Strengthening the links between industry and academia for a sustainable textile sector that promotes circular economy in Sub-Saharan Africa

WP2: Enhancing HEI students' knowledge on sustainability and circular economy in the textile sector

D2.1 Mapping Sustainable and Circular Pathways: A Comprehensive Study of the Textile Industry for the Co-Design of an Innovative Academic Course

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project acronym:	**METODIC**
Project full title:	**STRENGTHENING THE LINKS BETWEEN INDUSTRY AND ACADEMIA FOR A SUSTAINABLE TEXTILE SECTOR THAT PROMOTES CIRCULAR ECONOMY IN SUB-SHARAN AFRICA**
Grant agreement no.:	**101178999**
Responsible partner for deliverable:	**IUMoi**
Contributing partners:	**UGent - UNIWA - TUK - BDU - JU - MU - BU - KyU**
Author(s):	**Benny Malengier, Kyriaki Kiskira, Mulualem Mekonnen, Aaron Wanyama, Edwin Kamalha, Godias Tumusiime, Innocent Tendo Mugaanire, Mirembe Jacquirine, Allan Kasedde, Karen Desta Agulei, Godias Tumusiime, Annie Nakagiri, Tesfu Berhane, Benson Dulo, John Githaiga, David Njuguna, Mebrahtom Teklehaimanot,**
Distribution level:	**Public**
Total number of pages:	**129**
Version:	**FINAL**
Language	**English**
Reviewed by:	**TUK (Fredrick Nzioka Mutua) & IDEC (Stefania Skandalou)**
Status:	**Completed**
Delivery date:	**31/03/2025**

Version control

Number	Date	Description
V0.1	16/12/2024	1st draft
V1	12/02/2025	Pre-review draft
V1.1	05/03/2025	Review by TUK
V1.2	10/03/2025	Review by IDEC
V1.3	28/03/2025	Final review by MOI
V2	31/03/2025	Final (final review by UNIWA)

Co-funded by the European Union

Table of Contents

Co-funded by the European Union

Co-funded by the European Union

Co-funded by the European Union

1. Abbreviations and Acronyms

UNIWA	University of West Attica
UGent	Ghent University
MoiU	Moi University
IDEC	IDEC S.A., a consultancy, high tech and training company based in Piraeus, Greece
TUK	Technical University of Kenya
BDU	Bahir Dar University
JU	Jimma University
MU	Mekelle University
BU	Busitema University
KyU	Kyambogo University
WP	Work Package

Co-funded by the European Union

1 Summary

The report aims to provide an in-depth understanding of the current state of the textile industry within the project's target regions, namely Kenya, Ethiopia, and Uganda. It covers key elements such as industry trends, challenges, opportunities, and existing sustainability practices adopted by textile companies in these regions.

Moreover, the deliverable involves an exploration of global best practices in sustainable and circular business models within the textile industry. It delves into case studies and initiatives worldwide, extracting insights that can inform the design of an innovative academic course tailored to the needs of the project.

This report is part of Work Package 2 of the METODIC project, which aims to enhance Higher Education Institution (HEI) students' knowledge on sustainability and circular economy in the textile sector. Objectives are:

- Foster collaboration between academia and industry to co-create a course that directly addresses the real-world needs of the textile sector, ensuring its relevance and applicability.
- Provide students with high-quality learning materials, facilitating a holistic understanding of sustainable and circular business models in the textile industry.
- Enhance the capabilities of academic staff, enabling them to effectively deliver the newly designed Bachelor course and ensuring a high standard of education for students.
- Provide students with access to necessary equipment and resources, enhancing their practical skills and creating a conducive learning environment
- Establish formal partnerships between HEIs and industries, fostering ongoing collaboration that benefits students, academia, and the industry through shared initiatives, research, and knowledge exchange.

