

# Toward an efficient and competitive circular textile industry

**National Roadmap for minimizing and valorizing  
pre-consumption textile waste**

*Egypt*

English Edition



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Each implementing organization contributes specialized experience and tools to partner with the eight beneficiary countries on policy development, capacity building, business support services, demonstration activities and networking.

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The concept of the circular economy is of essential importance for the fashion business today due to its potential to address and mitigate various environmental and sustainability challenges inherent in fashion’s conventional linear model of production and consumption. In this perspective, this document advocates for addressing a compelling case for radically improving segregation, handling and recycling of industrial waste in the textile and clothing value chain to allow the Egyptian industry to capture the value of the materials during the transformation process from the raw materials to the stores.

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# A. CONTEXT



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# 1. Executive summary

The concept of the circular economy is of essential importance for the fashion business today due to its potential to address and mitigate various environmental and sustainability challenges inherent in fashion's conventional linear model of production and consumption.

Fashion brands have started to commit to the circular economy model in recent years, adopting various strategies such as developing second-hand and resale platforms, introducing circular design practices, recycling initiatives, and commitments to use recycled materials in their collections. The impact of a brand's circular strategies is reflected all along its supply chain, where suppliers are pressured to source recycled fiber in a market that is not yet prepared to supply the requested volumes.

According to the waste mapping survey conducted within the framework of the SwitchMed Project 212,000 tons per year of pre-consumer textile waste was generated in 2019 by Egypt's textile and clothing industry. This is a remarkable volume, the majority of which could be channeled into textile-to-textile recycling in the cotton supply chain. On the other hand, waste consisting of blends of various fibers

– synthetic, cellulosic, natural, or pure synthetic – needs to find a different end use. For most of it, nonwoven applications will be the primary option.

This document provides a brief on the pre-consumption waste recycling value chain in the textile industry and an assessment of its state-of-the-art in Egypt, followed by a description of the SwitchMed pilot projects aimed at demonstrating the business case for the valorization of pre-consumption textile waste in the country. The core content of the document is the "Way ahead" section, which presents a comprehensive Roadmap of action to support the development of a textile waste valorization value chain in the country. This Roadmap aims to stimulate and guide stakeholder discussion about key steps, objectives, and timelines for developing and implementing a strategic plan for leveraging circular business models to make the Egyptian textile industry more competitive and reduce its environmental impact. It also provides a tentative framework for coordinating actions among various stakeholders involved in industry interest representation, business activities, research and development, and policy development and implementation.

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Two pilot projects were launched aiming to support the evolution of key elements within a circular industrial waste valorization value chain.

Pilot 1 concentrated on the modernization of recycling equipment and enlargement of the national recycling capacity, creating business contacts between Egyptian companies and European leading technology providers. The Pilot demonstrated the techno-economic viability of investing in new technologies for chemical recycling, to specifically valorise mixed polycotton waste, as well the latest advancements in mechanical recycling equipment for 100% cotton and cotton-rich waste.

Pilot 2 focused on a) enhancing waste collection, sorting, and segregation at the source, right at the originating textile and clothing companies' premises by training companies to use efficient waste management methods and protocols b) streamlining the waste handling in the recycling value chain by promoting the establishment of direct connections between waste-producing companies and recycling firms to increase the volume of waste diverted to higher value valorisation routes.

The two pilots were implemented with the cooperation of local stakeholders including the Industrial Modernization Center (IMC), Industrial Development Authority (IDA), both agencies of the Ministry of Trade and Industry, as well as the Apparel Export Council of Egypt (AEC) and the Textiles & Home Textiles Export Council (THTEC).

Building upon the findings about the volumes and the type of textile waste generated in Egypt and based on the experience gained in the implementation of the two pilots, seven objectives and ten related actions were defined and are reported in chapter 4 of this Roadmap that, if achieved, can foster the development of a circular economy approach for the Egyptian textile industry. Overall, it should be noted that the scaling up of Pilot 1 results would be conditional on scaling up results of Pilot 2. The key axes of interventions defined within this roadmap highlight the importance of raising awareness and training garment makers in waste segregation at source, the adoption of market-based incentives to promote investments in new recycling capacity as well as digital and physical infrastructure to create a proper market place for textile waste valorization, the implementation of regulatory reforms especially for facilitating the retainment and valorization within Egypt of the textile waste generated by the majority of the companies that are exporting, finally engaging brands sourcing in Egypt to establish partnerships for circular initiatives in the country.









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# 2. Introduction

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## The textile and clothing and circular economy

### *The Circular Economy and the Fashion Industry*

The concept of the circular economy is of essential importance for the fashion business today due to its potential to address and mitigate various environmental and sustainability challenges inherent in fashion's conventional linear model of production and consumption.

The essential nature of the challenge for textiles is due to its position as the second largest consumer goods sector, after food. The economic and material size of this sector means that it has a significant impact on the environment and on society.

The critical factors affecting the sustainability of the fashion industry are the depletion of natural resources, the release of GHGs and toxic chemical pollutants, water use and the enormous amount of waste generated at both the pre-consumption and post-consumption stages.

On the other hand, only too often circularity in fashion is considered in its most simplistic form, merely highlighting the "recycling route."

The concept referred to as the waste hierarchy, embraced by policymakers in many countries and regions, including the EU, has fixed this concept since the issuing of the Waste Framework Directive in the nineties. Indeed, the preferred policy for addressing the issue of waste is Prevention, by reducing the generation of waste, while the second best is Reuse, giving the products a second life before they become waste. Recycling comes third in this hierarchy, just above energy recovery through incineration and

disposal, and becomes a priority when waste is created, and materials cannot be reused without further transformation.

When recycling comes into play, several factors need to be considered, including:

- *Is the reclaimed material safe? Or might it be polluted by hazardous chemicals?*
- *Do the reclaimed materials come from the post-consumption or pre-consumption stages?*
- *Can the material be recycled, and what is the most suitable recycling technology?*
- *What is the best end-use for the recycled materials? Can recycled materials re-enter the textile and fashion businesses, or is using them in industrial symbiosis in other sectors more environmentally and technically sound?*
- *How can textile and fashion products be designed to permit better recycling?*

The answers to these questions will define the features of a circular economy business model. Fashion brands have started to commit to the circular economy model in recent years, adopting various strategies such as developing second-hand and resale platforms, introducing circular design practices, recycling initiatives, and commitments to use recycled materials in their collections.

