Textile waste mapping in Morocco and Tunisia

DELIVERABLE DA.9 (final)
English version
Introduction and methodology

1. Textile waste mapping in Morocco

2. Textile waste mapping in Tunisia
1. Introduction and methodology
This document is the final version of the mapping study of the textile waste value chain (post-industrial and pre-consumption) in Tunisia and Morocco, conducted by Blumine and Reverse Resources within the framework of the SwitchMed/MedTest III initiative launched by UNIDO.

The study includes:
- an estimate of the volumes of waste generated by the textile and clothing industry in Morocco and Tunisia by fiber, quality sector and region
- an assessment of the current and potential destinations of textile waste
- a description of the current and potential waste management and recycling value chain
- an analysis of the international scenario in the field of textile waste management
- an analysis of the evolution of textile recycling technologies and current developments
- finally, an elaboration on the more suitable business models from which to select potential pilot cases for the two countries
The methodology for the quantitative estimation of waste, the assessment of current waste destinations and the description of the current and potential waste management and recycling value chain, is based on two main pillars:

1. A survey of a large sample of enterprises, for the collection and analysis of the ratio of waste to materials processed in production in the different sectors of the textile-clothing sector and other qualitative information useful for better understanding the waste management methods of textile and clothing enterprises.

2. The creation of an accounting model of physical production flows in the textile-clothing supply chains of both countries: from the availability and import of raw materials, yarns and fabrics, to the production of clothing.
ESTIMATION OF THE WASTE/MATERIAL RATIO

The parameter of the waste/material ratio is estimated by subsector: spinning, weaving, cutting fabrics, manufacture of garments using the information collected from the 100 companies involved in the mapping survey, supplemented by information acquired in other countries.

Given the objective is to estimate an average annual production of waste over the years, changes in the volumes of material stocks are not taken into account and are set at zero in the model.

The waste/material ratio is applied to the volume of fibers processed and the amount of waste generated is calculated at each stage of the supply chain.
Methodology

Waste/material ratio and waste management information

THE PRIMARY DATA COLLECTION CAMPAIGN

Target: all textile and clothing companies
Objective: to extend data collection
Method: short on-line questionnaire

Target: a balanced sample by sector and size
Objective: to collect richer information, to add qualitative information,
Method: detailed questionnaire in the form of an interview

Target: 20 leading companies
Objective: to understand the practices, the challenges and the opportunities
Method: in-depth interview with the participation of the team of international experts. Quantitative data collection + qualitative information, views and perspectives

Source: Blumine and Reverse Resources
RESULT AND EVALUATION OF THE COLLECTION OF INFORMATION

The information collection campaign was blocked by the COVID outbreak in March 2020 when it became difficult if not impossible to contact companies to submit questionnaires or arrange interviews. In mid-September, the campaign restarted among many difficulties that led to a lower-than-expected participation rate of companies. 100 textile companies were involved in both countries (54 in Tunisia, 46 in Morocco) as well as a total of 8 recycling/waste management companies.

The two samples were merged into a single larger sample of 100 companies to estimate a common waste rate for each subsector for both countries.

Source: Blumine and Reverse Resources
THE PRIMARY DATA COLLECTION CAMPAIGN

The sample of enterprises selected for the 3 levels of the survey was extracted from lists created from the combination of different sources including:

- **In Tunisia:** The Agency for the Promotion of Industry and Innovation – API; latest available lists of public brand installations (Benetton, C&A, PVH, ASOS, Esprit, G-Starraw, Next, Levi’s, VF, Adidas)
- **In Morocco:** AMITH database; list of exhibitors 2019 Morocco in Mode and Maroc Sourcing; latest available lists of public brand installations (Arcadia Group, Benetton, C&A, G-Starraw, Inditex, John Lewis, Next, PVH, VF).

COOPERATION OF NATIONAL FEDERATIONS OF THE TEXTILE AND CLOTHING INDUSTRY (AMITH IN MOROCCO AND FTTH IN TUNISIA)

The Blumine / Reverse Resources team acknowledge the support from AMITH (Moroccan Association of Textile and Clothing Industries) and FTTH (Tunisian Textile and Clothing Federation) for the help in compiling the lists of companies, organizing regional meetings, distributing the online questionnaire, as well as for the revision of documents and general support.

The findings of the mapping remain an independent estimate and by the Blumine/Reverse Resources team.
The fabric cutting and spinning processes have the highest waste rate. The type of fiber strongly influences the waste rate, which is lower for synthetic fibers than for cotton.