2 Introduction

2.1 Objectives of This Deliverable

The objective of this deliverable is to provide a preliminary study on comprehensive understanding of the current state of the textile industry and regulatory landscape in each African country, sustainability practices, circular economy principles, emerging trends and Innovations. The background study will serve as a foundation for meaningful discussions during the co-design process, providing industry representatives and project partners with a shared understanding of the current landscape and future possibilities. It ensures that the course outline is informed by the latest industry insights, aligns with global best practices, and addresses specific challenges and opportunities.

Co-funded by the European Union

2.2 Relationship to Other Work Packages

As a first task in this WP, Task 2.1 concerns the collaborative planning between project partners and industry representatives to outline the structure and content of a new course at Bachelor level for the Universities. The aim is to ensure that the course aligns with industry needs, integrates real-world examples, and addresses sustainability and circular economy concepts in the textile sector. Apart from this report, other key steps in this task include:

1. Identifying key industry stakeholders from industry who will contribute to the course design.
2. Organizing workshops or meetings with industry representatives to gather insights on current industry practices, challenges, and opportunities (organization of 1 workshop per African HEI). Methodology for workshops will be prepared by UGent
3. Drafting an outline of the course based on the collaborative input from academia and industry. Templates will be provided by MOI.

The course will be one of the main outputs from the METODIC project, and will start from this report.

2.3 Structure of This Deliverable

This study will start with an in depth look at the current textile industry in the South partner countries: Kenya, Uganda, and Ethiopia. This is done by providing an overview of the current state of this industry in each country, and by next looking at the regulatory landscape for sustainable practices in each country. Section 3 provides the details, looking at one country at a time.

In the following section 4 we focus on existing sustainability practices in the different South countries. This is done by focusing on at least 4 cases in each country. In order to put these existing practices in a more global context, section 5 looks at the bigger picture by considering the situation in the European Union. First the Green deal and REACH are explained, and what opportunities will arise due to this. Next, 4 cases of sustainable practices in the EU are provided to shed light on how SME in the EU react to the Green deal and REACH.

3 Current State of the textile industry

In this section we give an overview of the textile industry in the target regions in 2024. This includes the size of the industry, most important sectors, industry trends over the last decades, and the challenges and opportunities present in the industry.

Co-funded by the European Union

3.1 State of the textile industry in Kenya

i. 3.1.1 Overview

The cotton, textile and apparel industry in Kenya is of great economic significance. The industry has been at the core of all successive Kenya government administrations economic development programs since independence, back in 1963. Prioritization of the sector in manufacturing and industrialization of the development blueprints including the import substitution policies put in operation during the period 1963 to 1986, the long-term Kenya Vision 2030, the Big Four Agenda and the Bottom-Up Economic transformation Agenda (BETA), underpins its importance. The textiles and apparels sector is one of the most labor intensive sectors of the manufacturing industry, and has the ability to create a large number of employment opportunities within a short duration of time. The sector has an elaborate value chain (farm to fashion) that presents immense opportunities in cotton farming, fibre, yarn and fabric processing, and apparels/fashion industry.

The sector recorded its peak performance in 1984, when cotton production was over 70,000 bales, supplied to about 52 local textiles mills that employed over 42,000 people. The sector then was the second largest employer after the civil service in the country. The sector declined in the late 1980s and collapsed in the 1990s, due to trade liberalization, Global Economic Reforms under the Structural Adjacent Program's (SAPs), old processing machinery and equipment, poor infrastructure, increased competition from cheap imports, etc. (KIPPRA 2003, Wario & Njoroge, 2020).

Over the years, the sector has experienced notable growth, particularly in the apparel manufacturing segment, driven by favorable trade agreements such as the African Growth and Opportunity Act (AGOA) and government initiatives aimed at boosting industrialization. This growth has enabled Kenya to emerge as a key player in the global textile and apparel value chain, particularly as an exporter to international markets like the United States and Europe.