The impact of a brand's circular strategies is reflected all along its supply chain, where suppliers are pressured to source recycled fiber in a market that is not yet prepared to supply the requested volumes.

The demand for recycled polymers and fibers made from reclaimed waste is increasing rapidly on a global scale. Driven by the fashion brands' growing appetite for more sustainable materials. According to the latest Textile Exchange Report, recycled fiber production grew by 26.5% (CAGR 4.8%) from 2017 to 2022, double the growth rate for virgin fibers (+12.7%, CAGR 2.4%). Notwithstanding this rapid growth, the market share of recycled fibers in the global textile fiber market remains below 10% (7.9% in 2022). The supply of recycled fiber is limited by existing production capacity limits and by low waste recycling rates. Over 90% of the recycled fiber currently available for the textile industry is polyester from plastic bottles, and less than 1% of the global fiber market is from pre- and post-consumer recycled textiles. The supply limitations make the available recycled fibers insufficient to meet the brands' and other end users' requests and have raised prices for rPET (recycled polyester) and recycled cotton in recent years. At the same time, a new generation of technological innovations is providing new solutions that can help valorize untapped resources of textile waste while adopting a circular economy perspective therefore creating the proper conditions for expanding the global capacity of recycling textile waste which is essential for mitigating the resource and energy intensity of the fashion industry.

### *About the SwitchMed II Project*

Launched by the European Union and managed by the United Nations Industrial Development Organization (UNIDO), the SwitchMed Programme has demonstrated the potential for a green and circular economy in Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine, and Tunisia since 2014. SwitchMed scales up the transition towards sustainable consumption and production practices in the Southern Mediterranean region through industry demonstrations, policy development, networking opportunities, and support for start-ups and green entrepreneurs. The project was financed by the European Commission's Directorate-General for Neighbourhood and Enlargement (DNEAR); the Italian Development Cooperation, and the Catalan Waste Agency.

Stimulating the creation of business opportunities that can reduce the inefficient use of resources and the environmental footprint of industrial activities offers a chance for the region to respond to economic, social, and environmental challenges.

*The demand for recycled polymers and fibers made from reclaimed waste is increasing rapidly on a global scale. Driven by the fashion brands' growing appetite for more sustainable materials.*

Designing out waste, reducing pollution, and keeping products and materials in use for longer are all cornerstones of a circular economy.

These principles also outline the activities of UNIDO in developing resource-efficient and circular industries under the second phase (2019-2023) of the SwitchMed programme. This phase launched an initiative targeting the textile supply chains of Egypt, Morocco, and Tunisia. Collaborating with international brands and expert organizations, UNIDO has engaged national stakeholders in: i) developing circular value chains to valorize pre-consumption textile waste; ii) guiding the textile industries toward adoption of safer chemical protocols.

The SwitchMed initiative for valorization of textile waste aims to demonstrate the potential for recycling pre-consumer textile waste and transfer know-how to develop a local value chain for recycling textile fibers, focusing on two critical components of the circular economy business model:

- The design of new garments aimed at minimizing waste and making garments easily recyclable under the concept of eco-design.
- The valorization of existing waste, primarily generated in manufacturing, also known as post-industrial and pre-consumption waste.

The elimination of hazardous chemicals from the textile supply chain is a prerequisite for safe circular production. Through collaboration with the ZDHC Foundation, UNIDO has enhanced expertise in the safer management of chemicals within the local textile industry.

The SwitchMed textile initiative was implemented in the three countries within two phases: a first phase focusing on understanding the business environment, including a waste mapping survey during 2020, and a second phase commencing between 2021-2022 implementing a totality of 8 pilot projects based on circular textile business models relevant to the context of Tunisia, Morocco and Egypt.

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## *Purpose and Scope of the Roadmap*

This document provides a brief on the pre-consumption waste recycling value chain in the textile industry and an assessment of its state-of-the-art in Egypt followed by a description of the implemented SwitchMed pilot projects aimed at demonstrating the business case for the valorization of pre-consumption textile waste in the country. (section 3)

The core content of the document is the “Way ahead” section (section 4) that presents a comprehensive Roadmap of action to support the development of a textile waste valorization value chain in the country.

This Roadmap aims to stimulate and guide stakeholder discussion about key steps, objectives, and timelines for developing and implementing a strategic plan for leveraging circular business models to make the Egyptian textile industry more competitive and reduce its environmental impact.

It also provides a tentative framework for coordinating actions among various stakeholders involved in industry interest representation, business activities, research and development, and policy development and implementation.

An equally important role is to enhance transparency by clearly articulating the steps and processes involved in roadmap development.

The document draws from the experience and lessons learned during the implementation of the UNIDO textile circular initiative within the framework of SwitchMed II across the textile and apparel value chain between 2019 and 2023.

The Roadmap also incorporates international experience from other projects and policies dealing with the circularity and sustainability of textiles and is meant to complement the policy recommendations and findings from other projects concerning the circular business model for textiles that has been implemented in Egypt in recent years.





# 3. Assessment of the Textile and Clothing Value Chain and pilot Project Interventions

## The Textile Recycling Value Chain

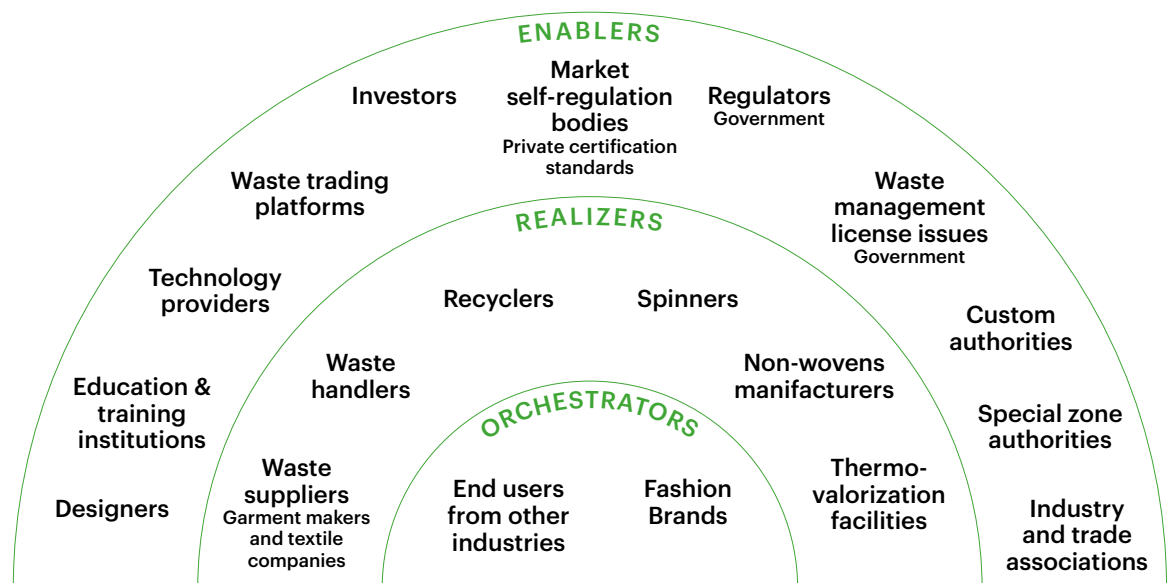
### *Textile waste valorization as an “ecosystem”*