Cotton waste generated in spinning is often reused in industry - for example, waste from combed cotton spinning is reused in carded cotton spinning.

The waste rates calculated here are the average for the different fibres.

Although dead stocks of clothing have increased dramatically with the COVID pandemic, the ratio considered in the study is the pre-pandemic level, considered a "normal level".

**THE WASTE/MATERIAL RATIO BY SECTOR**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Waste Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting</td>
<td>14.6%</td>
</tr>
<tr>
<td>Spinning</td>
<td>10.6%</td>
</tr>
<tr>
<td>Weaving</td>
<td>7.5%</td>
</tr>
<tr>
<td>Overproduction</td>
<td>3.4%</td>
</tr>
<tr>
<td>Deadstocks</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

*Source: Blumine and Reverse Resources estimates*

Ratio of waste to transformed material
MATERIAL FLOWS ANALYSIS

The method of material flow analysis is an accounting technique to track the physical in/out flows of material into and from the reference system and on the principles of mass conservation(*) (see diagram on the next page)

- The boundaries of the system in question are the national clothing sector in each country.
- At each stage of the supply chain, imports of raw materials and semi-products are the flows into the system.
- At each stage of the supply chain, exports, waste of the chain, retail sales on the domestic market and exits to other industrial sectors are the outflow from the system.
- The materials that remain inside the system are transformed and used in the next stage in the chain.

(*) The accounting of physical flows, is based on the work carried out by the World Resource Institute at the end of the 1990s and subsequently adapted for European countries by Eurostat through the methodology "Economy-Wide Material Flows Accounts"
MATERIAL FLOWS ANALYSIS

A HIGH-LEVEL VIEW OF THE WASTE ESTIMATION MODEL

Source: Blumine and Reverse Resources
ASSESSING THE USES OF TEXTILE WASTE: THE WASTE HIERARCHY

The concept of waste hierarchy indicates an order of preference for actions aimed at reducing and managing waste and at maximizing the practical benefits - ecologically and economically - of products. **Waste prevention** is the preferred option for waste hierarchy models adopted around the world (*).

However, as part of this waste mapping study, we are considering the best management of waste already generated.

**When the waste is already generated, the most preferred option is re-use, followed by recycling (upcycling or downcycling).**

Another dimension of the waste hierarchy adopted in the study is THE economic potential.

An assessment of the higher or lower value of the fibres produced with the recyclable waste has been implemented.

(*) see, for example, Directive 2008/98/EC of the European Parliament and of the Council or the waste management hierarchy of the United States Environmental Protection Agency.
The top level of the waste hierarchy is reuse and includes dead stocks and overproduction of clothing.

The second level is recycling which, in turn, can be divided into two components:

- higher-value recycling: textile to textile recycling with different technologies, candidate for the closed-loop project by brands.
- lower-value recycling: candidate for downcycling in upholstery and mattresses or industrial symbiosis projects that target sectors such as nonwovens, automotive, furniture, construction and others
Waste mapping in Morocco

2.
THE MOROCCAN T&C INDUSTRY

More than 1,100 companies produce a billion garments a year, more than half of them as brand subcontractors. (source: AMITH)

The textile and clothing sector is the largest industrial employer in Morocco, with more than 160,000 employees, representing 26% of industrial jobs.

In 2016, the annual turnover of the sector was DH 24 billion, or 6% of the total turnover of the country's industry. It also accounts for 24% of Moroccan merchandise exports. (source: Haut Commissariat au Plan, Annuaire Statistique du Maroc, 2019)

Source: Haut Commissariat au Plan
The T&C industry in Morocco is highly concentrated at regional level. No updated statistics on the regional distribution of the T&C industry are available. Based on the data available for the most recent years (2014 and 2016), it can be estimated that between 70% and 80% of the entire Moroccan T&C industry is concentrated in two regions, Tangier and Casablanca. Most of the remaining 20%-30% are in the regions of Rabat-Salé and Fez-Meknes.

Source: Blumine and Reverse Resources
With an export value of 3.3 billion euros in 2019, or 12.5% of the country's total exports, the textile and clothing (T&C) industry is one of the main export sectors in Morocco. Clothing is by far the largest component of the T&C industry's exports with a value in 2019 of €2.9 billion, or 88% of the total.

Among garments, half of exports are women's clothing (not-knitted), 15% men's clothing (not-knitted) and 22% knitwear.

