the other hand, regenerative natural fiber production may have a lower yield (in some examples, 25% lower than conventional farming), hence requiring more land and associated resources to produce the same output (Foster et al. 2013).

More research is still needed on the impact of this objective on resource use. For example, full lifecycle assessment comparison between recycled fibers and virgin fibers from regenerative farming is needed.

CLIMATE CHANGE

Similar to resource use, the impact on climate change by shifting to recycled or renewable inputs for textiles can be complex, and trade-offs may occur. Silk, wool, and cow leather are among the materials with the highest global warming potential per kilogram of fiber. Transitioning from such materials to recycled polyester, viscose and lyocell could lower the global warming potentials per kilogram of fiber (for full comparison see Global Fashion Agenda and The Boston Consulting Group 2017; van de Vreede and Sevenster 2010;

Shen, Worrell, and Patel 2012). If renewable material inputs come from wood-based fibers grown on degraded cropland, above-ground and soil carbon may increase (Piemonte and Gironi 2011). Attention should be given to the impact of regenerative natural fiber production in substitution of conventional production. Even though there is potential for a relatively lower CO₂ footprint in farming operations, the need to bridge the yield gap may lead to land conversion and associated carbon emissions (Foster et al. 2013; Peltzer 2014).

HUMAN HEALTH AND BIODIVERSITY

Moving to safe inputs will deliver benefits for workers, general public, and biodiversity by eliminating toxic substances from the textiles value chain. Avoiding work-related safety and health hazards from imprudent use of unsafe chemicals in the fashion industry could save €3 billion globally (Global Fashion Agenda and The Boston Consulting Group 2017). Attention should be given to the potential for recycled fibers and new chemicals and materials to contain unknown concentrations of hazardous substances and pose risks to human health (Patterson 2020). Additionally, the move to renewable inputs may increase fertilizer and pesticide use, exacerbating human health and biodiversity concerns caused by unsustainable agriculture practices. Regenerative agricultural practices for natural fiber production could reduce excess nutrients in waterways and decrease eutrophication while enhancing biodiversity and soil health (Gomiero, Pimentel, and Paoletti 2011; LaCanne and Lundgren 2018; Global Fashion Agenda and The Boston Consulting Group 2017).

ECONOMIC WELLBEING

Implementing regenerative techniques in natural fiber production may benefit farm economics compared to conventional production (Sodjinou et al. 2015). For example, in west Africa, where rural livelihoods are particularly vulnerable, regenerative cotton production is expected to contribute not only to poverty reduction but also to strengthen households' resilience (Sodjinou et al. 2015). A study from central Asia found that while cotton yields on organic farms were 10% lower, input costs per unit were 42% lower; as a result, organic farmers' cotton revenues were 20% higher (Bachmann 2012).

Regenerative natural fiber farming can also provide benefits regarding resilience to either physical shocks (i.e. adverse weather) or financial ones (i.e. price fluctuations). Regenerative farming systems are typically more resilient to both with, for example, better soil management leading to a better ability to deal with droughts and floods. In some cases, regenerative farms can out-yield conventional ones under severe drought conditions (Gomiero, Pimentel, and Paoletti 2011). Additionally, maintaining and increasing soil health will ensure future fiber production.

It should be noted that the aforementioned literature mainly analyzes the economic impacts on transitioning from conventional natural fiber production to regenerative production methods. There is still limited research on the overall economic impact of the textiles industry shifting from virgin inputs to recycled or renewable inputs. Economic growth opportunities have been suggested (Ellen MacArthur Foundation 2017) but need validation by quantitative modeling.

DECENT WORK

Moving to renewable inputs, especially if natural fibers are produced in a regenerative way, can lead to more jobs. For instance, regenerative cotton farming is associated with more manual labor than conventional production, potentially resulting in more jobs per kilogram of produced cotton (Bachmann 2012). A field study in Benin found that regenerative cotton farming is more attractive to women compared to conventional farming and has the potential to increase women's economic independence (Sodjinou et al. 2015). Still, women, self-employed farmers in low-income countries and indigenous peoples are among the most vulnerable to socio-economic and environmental disturbances. Job creation in safe and recycled or renewable material inputs will need to be associated with skills development programs. The impacts on social protection, social dialogue, and rights at work still need to be understood (Montt, Fraga, and Harsdorff 2018).

Moving to recycled inputs is not expected to have a significant impact on jobs related to fossil resource extraction, since the textiles industry currently uses only about 1% of global oil produced (derived from Ellen MacArthur Foundation 2017). The impact on virgin natural fiber production jobs will depend on the technical feasibility for recycled natural fibers to replace virgin ones, and to what extent.

Moving to safe inputs, including shifting from conventional natural fiber farming to regenerative farming, can reduce exposure to toxic substances for workers (Schröder and Howarth 2019; Global Fashion Agenda and The Boston Consulting Group 2017). The outcome of the transition in terms of decent work will be dependent on the implementation and monitoring of safer practices and chemicals (ILO 2018).