The textile waste valorization ecosystem engages a network of interconnected participants, the stakeholders, across industry boundaries and with different roles.

Policies aimed at valorizing textile waste and promoting circular business models in the textile and fashion supply chain are expected to address the ecosystem’s various components and

stakeholders and go beyond the strict boundaries of the textile value chain.

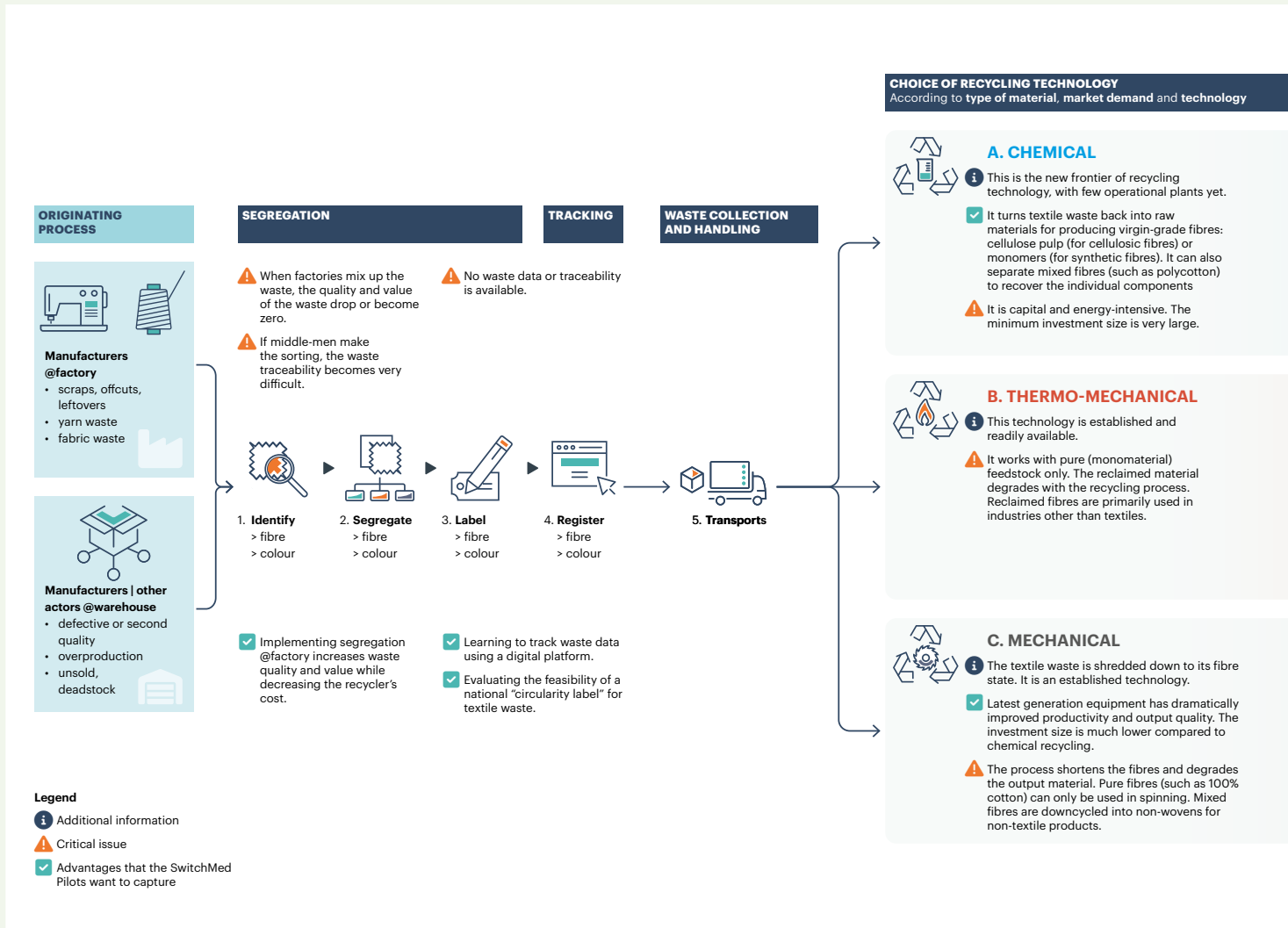
Some of these participants play the role of *Orchestrators*, maintaining direct contact with the final markets; they may be in the fashion business (fashion brands, fabric makers, etc.) or other end-user industries of textile fibers in different sectors (automotive, furniture, construction, etc.). These business players identify the needs and requirements of the market and match them with the Realizers’ capabilities.