Despite these achievements, the industry continues to grapple with several challenges that hinder its ability to fully capitalize on its potential. Issues such as inadequate local production of raw materials (notably cotton), outdated technology, high production costs, and stiff competition from global players present significant obstacles. Additionally, the informal nature of much of Kenya's textile sector limits the ability of businesses to scale and compete effectively on a global stage.

Understanding the current state of Kenya's textile industry, including its strengths, weaknesses, opportunities, and threats, is essential for identifying pathways to sustainable growth and competitiveness. By addressing key barriers and leveraging its strategic

Co-funded by the European Union

position in the global market, Kenya can unlock the untapped potential of its textile industry and cement its place as a leader in the region's manufacturing sector.

It is estimated that by 2030, with a fully developed value chain, the sector will provide about 2.1 million direct jobs, and many more informally (Ministry of Industrialization, Trade and Enterprise Development, 2021, Ministry for Investments, Trade and Industry, 2024). The sector, with the strong forward and backward linkages is also an important driver of inclusivity, providing employment opportunities to women in excess of 60%.

ii. 3.1.2. The Textile Value Chain

During the 1960s to the 1980s, Kenya's textile industry flourished as a central pillar of the country's manufacturing sector. There were strong government policies that supported the sector from cotton farming through to garment and apparel manufacturing. The Kenyan government adopted the import substitution policies that encouraged local production and reduced reliance on imports, supporting the private sector and helped the establishment of state-owned industries mainly through the government parastatal; the Industrial and Commercial Development Corporation (ICDC). Imposition of high tariffs on finished imported clothes created a favorable environment for local manufacturers. Major vertically-integrated textile mills were established, besides those that targeted specific segments of the value-chain only, like spinning, knitting, weaving, garment manufacturing, etc.

A vertically integrated cotton textile mill means that the factory has installed machinery and equipment capable of processing cotton fibres into yarns, then converting yarns into fabrics and eventually the finished fabrics into clothing, apparels and garments. A representation of a typical vertically integrated cotton industry is shown in Figure 3.1.1. It comprises cotton growing, ginning, seed milling (for oil and animal feed manufacture), textile manufacturing processes (spinning, weaving, knitting, fabric dyeing, printing, finishing), garment and apparel manufacturing.