Source: Blumine & Reverse Resources calc. on UN Comtrade database
TRADE BALANCE (physical volumes)

From the point of view of available resources, physical imports represent a contribution of materials to the local economy and physical exports a production of materials that cannot be used in the local economy.

In order to calculate the material flows within the Moroccan textile industry, the physical volume of textile imports and exports in 2019 was taken into account, which amounted to:

517Ktons of textile materials imported into the country:
- 376Ktons of yarn and fabric which have been transformed into other textile and clothing materials
- 83Ktons of yarns and technical fabrics used in the manufacture of industrial products and floor coverings
- 16Ktons of made-up articles and household textiles
- 43Ktons of clothing

157Ktons of textile and clothing materials exported from the country

Source: Blumine & Reverse Resources calc. on UN Comtrade database
TEXTILE MATERIAL FLOWS IN THE MOROCCAN TEXTILE AND CLOTHING INDUSTRY – 2019
Tons

Source: Blumine and Reverse Resources calculations
47.3ktons of textile fibers were imported into Morocco in 2019.

42.3Ktons of fibre were spun by the domestic spinning sector, in addition to 126.5Ktons of imported yarn. 5Ktons of yarn were exported, 16.4Ktonnes made up for retail sale and 16.4Ktons for non-clothing end-uses. The remaining 131ktons are available for the domestic weaving or knitting industry.

121.3Ktons of woven or knitted fabrics were manufactured, in addition to 240.8Ktons of imported woven or knitted fabrics. 8.1Ktons are for export and 9.1Ktons for retail sale. The remaining 344.9Ktonnes of fabrics available for the manufacture of clothing and home textiles.

293.2Ktons of clothing, were made from available knitted or woven materials, of which 16.7Ktons remained in the warehouses as dead stock or overproduction. 51.6Ktons are cutting waste.

Source: Blumine & Reverse Resources calc. sur base de donnés UNComtrade
BY FIBRE

About 1/4 of the waste consists of pure fibers: pure cotton, pure synthetic other pure fibers. Almost half of the total, however, are cotton blends that can be more difficult to value.

Source: Blumine & Reverse Resource estimates
More than 60% of the total textile waste generated by textile processes is cutting waste. Given the availability of knitted and non-knit fabrics in the supply chain, we can estimate that non-knit cutting waste is about 31Ktons per year and knitting cutting waste is about 21Ktons.

A significant proportion of spinning waste (which accounts for 6% of total textile waste) is already reused in both textile and non-textile processes. At the other end of the spectrum, an interesting 20% of total waste is made up of finished products, whether deadstock or overproduction.

**Source:** Blumine & Reverse Resources estimate
In clothing activities, each year are generated:

- 51.6 Ktons of cutting waste
- 11.9 Ktons of overproduction
- 4.8 Ktons the deadstocks

Source: Blumine & Reverse Resources estimates
Transport and logistics costs can account for up to 30-40% of the cost of recycling. Proximity to recycling facilities is therefore a key factor in the development of a recycling value chain.

More than 75% of textile waste in Morocco is generated in just two regions: Greater Casablanca and Tangier.
The higher specialization in the Denim sub-sector – with heavier fabrics per m². – compared to the higher Tangier specialization in knitting – gives Casablanca an advantage in terms of the physical amount of waste.

In the Casablanca region, more than 7,000 tons of denim waste are generated each year, which represents nearly 80% of all denim waste in Morocco.

In the third row is the region of Fez-Meknes.

The 3 regions account for more than 90% of the country's textile waste production.

**Source:** Blumine & Reverse Resources estimates
The geography of textile waste

The geographically concentrated structure of the Moroccan T&H industry is an asset to reduce waste transport costs.

In the Tangier Region, about 30Ktons of textile waste production per year are located over a maximum distance of 100Km, with a high concentration in three restricted places: Tangier, Tetouan and Larache.

Similarly, in the Greater Casablanca Region, about 35Ktons of textile waste production per year are located within a radius of 50 Km, around Casablanca.
GRAND CASABLANCA
The industry is mainly composed of small businesses and old infrastructure, with a strong informal sector of management, and reuse of textile waste. The presence of felt and wadding producers and of pet into polyester fiber recyclers are a potential for the region.

TANGER
Good practices exists in the region, in terms of textile-to-fashion recycling and non-woven recycling, with the presence of leaders in the field.
The separation of waste in the factory can be improved.
There is the need to create a real waste market by generalising these practices and involving weaving factories.