SOURCE: BLUMINE

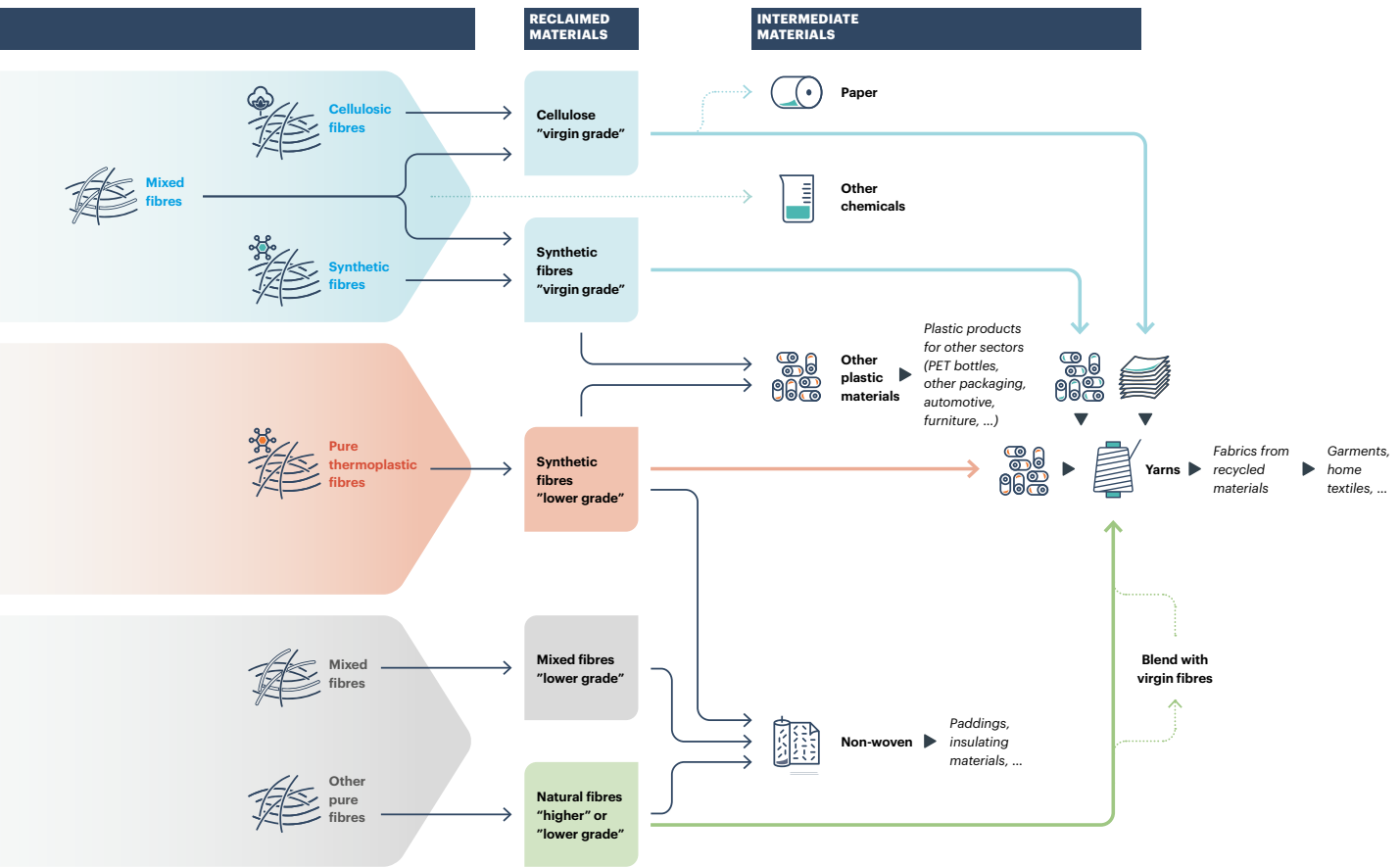
Figure 1 – The textile waste valorization ecosystem

Figure 2 – The post-industrial textile recycling value chain



SOURCE: BLUMINE





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*Realizers* are providers of products, such as recycled fibers and yarns, and services, such as collection, transportation treatment and recycling of textile materials, in the waste valorization value chain.

*Enablers* are supporters of both *Realizers* and *Orchestrators*. They can be private organizations or government institutions, and contribute as regulators, voluntary standards maintainers,

market connectors, such as trade or traceability platforms, or technology providers. It is also interesting to note that the same player can take on several roles in the ecosystem. For example, a textile company or a brand can simultaneously act as a supplier (of textile waste) and buyer (of recycled fibers).

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## An Assessment of the Textile Recycling Value Chain in Egypt

### Methodology

In 2021, UNIDO commissioned Blumine and Reverse Resources to conduct a waste mapping study with the support of the Industrial Modernisation Centre – IMC, Industrial Modernization Center (IMC); Apparel Export Council of Egypt (AECE); Textiles & Home Textiles Export Council (THTEC); Federation of Egyptian Industries (FEI); Egyptian Chamber of Apparel & Home Textile Industries (ECAHT); Egyptian Chamber of Textile Industries (ECTI). The study analyzed the textile waste value chain, engaging a representative group of key market players and estimating the pre-consumer textile waste flows generated by Egyptian's textile and clothing industry to be 212,000 tons per year.

The survey was instrumental in validating the most suitable circular business models adapted to the Egyptian business sector, the key players and market dynamics in waste recycling, and the specific needs and opportunities to upgrade the sector. Two pilot projects have been defined at the end of the waste mapping phase: this Roadmap builds on the lessons learned from the practical experience of working with most the actors in the textile recycling value chain.

### Baseline Analysis

According to the waste mapping study, pure-cotton and cotton-rich (>85% cotton) waste accounts for 57% of the 212,000 tons per year of pre-consumer textile waste generated by Egypt's textile and clothing industry in 2019. This is a remarkable volume, the majority of which could be channeled into textile-to-textile recycling in the cotton supply chain. On the other hand, most of the remaining 43%, consisting of blends of various fibers – synthetic, cellulosic, natural, or pure synthetic – needs to find a different end use.

For most of it, nonwoven applications will be the primary option.

Cutting scraps are the most significant part (39%) of the waste flow, and more than 50% originate in the Greater Cairo region (accessible within a radius of 150 km).

Garment makers seldom or never have information about the destination of the waste they deliver to waste handlers as also their clients are not imposing any traceability requirement on them regarding the waste management practices. Lack of information and traceability pose significant obstacles to the successful implementation of circular business models. Without adequate information on the origin, composition, and condition of these materials:

- ensuring the quality and safety of products made with recycled materials becomes challenging.
- compliance with regulations promoting sustainability and waste reduction can be impossible, leading to legal and reputational risks for businesses.
- sustainability claims regarding circularity in terms of both the use of recycled materials and responsible management of the brand's own waste can be considered greenwashing.
- the accurate assessment of products' environmental footprint with Life Cycle Assessment (LCA) or LCA-like approaches is a challenging task.