Co-funded by the European Union

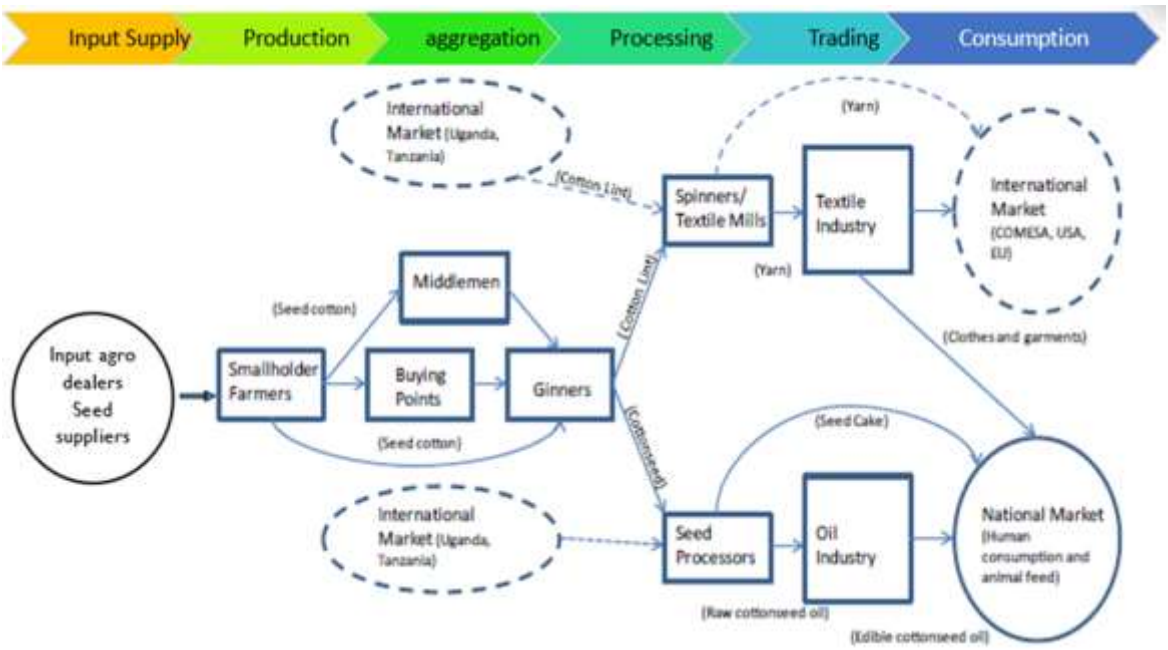

Figure 3.1.1: Mapping of a typical Kenyan cotton value chain

The process of cottonseed processing into oil and other products like animal feed is not considered as a textile manufacturing process, although it is a ginning by-product value addition process. The main textile value chain addition processes are given in the following sections.

1. Cotton Production

Cotton production in Kenya reached a peak of 13,000 tons of lint (70,000 bales) in 1984/85, due to strategies that Kenya adopted immediately after independence in 1963, including the import substitution policy that ensured a backward integration of the textile processing. In addition, the crop was also introduced as a cash crop across the country, with emphasis in the arid and semi-arid lands (ASAL) (EPZA, 2005). This was in recognition of the fact that cotton production offers the greatest potential for increased employment, poverty reduction, rural development and generation of increased incomes in arid and semi-arid areas of the country.

Cotton production declined from the late 1980s, following the textile and apparel sector collapse due to trade liberalization, declining world prices, poor infrastructure, and increased competition from cheap imports. This led to collapse of the backward linkage for input supply of agrochemicals, seeds, ginning, extension, and seed cotton buying, which resulted in thousands of cotton growers abandoning the crop (Wario & Njoroge, 2020). Seed cotton production has fallen over the years, as illustrated in Figure 3.1.2 for

Co-funded by the European Union

the period 2018-2022. This is due to a combination of adverse factors, key among them the collapse of cooperatives, unstable producer prices, poor agronomic practices, high costs of pesticides, and delayed payment to farmers. The total income from the sale of seed cotton and lint in the year 2022 was a mere KES 494 million [cotton act].