RABAT – FES - MEKNES
The management of textile waste has become a real problem for local businesses. There is little storage capacity and little opportunity for recycling.
The traditional carpet industry used to be a destination for textile waste but has now almost disappeared.
What is the potential economic impact of developing a recycling value chain?

If we consider only the higher value textile waste available in the Casablanca region (100% cotton and cotton-rich waste) which accounts for about half of the total textile waste created in the region, there is about 22Ktons of waste per year.

Considering a segregation rate of 80% and a shredding facility capacity utilization of 75%, there is potential room for 8 shredding lines with modern and state-of-art technology: 7 operating at 75% capacity utilization, and one at 58%.

**Scenario**

- 80% of waste is sorted and recycled
- Modern shredding line with a capacity of 250 t/month (600-2,500 kg/h × 8 hours/day and 20 days/month)
- Maximum capacity utilization of 75%

*source: Blumine & Reverse Resources estimates*
Considering only the higher value textile waste available in the Tangier region (100% cotton and cotton-rich waste) which accounts for about half of the total textile waste created in the region, there is about 18Kt of waste per year.

Considering a segregation rate of 80% and a shredding facility capacity utilization of 75%, there is potential room for 7 shredding lines with modern and state-of-the-art technology: 6 operating at 75% capacity utilization and one at 40% capacity.

**Scenario**

- 80% of waste is sorted and recycled
- Modern shredding line with a capacity of 250 t/month (600-2,500 kg/h × 8 hours/day and 20 days/month)
- Maximum capacity utilization of 75%

*source: Blumine & Reverse Resources estimates*
Considering only the higher value textile waste available in the Rabat, Fès et Meknès (100% cotton and cotton-rich waste) which accounts for about half of the total textile waste created in the region, there is about 7,2Kt of waste per year.

Considering a segregation rate of 80% and a shredding facility capacity utilization of 75%, there is potential room for 4 shredding lines with modern and state-of-the-art technology: 3 operating at 75% capacity utilization, 1 to 60%

**RABAT – FES - MEKNES**

**SIMULATION**

100% COTTON + COTTON-RICH

- 75%
- 75%
- 75%
- 60%

**Scenario**

- 80% of waste is sorted and recycled
- Modern shredding line with a capacity of 250 t/month (600-2,500 kg/h x 8 hours/day and 20 days/month)
- Maximum capacity utilization of 75%.
We separate textile waste from production into 2 main categories: reusable waste (surplus production, find of rolls ...) and recyclable waste (cutting scrap, filaments ...).

The latter category is itself separated into two types of high and low value waste according to their composition and demand on the current market.
Waste hierarchy in Morocco
Potential scenarios

Reusable waste
16,7 Ktons

Recoverable Waste:
66,5 Ktons

Ktons= thousands tons

Source: Blumine & Reverse Resources estimates
Some cases and good practices exist in the country that demonstrate the use case of a circular textile economy. However, information on current recycling capacity at the country level is scarce or non-existent and official data on recycling capacity and the technologies used are not available.

In addition, we could not find an official list of authorized collectors and recyclers who specialize in or can work with textile waste. Indeed, the authorization and the legal framework for waste management are still to be developed in the country and constitute a key element of the "National Strategy for waste reduction and recovery" (SNRVD) published by the Minister of Energy, Mining and Sustainable Development in 2019(*).

(*): Axe stratégique 1: Renforcement du cadre législatif et réglementaire relatif à la réduction valorisation des déchets-Action 4 : Mettre en place un système d’autorisation des entreprises œuvrant dans le recyclage et la valorisation des déchets.
Some indices may come from the size of the recycling capacity of higher value fibres for textile-to-textile recycling, based on trade data.

According to official export data, textile waste exports were 2.3 Ktons in 2019, mainly synthetic fibres.

The trade classification does not distinguish between “shredded” and "non-shredded" wastes. Nevertheless, this data provides an upper limit for an estimate of domestic recycling capacity.

Another interesting measure is the volume of rags exported. In fact, rags can be the result of a low-value recycling process. By limiting the analysis to exports to Europe, we found 2.7Ktons of exports, which, when added to fibre exports, brings the upper limit for estimating the volume of waste transported for export to 3.3Ktons.

source: Blumine & Reverse Resources estimates
The Moroccan textile industry includes leading companies in technical textiles, wadding and non-wovens. The market for this class of products can range from high to low end, from natural fibers to technological fibers, high and low-tech processes, fashion clothing, bedding, furniture, workwear, automotive and other industrial uses. Analysis of trade data shows a domestic supply potential for this product class, which has not yet been fully developed: the volume of exports is still limited and the trade balance is negative to a significant extent.
Summary of the analysis

Textile factory

**STRENGTHS**
- Large CMT/clothing manufacturers
- International brands want to manage waste responsibly and increase recycled fibers in collections.