Overcoming the obstacles created by the lack of information and traceability requires collaboration between stakeholders, adopting standardized tracking systems, and appropriate digital technology to enable accurate data collection and sharing throughout the supply chain.

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# Outcomes of the Textile Waste Valorization Pilot projects

## *The pilot projects*

The decision to exclusively focus the valorization pilots on post-industrial waste (such as spinning and weaving waste, cutting scraps) and pre-consumption waste (including second-quality and defective garments, overproduction, and deadstock), which will be collectively referred to as pre-consumption waste in this document, was motivated by four considerations:

- Dealing with pre-consumption waste is the action with the highest short-term impact on the valorization of textile waste. Recycling post-consumption waste is much more challenging and requires the preliminary establishment of a complex worn garments collection and management supply chain.
- The volume of resources in pre-consumption waste is huge, and so far, untapped.
- Working with pre-consumption waste directly supports companies' competitiveness.
- The valorization value chain created for pre-consumption waste can easily be extended to post-consumption waste in the future.

### **Pilot Project 1: Modernisation of the recycling capacity**

The Pilot focused on modernizing and expanding recycling installations through the creation of business connections between Egyptian companies and leading European technology providers.

A review of LCA-based studies on the environmental impact of different pathways to polyester production and polyester waste treatment, including the production of virgin polyester, mechanical and chemical recycling as well as the evaluation of energy recovery from polyester waste through incineration has shown that recycling either mechanically or chemically existing waste is preferable to both the production of virgin polyester and energy recovery through incineration. The comparison among recycling technologies shows that the mechanical pathway is less impactful than the chemical one. However, the latter is better suited for recycling textile waste, especially mixed fibers such as polycotton, that cannot be treated efficiently with the former. The survey findings suggest that mechanical and chemical recycling are complementary solutions for textile waste, with mechanical processes more suitable for natural or single-fiber waste, and

chemical processes for mixed fibers. Accordingly, the pilot explored the business case for investment in Egypt of two technology groups: innovative chemical recycling technologies and state-of-the-art mechanical recycling equipment.

Regarding chemical recycling, the emphasis was on technologies that allow for recycling mixed polycotton waste. For mechanical recycling equipment, the focus was primarily on 100% cotton and cotton-rich waste.

Chemical recycling is a family of new and advanced technologies designed for transforming synthetic, cellulose-based, and mixed waste, including textiles, into new virgin-grade fibers. In the realm of chemically recycled textile fibers, the first industrial-scale plants are commencing operations in Europe, with additional facilities anticipated to become operational from 2025 onwards. While there are a large number of uncertainties regarding the wide variety of proprietary technologies coming on the market in terms of operational and environmental costs and considerations, since nearly half of the pre-consumption textile waste produced in Egypt consists of mixed fibers, which are not ideally suited for mechanical methods, chemical recycling techniques could potentially provide a solution to these waste streams in Egypt. The Pilot presented a pre-feasibility study for the investment in a chemical recycling plant in Egypt facilitating connections between Egyptian companies, investors, and technology providers.

State-of-art technologies in mechanical recycling were also explored revealing investment prospects and opportunities. Mechanical recycling equipment is advancing rapidly, with innovations improving the quality of recycled fibers and making the processes more adaptable. A study tour to ITMA exhibition – the leading trade exhibition for textile and textile recycling technologies, a standard business plan for a complete recycling plant, and the employment impact evaluation of mechanical recycling were offered by the Pilot to local companies and stakeholders.

An international seminar on textile recycling solutions was held in Cairo including a half-day B2B meetings to facilitate contact between Egyptian companies and European technology providers.

This Pilot benefited from the collaboration of European cutting-edge chemical recycling technology and equipment providers and leading manufacturers of mechanical recycling equipment.



### *Achievements*

- A pre-feasibility study for the investment in a chemical recycling plant delivered
- A business plan for the investment in modern mechanical recycling unit delivered
- Investments in advanced chemical and mechanical recycling technologies promoted, with total investments ranging from €115 million to €230 million
- Five leading European technology providers of chemical and mechanical recycling solutions engaged

### **Pilot Project 2: Improvement of the textile waste management practices for enhanced valorization**

The Pilot focused on a) enhancing waste collection, sorting, and segregation at the source, right at the originating textile and clothing companies' premises by training companies to use efficient waste management methods and protocols and b) streamlining the waste handling in the recycling value chain by promoting the establishment of direct business relations between waste-producing companies and recycling firms.

The candidate companies for participation in Pilot 2 were engaged through a call for interest that outlined the pilot's goals and actions. Interested companies were then invited to attend regional meetings with the team of experts, leading to the final selection of 11 Pilot participants, to receive more details and contribute to fine-tuning the Pilot's actions. The Egyptian companies involved in the pilot were:

- 11 leading textile and clothing companies from the private sector, acting as waste-generating entities and suppliers of textile waste. These companies included DNM Textile for Spinning, Weaving & Dyeing; El Sayyad Tricot Co.; Giza Spinning and Weaving; Lotus Garments Co.; Marib International Garments Company; Egyptian Textiles for Dyeing and Finishing; Wagdy Moemen; Jade (Yesim); Velocity; Merlin; and Filmar Nile Textile.
- 3 recycling companies: Perfect Spinning, ZamZam Spinning and Alroubaia Fourtux Textile Co.

The 11 providers of textile waste underwent training in effective waste management protocols, aimed at increasing the recyclability and value of their waste. Additionally, they learned about digital platforms for waste registration and tracking. During the pilot's implementation, they had the opportunity to

use a premier digital platform in the market at no cost. Over three months of implementing waste segregation and management, the data on waste types and volumes collected by the suppliers were shared with recycling companies. A concerted effort was undertaken to facilitate matchmaking between suppliers and recyclers, to establish direct relationships wherever possible, thereby streamlining the supply chain and achieving cost savings.

### *Achievements*

- 11 Egyptian textile and clothing companies engaged and trained in waste management protocol and the use of a waste-tracking digital platform
- 3 Egyptian recyclers engaged in the Pilot
- Companies that adopted proper segregation received higher demand for their waste, and the price of waste recorded a 300% increase in some cases
- 2,400 tons of textile waste segregated and delivered to waste handlers or directly to a recycler during the Pilot action, from June 2023 to March 2024.

### ***Lesson Learned from the Pilots***

The implementation of the pilot projects indicates that the proposed circular business models are feasible and potentially scalable within the Egyptian context. Several critical factors and priorities have also been identified shaping the actions of the roadmap.