Textiles are kept in use for longer

RESOURCE USE

If increased textile utilization rates displace production and consumption of new products, there will be a reduction in resource use from avoided natural and synthetic fiber production (WRAP 2017), as well as chemical use in processing (e.g. dyeing). Based on a lifecycle assessment study on second-hand garments in Sweden and Estonia, the purchase of 100 second-hand garments can displace the production of up to 85 new garments (Farrant, Olsen, and Wangel 2010). WRAP (2017) suggests that extending the lifetime of 50% of

UK clothing by an extra nine months of active use would reduce waste by 10% and water footprint by 4%, assuming a displacement rate of 30%. Operational impacts will offset some of the benefits (e.g. water and chemicals resulting from increased reverse logistics, laundry, and packaging). Still, the benefits are expected to outweigh (Farrant, Olsen, and Wangel 2010). Further research is needed, for instance, to compare the impacts in different geographical contexts and the possible difference in the lifetime of second-hand clothes compared to new clothes.

CLIMATE CHANGE

Increasing textile utilization rates will reduce greenhouse gas emissions of the textiles industry if new production is displaced (Fortuna and Diyamandoglu 2017). If on average the number of times a garment is worn were doubled, then greenhouse gas emissions would be 44% lower (Ellen MacArthur Foundation 2017). Woolridge et al. (2006) performed a lifecycle assessment on reuse of donated garments from the UK in comparison with producing virgin material. The outcome shows that reusing garments as second-hand clothing consumes only 1.8% of the energy needed from virgin materials for polyester and 2.6% for cotton (Woolridge et al. 2006). These results are subject to factors such as washing and drying frequency, methods and equipment, and will have a great impact on the lifetime extension of a garment (Levi Strauss & Co. 2015; van de Vreede and Sevenster 2010). Benefits will likely outweigh additional transport needs such as in used clothing export, provided that the exported clothing gets re-used for a sufficiently long period (Sandin and Peters 2018). Extending the use phase of garments has a lower carbon footprint than recycling or incineration (Woolridge et al. 2006; Bartl, n.d.; Zamani et al. 2014).

HUMAN HEALTH AND BIODIVERSITY

The production phase of textiles accounts for most of the environmental, safety and health hazards throughout the lifecycle, including eutrophication, ecotoxicity, and other pollution (Ellen MacArthur Foundation 2017; Global Fashion Agenda and The Boston Consulting Group 2017; van de Vreede and Sevenster 2010). Therefore, increasing textile utilization rates will benefit human health and biodiversity if it displaces new production.

ECONOMIC WELLBEING

The impact on the global economy of increased utilization rates can be complex and multifaceted. Economic growth opportunities and the emergence of new business models are suggested in some literature (Ellen MacArthur Foundation 2017). For instance, the UK's potential fashion rental market is valued at £923 million (Westfield 2020). Increasing clothing utilization rates can also deliver benefits in household savings as well as government savings through reduced externality costs (Global Fashion Agenda and The Boston Consulting Group 2017). On the other hand, the clothing manufacturing industry

may see a reduced revenue (Ellen MacArthur Foundation 2017), and second-hand trading has the risk of suppressing the textiles industry of low-income importing countries (Katende-Magezi 2017). Overall, more quantitative research on the economic impact of increased textile utilization rates is needed, particularly beyond the clothing industry.

DECENT WORK

Increasing the utilization rate of textiles will create new business models and employment in proximity to the consumer (ILO 2019; Circle Economy 2020b). The labor intensity and quality of the jobs created remains unknown. Skills development programs that are sensitive to the differing conditions faced by women and men workers in, for example, repair and resale will be needed (Schröder and Howarth 2019). In high consumption countries, a garment service skill shortage (e.g. repair) is expected.

Increasing utilization rates may lead to some job loss in fiber production (i.e. agricultural and synthetic fiber production) and manufacturing, especially in low- and middle- income countries, where fast fashion has been a major employer of women (ILO 2019). On the other hand, a slower pace of production resulting from a decrease in demand may support safer and healthier working conditions in the sector, because of reduced pressure on workers to meet high demand (Schröder and Howarth 2019). If increased utilization of textiles decreases retail of new garments, it may also result in decreased employment in traditional retail.

Textiles are recyclable and recycled at end-of-use

RESOURCE USE

If increased textiles recycling, enabled by increased recyclability, displaces demand for virgin plant-based fibers, then land, water, and chemical use will be reduced (Sandin and Peters 2018). This reduction is attributed to the avoidance of, among others, cotton cultivation and its associated high water, pesticide, and fertilizer use. If increased recycling reduces demand for virgin synthetic fibers, then fewer oil resources will be used, though the impact on total fossil resource use will be limited since the textiles industry currently uses only about 1% of global oil produced (derived from Ellen MacArthur Foundation 2017).