**WEAKNESSES**
- No waste segregation or sorting in most enterprises
- Low knowledge of waste management laws and regulations

Waste management

**STRENGTHS**
- A potentially favorable logistics since about 90% of the waste is concentrated in 3 neighboring regions.

**WEAKNESSES**
- Weak legal framework that needs to be updated
- Widespread informal waste collection sector
- Waste delivered "in bulk" by manufacturers

Recycling

**STRENGTHS**
- Good practices and use cases exist in the country, both for textile textiles and non-woven textiles.

**WEAKNESSES**
- Low recycling capacity
- High-quality waste is mainly exported without shredding
- Need to diversify raw materials in the recycling into nonwovens

End-use

**STRENGTHS**
- Good practices and use cases exist in the country, both for textile textiles and non-woven textiles.
- Large market and local production capacity for nonwovens and technical textiles.

**WEAKNESSES**
- Limited spinning capacity for higher value recycled waste.
- Low know-how of local companies in spinning recycled fibres.

*Source: Blumine & Reverse Resources*
The Moroccan textile and clothing industry has the assets to become a leader in textile circularity.

Proximity to Europe makes it an ideal candidate to provide quality textile waste to recyclers.

Achieving a successful development needs an increase in the cooperation level among industry players, local authorities, leading brands and technology leaders.

Morocco can also attract investors to install these recycling technologies on its territory, through a more organized management of textile waste oriented towards a circular strategy.
3. Waste mapping in Tunisia
There are more than 3,000 companies in the Tunisian T&C industry. Enterprises with 10 or more employees numbered 1,860 (source: Statistiques Tunisie). T&C is the largest industrial employer in the country, with a total of 159,000 jobs or 31% of the total manufacturing industries. (source: APII, 2018)

More than 80% of enterprises produce entirely for the export market ("total exporters").

In 2016, the annual income of the sector was DT 5.4 billion, with a value added of DT 2.1 billion, or 16% of the value added of manufacturing industry. (source: APII, 2018)

It also accounts for 18% of all Tunisian exports of goods. (source: UN Comtrade, 2019)
With an export value of 2.6 billion euros in 2019, equal to 17.6% of the country's total exports, the textile and clothing (T&C) industry is one of the main export sectors in Tunisia. Clothing is by far the largest component of the industry's exports with a value in 2019 of 2 billion euros, equal to 86% of the total.

Among garments, 13% of exports are women's clothing (non-kint), 26% for men's clothing (non-knit) and 21% for knitwear, a further 23% includes workwear and other non-knitted clothing.

Source: Blumine & Reverse Resources calc. on UNComtrade database
TRADE BALANCE (physical volumes)

207Ktons of textile products were imported into the country:

- 143Ktons of yarn and fabric which have been transformed into other textile and clothing materials
- 37Ktons of yarn and technical fabrics used in the manufacture of industrial products and floor coverings
- 9Ktons of made-up articles and household textiles
- 19Ktons of clothing

109Ktons of textile and clothing materials were exported from the country

Source: Blumine & Reverse Resources calc. on UN Comtrade database
TEXTILE FLOWS IN THE TUNISIAN TEXTILE AND CLOTHING INDUSTRY

Tons

Imported Fibres: 19,881
Imported Yarns: 42,205

Spinning: 17,418
Yarns: 59,979

Weaving: 31,763

Yarn Exports: 4,902
Retail Yarn: 5,508

Knitting: 12,298
Knitting Waste: 922

Weaving Waste: 2,382

Garment Production: 129,454
Garments: 101,208

Woven Fabrics Import: 88,153
Woven Fabrics Export: 12,069

Knit Fabrics Export: 1,147
Retail Knit Fabrics: 720

Knit Fabrics Import: 28,794
Knit Cutting Waste: 5,442

Woven Cutting Waste: 13,993
Deadstock: 1,810
Overproduction: 4,460

Source: Blumine & Reverse Resources estimates
19.9 Ktons of textile fibers were imported into Tunisia in 2019.

17.8 K tones were spun by the domestic spinning sector, which was added to 42.2 Ktons of imported yarn. Of the total yarn available, 4.9 Ktons were exported, 11 Ktons were made up for retail sale or were used for uses other than clothing. The remaining 44 Ktons were available for further processing in the domestic weaving or knitting industry.