The following lessons have been learned, not necessarily listed in order of importance:

- Waste handlers play a crucial role in the circular value chain: an increase in the quantity and quality of collected waste can hardly be achieved without their involvement. However, their participation needs to be grounded in formal and legal practices.
- Individual companies can hardly succeed in implementing a circular business model alone. A collaborative approach is required involving all parties – waste suppliers, waste handlers, recyclers, textile companies, and garment makers – to behave efficiently and transparently.
- Lack of cooperation and transparency can jeopardize the best efforts and dramatically increase costs.
- Waste segregation directly at the source is more efficient and can produce economic advantages for all players in the recycling value chain in cascade.

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## Opportunities

Proper segregation of cotton and cotton-rich waste could feed up to 15-20 new mechanical recycling lines, which would produce 30,000 tons of recycled fibers each year. The total investment needed for this initiative ranges from 15 to 30 million euros, potentially creating 75 to 100 new green jobs.

## Challenges

The pilot projects demonstrated that waste segregation at the source, i.e. right on the textile or ready-made garments (RMG) company's "factory floor," is more efficient and increases the opportunity to generate value from waste. However, textile and RMG companies do not see segregation as part of their business, and it is considered just another additional cost, so selling the concept of efficient waste segregation and management to these companies can be a challenge. Some form of public support or incentive could help overcome the obstacle.

Secondly, the competitive landscape in the textile recycling value chain is evolving quickly.

Several ambitious textile recycling projects were announced in 2023 in the broader Mediterranean region and Europe:

- In Morocco, the investment of 60 million euros by the Spanish company Recyclados in an integrated recycling and spinning facility in the Tangier region, supported by the IFC (International Finance Corporation, part of the World Bank Group).
- In Morocco, the 90 million euros investment by the Portuguese company Valérius Têxteis for a recycling facility in collaboration with the Moroccan company SG3H.
- In Spain, in 2023, the Spanish company Recover, specializing in recycling and spinning textiles, secured new funding for an investment aimed at increasing the production of recycled fibers and yarns to over 350,000 metric tons by 2026.
- In Europe, the first chemical recycling facilities on an industrial scale are underway, the entry of new players like Infinited Fiber in Finland, for cellulosic base materials, GR3N/Intecsa in Spain, Technip Energies with Under Armour in Germany, using the Volcat process developed by IBM for synthetic and mixed waste. The commissioning of all these plants will lead to a significant increase in demand for textile waste in the Mediterranean region to supply these facilities.

The swift rise of textile recycling capacity and demand for textile waste could trigger a spike in feedstock price and speculative behaviour on the part of waste handlers and put the economic viability of investments in the recycling value chain at risk, especially if brands will not accept a premium price for recycled fibers.

On the other hand, orderly growth in the prices of textile waste and recycled fibers, reflecting the forces of supply and demand without being influenced by speculative positions or lack of transparency on the market, could serve as a valuable incentive for establishing new recycling facilities.

## *High-level analysis of the textile valorization value chain opportunities for the Egyptian industry*

The implementation of the pilot projects revealed the Egyptian textile industry's strengths and weaknesses as well as some clear business opportunities and potential threats to be considered in defining a strategy and an action plan for an efficient and competitive circular textile industry in Egypt.

## Strengths

Egypt is acknowledged as a sourcing hub for major fashion brands, its geographical and logistical closeness to the European market offers a significant advantage over Asian suppliers.

The industry concentration around the Centre-North region of the country makes transportation costs for textile waste low. It is estimated that around 50% of the country's yearly waste generation is generated within a radius of 150 Km from the Greater Cairo region.

Several established and specialized businesses already operate in the local recycling value chain. Moreover, most local textile

companies are vertically integrated, including spinning units that can further be integrated upstream with recycling equipment.

The significant size of the industry can supply large recycling units, like those in the chemical sector, with sufficient feedstock to ensure economies of scale.

Law No. 202 of 2020 on Waste Management establishes an ambitious framework for waste management, encompassing collection, sorting, handling, and recycling. The law aligns with international standards and principles and is inspired by the circular economy vision.

## Weaknesses

The valorization of pre-consumption waste streams is hindered by inefficient collection and segregation processes, which in turn restrict the volume of waste available for recycling.

A waste traceability system has not been implemented, and a transparent waste trading platform is not available locally. Consequently, local clothing manufacturers and their ordering customers lack adequate information about the destination of waste once it is handed over to collectors.

The current production capacity for recycled fibers is markedly inadequate, falling well below the level needed to satisfy potential demand.

The legal framework established by the new law on waste management is well-structured, but its implementation is still in the initial phase. Enforcement will require time and effort.

## Opportunities

International brands want to manage waste responsibly and increasingly demand recycled yarns or fabrics in their collections.

Demand is growing for quality textile waste from local recyclers and brands.

Innovations in textile waste recycling technology are rapidly evolving, improving recycled fiber quality and broadening the types of waste that can be processed.

## Threats

Investment in textile waste recycling capacity in competing Mediterranean countries is booming.

The race to become the favored circular sourcing destination for international fashion brands has begun.

Waste is a resource that must be valorized domestically; large-scale chemical recycling projects are hunting for waste on a regional scale.

SOURCE: BLUMINE

**Figure 3 – SWOT Analysis**





# B. ROADMAP

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# 4. The Way Ahead

## Goals and Objectives of the Roadmap

Leveraging the insights obtained from the pilot's implementation, seven objectives and ten corresponding actions have been identified to enhance and expand the pilot project's reach, aiming for a comprehensive impact on the circular waste valorization value chain addressed by the pilots. The roadmap delineates the essential steps to escalate the project, aiming to spread its advantages to a broader audience and foster the growth of a circular textile value chain.

The key areas of intervention outlined in this roadmap prioritize actions such as eliminating regulatory barriers to pre-consumption waste recycling, enhancing the technology used in recycled fiber production, and increasing awareness and training for garment makers on

waste segregation at the source. It should be noted that a large number of these actions have inter-dependencies between them and would reinforce each other's success. For example, from the perspective of circularity, reducing waste in manufacturing and increasing the collection, sorting and segregation of pre-consumption waste goes hand in hand with increasing efficiency and transparency in a modernized waste recycling value chain. The priorities also include developing digital platforms dedicated to textile waste valorization, transparency, and traceability, as well as promoting the valorization of textile waste within Egypt by encouraging brands sourcing from Egypt to establish partnerships for circular initiatives in the country.