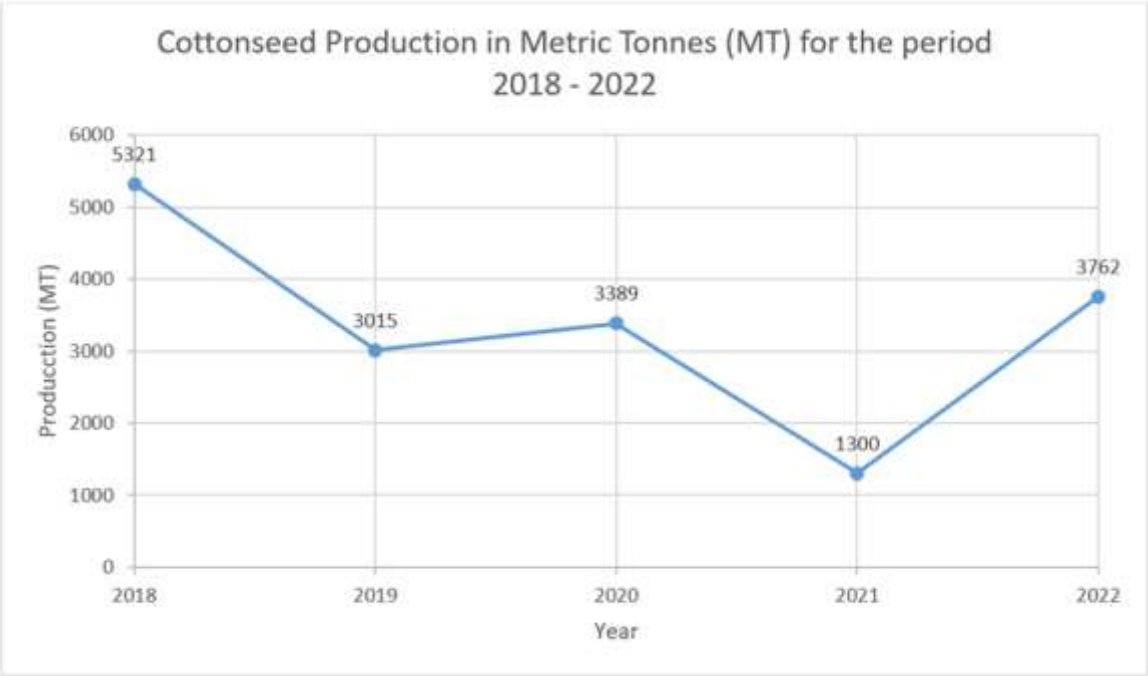

Figure 3.1.2. Cottonseed production in the 5-year period 2018 to 2022.

Kenya has a potential of producing 370,000 bales of lint annually, and over the years, cotton has been considered under different revitalization strategies. Under the Vision 2030, the industrialization strategy, and Agriculture Sector Growth and Transformation Strategy (ASGTS). Under The Big Four economic blueprint developed by the Government in 2017, the Cotton Textile Apparel sector in Manufacturing Pillar was to contribute to the GDP growth from 9% to 15% by 2022. Additionally, cotton is one of the priority crops value chain targeted under the current Bottom-Up Economic Transformation Agenda (BETA) to reduce the import bill for imports of lint and seed cake.

Cotton production is entirely by smallholder farmers, it's mostly under rainfed conditions with minimum inputs. The farmers' average land holdings are small, less than a hectare. Farmers are scattered and unorganized, thus complicating mobilization, advisory service delivery, access to credit facilities, and collective marketing.

Strategies are being put in place by the National government in collaboration with identified County governments with potential for cotton production to revive the crop. Approximately 384,500 hectares of land are suitable for cotton farming, with only a small fraction under cultivation. Further, in 2019 the country embraced Bt cotton and hybrid

Co-funded by the European Union

production, which have yield potential of 3800 kg/ha under irrigation. Adverse weather conditions unsuitable for cotton production, especially for hybrids, also contributed to low yields. However, this was not realized due to depressed yields in rainfed conditions. Cotton has been grown under irrigation in Kenya in the past by Bura and Hola irrigation schemes whereby 12,000 and 5,000 acres were utilized, respectively. Cotton production remains low, meeting only 15% of the industry's needs. Kenya imports most of its cotton from neighboring countries like Uganda and Tanzania.

2. Ginning

During the peak period of cotton, Kenya's ginning sector was vibrant at independence in 1963 there were twenty three (23) installed ginneries – see Figure 3.1.3. Majority of these facilities also ceased operations when the textile sector collapsed.