CLIMATE CHANGE

Textiles recycling in general is expected to reduce greenhouse gas emissions in production, if it replaces (part of) virgin material inputs (Achim et al. 2020). For example, outdoor clothing brand Patagonia estimates that recycling saves 75% of the energy needed and 40% of the CO₂ compared to using virgin polyester (Global Fashion Agenda and The Boston Consulting Group 2017). The quantity of greenhouse gas prevented depends on the product, material, and process being recycled. Caution should be paid in the case of energy-

intensive recycling technologies with high-carbon energy sources (Sandin and Peters 2018). Mechanical recycling has a lower global warming potential than chemical recycling and energy recovery through incineration (Pesnel and Perwuelz 2011; Zamani et al. 2014). However, mechanical recycling produces fibers of shorter length. As a consequence, it can only be used as a small percentage of the total fiber mass in quality apparel products. Chemical recycling on the other hand, promises to displace virgin fiber production even further, since the recycled fibers are of virgin quality and can be used at higher percentages (Palme et al. 2014).

HUMAN HEALTH AND BIODIVERSITY

If increased recycling displaces virgin material input production, the environmental, safety and health hazards derived from the production phase of natural and synthetic fibers may be lowered (Global Fashion Agenda and The Boston Consulting Group 2017). Increased recycling of natural fibers could reduce the need for the cultivation of cotton or other natural fibers, resulting in a reduction in pesticide use and exposure. For reference, it is estimated that the cultivation of cotton uses up to 18% of pesticides globally (Bartl, n.d.). In a study on three different recycling processes of cotton bed sheets, Pesneh and Perwuelz (2011) found a decrease in the eutrophication potential of the recycled bed sheet lifecycle in comparison with virgin production. This reduction was attributed to the avoided virgin cotton cultivation. Additionally, decreasing the demand for virgin natural fibers could facilitate forest preservation and make more land available for food production (Bartl, n.d.).

ECONOMIC WELLBEING

Overall, there is still limited research on the economic impact of increased textile recycling. New recycling technologies and business models may be an opportunity for economic growth. For reference, 87% of material used for clothing production is landfilled or incinerated after its final use. This represents a lost opportunity of more than €100 billion annually, and high costs for landfilling and incineration (Ellen MacArthur Foundation 2017).

The full impacts of increased recycling on the whole textiles system, including impacts on the upstream value chain (e.g. virgin material production), potential geographical redistribution of income, as well as externality cost savings, still need to be investigated by quantitative modeling.

DECENT WORK

If increased recycling displaces virgin natural fiber production, there might be a reduction in farm jobs. Cotton cultivation employs around 100 million farmers globally (Voora, Larrea, and Bermudez 2020). In developing countries, cotton cultivation employs close to 7% of the entire labor force (World Wildlife Fund 2020). Increased textiles recycling can create new jobs in areas such as research and development, engineering, sorting, pre-processing, and recycling

(Reuse 2015), mostly close to consumption centers. This may lead to a geographical reorganization of employment: job gains in high consumption countries and job losses in the fiber production sector affecting especially low-income countries.

New jobs in recycling cannot provide direct replacement for agricultural and farming job losses, since they tend to be less labor-intensive and based in urban areas (Circle Economy 2020). Furthermore, these new jobs will require a differently skilled workforce. Therefore, while a new cohort of skilled workers will be introduced, there is a risk that the existing workforce is not absorbed in the transition to a circular economy (Schröder and Howarth 2019). Alternative work scenarios for these workers need to be assessed. Impact on the quality of the jobs, including social protection, social dialogue, and rights at work, also still need to be understood (Montt, Fraga, and Harsdorff 2018).

It should be noted that actual impacts in any of the five areas assessed are affected by many different factors and trends in society, for example global population, behavioral and consumption patterns, and cultural and socio-economic context. How each of the impact areas will change over time is an aggregated result of forces often pulling in different directions. A circular transition is just one of these forces, and by itself cannot guarantee the net impact to move in a certain direction. This report analyzes possible impact from increased circularity alone, without considering other ongoing changes.



ENDNOTES

1. Interested readers can refer to the work of Ellen MacArthur Foundation, United Nations Environment Programme, WRAP, and Global Fashion Agenda.
2. For example, the Ellen MacArthur Foundation's Make Fashion Circular initiative and Jeans Redesign Guidelines; Fashion for Good's Innovation Platform; and the Global Fashion Agenda's Copenhagen Fashion Summit
3. All five impact categories are affected by many different factors and trends in society. How each of them will change over time is an aggregated result of forces often pulling in different directions. Circular transition is just one of these forces, and by itself cannot guarantee the net impact to move in a certain direction. This report analyzes the possible impact from increased circularity alone, without considering other ongoing changes.
4. A full definition of decent work by the International Labour Organization is: "Decent work sums up the aspirations of people in their working lives. It involves opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives, and equality of opportunity and treatment for all women and men."

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PHOTOS

Cover, Julian Mora; Contents, Ethan Bodnar; Pg 5, Trisha Downing; Pg 9, Priscilla DuPreez; Pg 11, Waldemar Brandt; Pg 13, Anna Auza;Pg 17, Waldemar Brandt; Pg 19, Toa Heftiba; Pg 22, Annie Spratt; Pg 27, Kenny Luo; Pg 33, Yves Junge; Pg 37, Noor Sethi; Pg 38, Janko Ferlic; Pg 41, Olesia Buyar; Pg 43, Ehannah Morgan; Pg 44, Vladimir Proskurovskiy; Pg 50, Maranda Vandergriff



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