Goals and Objectives	Roadmaps actions
Create a legal framework favorable to the circular economy and waste valorization in the textile and clothing industry	<b>1, 2</b>
Modernize and integrate the waste recycling value chain upgrading the technology and increasing efficiency and transparency	<b>3, 4, 5</b>
Reduce waste in textile and RMG manufacturing.	<b>6</b>
Enhance the collection, sorting, and segregation of pre-consumption waste to boost recycling rates.	<b>7</b>
Upgrade education in sustainability and circularity for future technicians, engineers, product managers and designers.	<b>8</b>
Raise awareness among Egyptian industry and society about the benefits and business opportunities associated with circular economy	<b>9</b>
Promote new partnership between Egypt's textile and garments industry and international brands on circular projects	<b>10</b>

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## Actions in the Roadmap

### *Toward an efficient and competitive circular textile industry*

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#### **1 – Remove the obstacles to waste management and recycling for companies located in free zones.**

<b>Type of Action</b>	Policy reform
<b>Description</b>	A significant portion of textile waste originates from companies situated in free zones. These companies frequently encounter obstacles, including administrative hurdles and associated costs, when attempting to transfer waste to recyclers operating in the domestic market and located outside the free zone, despite the existence of established procedures. Streamlining administrative processes for selling or transferring textile waste from free zones to domestic recyclers could offer substantial benefits.
<b>Objective</b>	Create a legal framework favorable to the circular economy and waste valorization in the textile and clothing industry
<b>KPIs</b>	Increased number of transactions of textile waste dedicated to recycling involving companies located in free zones.
<b>Key Stakeholders</b>	Ministry of Industry, WMRA, GAFI

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#### **2 - Consolidate the reforms in the waste management ecosystem**

<b>Type of Action</b>	Policy reform
<b>Description</b>	<p>The Law No. 202 of 2020 on Waste Management has laid down a well-structured legal framework, yet its implementation remains in the nascent stages. Ensuring the law's objectives and obligations are met will necessitate considerable effort and stakeholder engagement. In particular, the enforcement of Art. 29, 48, 49, and 51 will support the proper management of textile waste.</p> <p>An annex or memorandum about Industrial textile waste could also be drafted. The next steps to the implementation and enforcement are vital to effectively shape the waste management practices the law seeks to reform, emphasizing the need for persistent and dedicated application to bridge the gap between legislation and real-world impact.</p>
<b>Objective</b>	Create a legal framework favorable to the circular economy and waste valorization in the textile and clothing industry
<b>KPIs</b>	The Law 202 of 2020 implementation and enforcement timeline is respected.
<b>Key Stakeholders</b>	WMRA, IDA, IMC, Industrial Zones Authorities, Textiles & Home Textiles Export Council, Apparel Export Council, Egyptian Chamber of Textile Industries.

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### 3 – Introduce a national information system and digital platforms dedicated to textile waste valorization, transparency, and traceability.

<b>Type of Action</b>	Information system and capacity building
<b>Description</b>	<p>Egypt lacks quantification and characterization about waste, including textile waste, at the national and municipal levels.</p> <p>To address these gaps, a dedicated national information system is essential, to serve all stakeholders as part of an information circulation mechanism. The platform implementation can be facilitated by financial and non-financial incentives and training programs in the areas of traceability, digitization, and transparency.</p> <p>Establishing a mandatory digital platform will encourage the informal sector integration, promote traceability and a deeper understanding of the market; and enhance rigorous planning of policies.</p> <p>This action is aligned with the provisions of Law No. 202 of 2020 on Waste Management</p>
<b>Objective</b>	Modernize and integrate the waste recycling value chain upgrading the technology and increasing efficiency and transparency;
<b>KPIs</b>	The creation of the digital platform, the number of participating companies, the tons of registered and traced waste, and the publication of an annual report on textile waste.
<b>Key Stakeholders</b>	Ministry of Industry, WMRA, IMC, MSMEs, and companies in the informal sector.

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### 4 – Incentivize investment in mechanical recycling equipment

<b>Type of Action</b>	Market-based incentives for investments
<b>Description</b>	<p>Investments in mechanical recycling equipment are quickly amortized; however, the investment size is often high for SMEs. Green and resource-efficient investments can be accelerated or prioritized within existing investment incentive programs.</p> <p>Incentivize investments in recycling equipment with subsidies, low-interest loans, guarantee systems, or accelerated depreciation, which can be a decisive factor.</p>
<b>Objective</b>	Modernize and integrate the waste recycling value chain upgrading the technology and increasing efficiency and transparency
<b>KPIs</b>	Total value of investments leveraged, total production capacity installed
<b>Key Stakeholders</b>	IDA, GAFI, MSMEDA (Micro, Small and Medium Enterprises Development Agency), IFIs, developmental banks, CBE, recyclers, and textile and garment companies.



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## 5 – Further evaluate the options for investing in a chemical recycling plant in Egypt

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<b>Type of Action</b>	Market-based incentives for investment
<b>Description</b>	<p>A review of LCA-based studies on the environmental impact of different pathways to polyester production and recycling, including mechanical and chemical recycling, found that they are complementary solutions for textile waste, with mechanical processes more suitable for natural or single-fiber waste, and chemical processes for mixed fibers. That said, there is a number of significant uncertainties due to lack of reliable data, regarding the operational and environmental risks involved with investing in the new chemical recycling technologies –which are yet to be implemented on commercial scale in developing countries– such as the energy, water, and chemical inputs and potential climate impacts, as well as the global price point where the investment would be financially viable.</p> <p>Nearly half of the pre-consumption textile waste produced in Egypt consists of mixed fibers, which are not ideally suited for being recycled through mechanical methods thereby offering a viable feedstock for chemical recycling techniques, therefore chemical recycling can be an important solution for these waste streams in Egypt as opposed to business-as-usual scenario of landfilling/ incineration.</p> <p>Investments in the chemical recycling of textile waste are substantial in scale and necessitate a collaborative effort among various stakeholders and further assessment in terms of each specific technology financial feasibility and overall impact. This would require coordination between investors and technology providers, along with support from financial organizations and industrial zone authorities.</p>
<b>Objective</b>	Modernize and integrate the waste recycling value chain upgrading the technology and increasing efficiency and transparency
<b>KPIs</b>	Investment planned for chemical recycling
<b>Key Stakeholders</b>	GAFI, IDA, Industrial Zones Authorities, specialized government agencies, financial institutions, investors, technology providers