	Name of Ginnery	Year of Establishment	District	Original Owner	Present owner and operator	Installed/ No. of Gins	No of Gins operational	Bales at full capacity	Ginning costs/kg
1	Mwea	1969	Kirinyaga	CBK	Private	20	7	3600	30
2	Hola		Tana River	CBK	Private	20	0	3600	-
3	Lamu	1960s	Lamu			11	0	1980	-
4	Malindi		Malindi	Private	Private	37	37	6660	35
5	Mpeketoni		Lamu			16	16	2850	30
6	Voi	1969	Taita	Private	Private	8	8	1440	-
7	Kitui	1935	Kitui	Private	Private	16	16	2850	25
8	Makueni	1980	Makueni	CBK	Private	20	8	3600	30
9	Tharaka	1992	Tharaka	Private	Private	15	11	2700	-
10	Meru (1994)	1970	Imenti North	CBK	Private	30	10	5400	-
11	Meru Farmers	1996	Imenti North	Private	Private	6	0	1880	-
12	Homa Bay	1937	Homa Bay	CBK	Private	12	0	2160	-
13	Kendu Bay	1935	Homa Bay	CBK	Private	12	0	2160	-
14	Kibos	1935	Miwani	CBK	Private	7	7	1260	-
15	Nyanza	1971	Miwani	Private	Private	10	10	1800	30
16	Ndere	1937	Siaya	Private	Cooperative	8	2	1440	-
17	Algenya	1964	Siaya	Private	Private	5	4	900	-
18	Salawa	1985	Baringo	CBK	Private	10	7	1800	70
19	Isimbii	1992	Teso	Private	Private	20	0	3600	-
20	Luanda	1922	Busia	Private	Cooperative	20	14	3600	-
21	Malaba Malakisi	1921	Bungoma West	Private	Cooperative	10	0	1800	-
22	Angurai	1992	Teso	Private	private	0	0	0	-
23	Nambale	1922	Busia	Private	Cooperative	12	6	2160	-
Total									

Source: EPZA, 2005; CODA, 2013

Figure 3.1.3. Installed Ginning Capacity in the Country (EPZA, 2005)

Currently there are six (6) operational ginneries in the country located in Meru, Kitui, Baringo, Busia, Tharaka/Nithi and Makueni counties. Their distribution compared to

Co-funded by the European Union

cotton production areas are not matched, leaving areas with large production with high transportation cost of seed cotton to the ginneries.

The ginneries have old equipment installed which are inefficient and ineffective. The inefficient equipment leads to a high cost of production, and this cost is usually passed on to the farmer in the pricing model. This is confirmed by the fact that over the years the seed cotton price has not significantly improved when compared to lint price improvement as shown in Figure 3.1.4. Although there are many factors that affect the pricing, a direct correlation would be expected.