40.7 Ktons of fabrics or knitwear were made from the available yarns, which was added to 105.6 Ktons of imported fabrics or knitwear. Of the total available fabrics, 16.9 Ktons were retailed or exported. The remaining 129 Ktons of fabrics were available for the manufacture of clothing and home textiles.

101.2 Ktons of clothing were made from available knitted or woven materials, of which 6.2 Ktons remained in warehouses as dead stock or overproduction. 19.4 Ktons are cutting waste.

Source: Blumine & Reverse Resources estimates
WASTE BY FIBRE

It can be estimated that about 1/4 of the waste is made up of pure fibres: pure cotton, pure synthetic other pure fibres.

Nearly 40% of the total, however, are cotton blends that can be more difficult to value.

(*) viscose, lyocell, cupro,

source: Blumine & Reverse Resources estimates
More than half of the total textile waste generated by textile processes is cutting waste.

It can be estimated that non-knit cutting waste represents about 14,000 tons per year and knit cutting waste about 5,400 tons.

**WASTE BY PROCESS**

![Diagram showing waste by process](source: Blumine & Reverse Resources estimates)
In the garment-making sub-sector, each year are generated:

- 19.4Ktons of cutting waste
- 4.5Ktons of garments’ overproduction
- 1.8Ktons of deadstocks
Geography of textile waste in Tunisia

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monastir</td>
<td>27%</td>
</tr>
<tr>
<td>Nabeul</td>
<td>16%</td>
</tr>
<tr>
<td>Bizerte</td>
<td>13%</td>
</tr>
<tr>
<td>Sousse</td>
<td>9%</td>
</tr>
<tr>
<td>Sfax</td>
<td>7%</td>
</tr>
<tr>
<td>Mahdia</td>
<td>5.3%</td>
</tr>
<tr>
<td>Ben Arous</td>
<td>5%</td>
</tr>
<tr>
<td>Manouaba</td>
<td>4%</td>
</tr>
<tr>
<td>Tunis</td>
<td>4%</td>
</tr>
<tr>
<td>Others</td>
<td>10%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>31 Ktons</td>
</tr>
</tbody>
</table>

**Source:** Blumine & Reverse Resources estimates

**BY REGION**

- **North-East Region:**
  - Monastir 27%
  - Nabeul 16%
  - Bizerte 13%
  - Sousse 9%
  - Sfax 7%
  - Mahdia 5.3%
  - Ben Arous 5%
  - Manouaba 4%
  - Tunis 4%
  - Others 10%

- **Center-East Region:**
  - TOTAL 31 Ktons

---

**Map:**

- Center-East Region
- North-East Region

---

**Legend:**

- **Center-East Region**
- **North-East Region**
What is the potential economic impact of the development of a recycling value chain in the two macro regions of NORTH-EAST and CENTRE-EAST?

Information on the current size of the existing recycling capacity in the country is difficult to assess accurately.

An official list of approved collectors and recyclers of textile waste is maintained by the ANGED (National Agency for Waste Management). The list was used to organize meetings with recyclers to gather qualitative information.

On the other hand, the authorization list provides little help in the assessment of recycling capacity, as the capacity for collection, transport and simple cutting merges with the capacity for recycling. In addition, it includes companies that collect all types of waste, including but limited to textile waste.
By combining various sources of information, including ANGED, API and face-to-face interviews, we found that:

- a single company with the know-how and the ability to carry out shredding for textile-textile recycling
- about 4 to 5 companies with the know-how and capacity to perform shredding for the recycling of non-woven textile
- a few other companies that can reduce waste and/or manufacture rags, mops and wipes without shredding

Source: Blumine & Reverse Resources
Simulation of shredding potential by region

If we consider only the higher value textile waste available in the North-East region (100% cotton and cotton-rich waste) which accounts for about half of the total textile waste created in the region, there is about 8Ktons of waste per year.

Considering a segregation rate of 80% and a shredding facility capacity utilization of 75%, there is potential room for 3 shredding lines with modern and state-of-art technology, 2 operating at 75% capacity utilization, one at 60% capacity utilization.

**Scenario**
- 80% of waste is sorted and recycled
- Modern shredding line with a capacity of 250 t/month (600-2,500 kg/h x 8 hours/day and 20 days/month)
- Maximum capacity utilization of 75%

**Source:** Blumine & Reverse Resources estimates
If we consider only the higher value textile waste available in the Center-East region (100% cotton and cotton-rich waste) which accounts for la moitié du total des déchets textiles créés dans la région, il y a environ 8,4Ktons de déchets par an.