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## 6 – Incentivize investment in waste reduction technology

<b>Type of Action</b>	Market-based incentives for investment
<b>Description</b>	<p>The most effective waste management strategy is to avoid creating waste in the first place. Modern digital and automated systems, including modeling software and automated cutting machines, can significantly reduce waste volumes and conserve resources for clothing manufacturers. Green and resource-efficient investments can be fast-tracked or given priority within existing investment incentive programs.</p> <p>Encouraging the use of waste reduction technologies through incentives such as subsidies, low-interest loans, guarantee systems, or accelerated depreciation continues to be a preferred policy for promoting the circular economy.</p>
<b>Objective</b>	Reduce waste in textile and RMG manufacturing.
<b>KPIs</b>	Total value of investments leveraged.
<b>Key Stakeholders</b>	IMC, ENPC (Egypt National Cleaner Production Center), Textiles & Home Textiles Export Council, Apparel Export Council, Egyptian Chamber of Textile Industries, Egyptian Chamber of Apparel and Home Textile, financial institutions, investors, technology providers, developmental agencies

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## 7 – Training in proper and efficient waste segregation and management procedures for garment-makers

<b>Type of Action</b>	Training and awareness-raising
<b>Description</b>	<p>Waste sorting at the source has proven to be a fundamental prerequisite for reducing waste management costs and increasing the value of waste delivered to recyclers. However, clothing manufacturers might hesitate to undertake the necessary steps for proper and responsible waste management, which is often seen as an additional expense.</p> <p>Promote practical 'on-site' training for textile and garment companies on proper waste sorting and management procedures, followed by sessions to verify the implementation of quality waste management procedures. A national certificate or quality label for waste management could also be established for companies that have successfully completed the audit, training, and verification stages.</p>
<b>Objective</b>	Enhance the collection, sorting, and segregation of pre-consumption waste to boost recycling rates.
<b>KPIs</b>	Number of companies trained.
<b>Key Stakeholders</b>	IMC, Textiles & Home Textiles Export Council, Apparel Export Council, Egyptian Chamber of Textile Industries, Egyptian Chamber of Apparel and Home Textile Industries; national certification bodies; textile business associations, textile schools and technical research institutes; textile companies and garment makers.

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## 8 – Introducing circular business models and design for circularity in the higher education curricula

<b>Type of Action</b>	Training and awareness-raising
<b>Description</b>	The principles and practices of sustainability and circularity regarding textile and fashion processes and materials must be integrated into higher education course syllabi for textile engineering and management and Technical Vocational Education and Training (TVET). This includes the development of higher education courses focused on sustainability and circularity for aspiring fashion designers.
<b>Objective</b>	Upgrade education in sustainability and circularity for future technicians, engineers, product managers, and designers.
<b>KPIs</b>	Number of courses taught, number of students attending.
<b>Key Stakeholders</b>	Ministry of Higher Education, Universities, Fashion and Design schools, specialized technological centers.

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## 9 – Promote sustainability and circularity best practices within the Egyptian textile industry and society

<b>Type of Action</b>	Training and awareness-raising
<b>Description</b>	<p>Promote workshops on eco-design practices, safer chemical management, and waste valorization opportunities.</p> <p>Organize communication campaigns involving local businesses, international brands, and technology suppliers.</p> <p>Conduct targeted educational campaigns for citizens and the general public to inform, educate, and inspire individuals about the benefits of recycled textiles compared to virgin fibers, encouraging them to prefer sustainable clothing over disposable garments.</p> <p>Launch social media campaigns targeting young consumers (Generation Y, Generation Z), involving sustainability and circular economy ambassadors from international brands, celebrities, personalities, and Egyptian textile and clothing companies and brands.</p>
<b>Objective</b>	Raise awareness among Egyptian industry and society about the benefits and business opportunities associated with the circular economy.
<b>KPIs</b>	Number of events, number of companies participating in the events.
<b>Key Stakeholders</b>	Textiles & Home Textiles Export Council, Apparel Export Council, Ministry of Industry, Ministry of Environment, civil society actors (NGOs), consumers' associations, and citizens.

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## 10 – Engagement of international brands in circular economy initiatives in Egypt

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<b>Type of Action</b>	Communication outreach for new partnerships
<b>Description</b>	Launch a communication plan targeting international brands sourcing from Egypt to showcase the achievements and efforts of the Egyptian textile industry in sustainability and circular textiles, aiming to establish new partnerships. Brands play a crucial role in engaging the local supply chain in circular projects. A significant portion of the Egyptian apparel sector operates through subcontractors with limited decision-making independence. Conversely, brands are eager to assess new projects to advance circular business models.
<b>Objective</b>	Promote new partnership between Egypt's textile and garments industry and international brands on circular projects.
<b>KPIs</b>	Number of brands engaged; new partnerships/programs launched.
<b>Key Stakeholders</b>	Textiles & Home Textiles Export Council, Apparel Export Council, Ministry of Industry, Ministry of Environment, International Organizations (e.g. UNIDO), and international fashion brands.

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## Implementation plan

The roadmap schedule is organized into phases based on the level of importance within the intervention framework. Almost all measures, except two, are short-term priority interventions for the period 2024-2027. Meanwhile, four

of these measures, aiming to generate the necessary impact to transform the recycling value chain into a modern and efficient one, should continue during the period 2027-2030.

	Priority 2024-2027	Medium to long term 2027-2030
1) Remove the obstacles to waste management and recycling for companies located in export zones	✓	
2 Consolidate the reforms in the waste management ecosystem	✓	✓
3) Introduce a national information system and digital and platforms dedicated to textile waste valorization, transparency, and traceability		✓
4) Incentivize investment in mechanical recycling equipment	✓	✓
5) Further evaluate the options for investing in a chemical recycling plant in Egypt		✓
6) Incentivize investment in waste reduction technology	✓	
7) Training in proper and efficient waste segregation and management procedures for garment-makers	✓	
8) Introducing circular business models and design for circularity in the higher education curricula	✓	
9) Promote sustainability and circularity best practices within the Egyptian textile industry and society	✓	
10) Engagement of international brands in circular economy projects	✓	