Considering a segregation rate of 80% and a shredding facility capacity utilization of 75%, there is potential room for 3 shredding lines with modern and state-of-art technology, operating at 75% capacity utilization.

<table>
<thead>
<tr>
<th>CENTER-EAST REGION</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMULATION 100% COTTON + COTTON-RICH</td>
<td>✓ 80% of waste is sorted and recycled</td>
</tr>
<tr>
<td>✓ 75%</td>
<td>✓ Modern shredding line with a capacity of 250 t/month (600-2,500 kg/h x 8 hours/day and 20 days/month)</td>
</tr>
<tr>
<td>✓ 75%</td>
<td>✓ Maximum capacity utilization of 75%.</td>
</tr>
<tr>
<td>✓ 75%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Blumine & Reverse Resources estimates
We separate textile waste from production into 2 main categories: **re-usable waste** (surplus production, end of rolls ...) and **recyclable waste** (cutting scrap, filaments ...).

The latter category is itself separated into two types of high and low value waste according to their composition and demand on the current market.
Waste hierarchy in Tunisia
Potential scenarios

Re-usable waste: 6.3 Ktons

**DEADSTOCK**
- **AVERAGE INTERNATIONAL STANDARDS**
  - Sold or stored: 67%
  - Internal reuse: 33%
- **BEST INTERNATIONAL STANDARDS**
  - Sold or stored: 50%
  - Internal reuse: 50%

**OVERPRODUCTION**
- **AVERAGE INTERNATIONAL STANDARDS**
  - Sold or stored: 73%
  - Recyclé: 2%
  - Landfill/inincineration: 24%
- **BEST INTERNATIONAL STANDARDS**
  - Sold or stored: 98%
  - Recyclé: 2%

Source: Blumine & Reverse Resources estimates
Recyclable waste: 24.8 Ktons

**Waste hierarchy in Tunisia**

**Potential scenarios**

### Higher Value
- **Internal Reuse**: 10%
- **Recycled**: 35%
- **Downcycled**: 26%
- **Landfilling / Incineration**: 30%

### Lower Value
- **Recycled**: 10%
- **Downcycled**: 40%
- **Landfilling / Incineration**: 50%

**Average International Standards**
- **Internal Reuse**: 20%
- **Recycled**: 55%
- **Downcycled**: 15%
- **Landfilling / Incineration**: 9%

**Best International Standards**
- **Recycled**: 20%
- **Downcycled**: 50%
- **Landfilling / Incineration**: 30%

Source: Blumine & Reverse Resources estimates
The capacity to recycle high-quality fibres in clothing is limited by the spinning capacity in the country. The API database lists 6 spinning companies but only 2 with more than 100 employees.

Synthetic fiber waste, mainly acrylic, is recycled in the carpet industry, data suggests that volumes are very small.

Most of the high-quality waste, 100% cotton and rich in cotton, is exported to Europe, mainly to Italy, Spain, and to Turkey, most of which is not shredded. (from 3 to 4ktons), the export classified as "recycled cotton" is minimal.

Textile waste is also classified as "rags", which can be the result of a recycling process with low added value (without shredding). By limiting the analysis to export to Europe – which should receive the higher value materials – Tunisia exports 4.8 Ktons, which include rags, mops and wipes, as well as cut cotton waste.

It can be estimated that overall exports of recycled materials do not exceed 6Ktons.
Analysis of import/export data shows that the domestic supply potential of this product class is not yet fully developed.

The volume of exports is still limited and the trade balance is negative by a significant amount. Especially in nonwovens, local production capacity is almost absent and represents a critical gap that should be filled.

**IMPORT**

<table>
<thead>
<tr>
<th>Product</th>
<th>Tons 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felt</td>
<td>2.019</td>
</tr>
<tr>
<td>Nonwovens</td>
<td>15.914</td>
</tr>
<tr>
<td>Wadding</td>
<td>571</td>
</tr>
</tbody>
</table>

**EXPORT**

<table>
<thead>
<tr>
<th>Product</th>
<th>Tons 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felt</td>
<td>1</td>
</tr>
<tr>
<td>Nonwovens</td>
<td>819</td>
</tr>
<tr>
<td>Wadding</td>
<td>106</td>
</tr>
</tbody>
</table>

**BALANCE COMMERCIALE**

<table>
<thead>
<tr>
<th>Product</th>
<th>Tons 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felt</td>
<td>-2.018</td>
</tr>
<tr>
<td>Nonwovens</td>
<td>15.095</td>
</tr>
<tr>
<td>Wadding</td>
<td>-465</td>
</tr>
</tbody>
</table>

*Source: Blumine & Reverse Resources*

*Calc. on UN Comtrade*
The mapping study and this report focus on post-industrial and pre-consumption waste. Post-consumer waste is outside the scope of the analysis. There is, however, a link with the “friperie” trade.

The friperie is an important and controversial market in Tunisia for post-consumer waste (domestic or imported). Le Décret n° 95-2396, décembre 1995, laying down detailed rules for the import, processing and distribution of “friperie” states:

Art. 5 «Pour bénéficier du régime de l'entrepôt industriel, l'industriel doit s'équiper de matériels de coupe et d'effilochage agréés par le ministère de l'industrie pour la transformation industrielle des articles de la friperie.»

Companies in the “friperie” market must have an internal shredding capacity – which, as an internal processing capacity, is not precisely regulated by the Specifications for waste management set by the Ministry of the Environment and ANGED.

This shredding capacity is largely underused and could become a driver for the recycling of post-industrial waste. A qualitative analysis of the current destination of materials recycled by the “friperie” sector suggests that they are mainly sold to the non-woven sector.
### Summary Tunisia

<table>
<thead>
<tr>
<th>Textile factory</th>
<th>Waste management</th>
<th>Recycling</th>
<th>End-use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STRENGTHS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Large CMT/ clothing manufacturers</td>
<td>o A potentially favorable logistics since about 90% of the waste is concentrated in 3 neighboring regions.</td>
<td>o Good practices and use cases exist in the country, both in high-quality recycling.</td>
<td>o Good practices and use cases exist in the country, both in high-quality recycling.</td>
</tr>
<tr>
<td>o International brands want to manage waste responsibly and increase recycled fibers in collections.</td>
<td>o Structured legal framework for waste management</td>
<td>o Low recycling capacity for higher value waste</td>
<td>o Limited spinning capacity for higher value recycled waste.</td>
</tr>
<tr>
<td><strong>WEAKNESSES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o No waste segregation or sorting in most enterprises</td>
<td>o The legal framework needs to be updated to support circular business models</td>
<td>o Low recycling capacity for low-value waste</td>
<td>o Widespread informal waste collection</td>
</tr>
<tr>
<td>o Low knowledge of waste management laws and regulations</td>
<td>o Widespread informal waste collection</td>
<td>o High-quality waste is mainly exported without shredding.</td>
<td>Waste delivered “in bulk” by manufacturers and often collected by non-specialized companies</td>
</tr>
<tr>
<td>o In some regions, the age of factories and infrastructure limits effective waste management.</td>
<td>Waste delivered “in bulk” by manufacturers and often collected by non-specialized companies</td>
<td>o Demand for nonwovens and technical textiles met by imports</td>
<td>o Lack of information on the prospects of the recycled fibres market</td>
</tr>
</tbody>
</table>

**Source:** Blumine & Reverse Resource
A BUSINESS DEVELOPMENT POTENTIAL FOR TUNISIA

The Tunisian textile and clothing industry has the assets to become a leader in textile circularity.

Proximity to Europe makes it an ideal candidate to provide quality textile waste to recyclers.

Achieving a successful development needs an increase in the cooperation level among industry players, local authorities, leading brands and technology leaders.

Tunisia can also attract investors to install these recycling technologies on its territory, through a more organized management of textile waste oriented towards a circular strategy..
This document has been produced without formal United Nations editing and within the framework of the SwitchMed initiative with the assistance of the European Union. The contents of this publication are the sole responsibility of the authors and can in no way be taken to reflect the views of the European Union. The mention of firm names or commercial products does not constitute an endorsement by UNIDO. The opinions, figures and estimates set forth are the responsibility of the authors and therefore should not be considered as reflecting the views or carrying the endorsement of UNIDO.

SwitchMed is funded by the European Union, coordinated by UNIDO and collaboratively implemented with the UN Environment Economy Division, the United Nations Environment Programme Mediterranean Action Plan (UN Environment/MAP), and the Regional Activity Centre for Sustainable Consumption and Production (SCP/RAC).

© 2021 United Nations Industrial Development Organization - All rights reserved

Image: Tony Webster is licensed with CC BY 2.0.