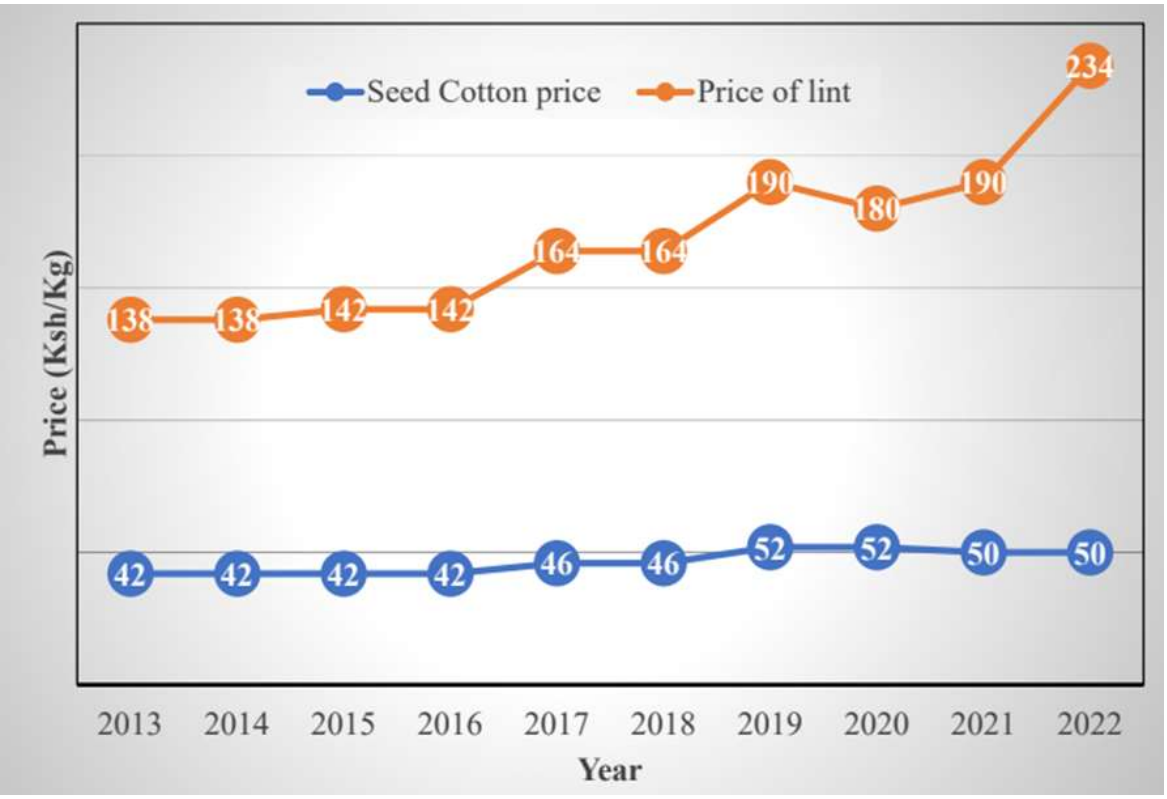

Figure 3.1.4. Seed cotton and lint price trends for the period 2013-2022

However, with a ginning capacity of 14,000 MT (76,500 bales) lint, the average ginning capacity utilization across the ginneries is less than 25% due to the low supply of seed cotton. Operations of the ginnery normally last for about 3 months annually. Therefore, in spite of the ginning challenges highlighted, the current capacity, with slight upgrade would effectively cope with projected optimal production of 14,000 MT [NAVCPD].

3. *Textile processing*

Textile processing refers to the process of fibre to yarn conversion (spinning), yarn to fabric conversion (weaving and knitting) and finally finishing (imparting of designed colour,

Co-funded by the European Union

aesthetics, patterns, prints, etc.) of fabrics. For a vertically integrated industry, these constitute the major manufacturing processes of textiles, taking up over 90% of the machinery, equipment, infrastructure, investments and development for the entire cotton, textile, apparel value chain.

During the period 1963 to 1986 when the sector flourished, the government and the private sector invested heavily in textile mills, with over 52 local textiles mills established. There were large mills, such as Rift Valley Textiles (Rivatex), Mount Kenya Textiles (MOUNTEX), Kisumu Cotton Mills (KICOMI), Kenya Taitex Mills (KTM), etc. that were state-owned. The private sector has industries like Thika Cloth Mills Ltd (TCM), United Textile Industries (UTI), Sunflag, Bedi Investments, Londra, Raymonds Woolen mills, etc. These mills had extensive forward and backward linkages that supported the ginneries and by extension the farmers. The good performance was due to the fact that most textile mills during this period were equipped with modern machinery, enabling efficient and quality production, whereby most mills operated at full capacity, producing diverse products ranging from yarn to finished garments. The country had good infrastructure ranging from roads, railways, and ports that facilitated the transportation of raw materials and finished goods, reducing logistical bottlenecks.

The decline of Kenya's textile industry during the 1990s marked a dramatic downturn after decades of prosperity. The key factors contributing to the decline included market liberalization through adoption of the Structural Adjustment Programs (SAPs) which implied reduced government intervention, removal of subsidies and the privatization of state-owned textile mills. Many textile mills operated with outdated machinery, leading to low productivity, poor quality and high operational costs. Trade barriers, such as tariffs on imports were reduced or eliminated, exposing the local industry to international competition. This led to an influx of cheap textiles from countries like China, India, and Pakistan, which offered mass-produced products at significantly lower prices. Also, importation of second-hand clothes (mitumba) surged, dominating the local market and reducing demand for locally manufactured textiles. Unfortunately, most of the new fabric/garments are imported and distributed through illegal hubs while some are disguised as used clothes whose import duties are very low [chemngetich]. The State-owned mills faced mismanagement, corruption, and inefficiency, eventually leading to privatization, which often resulted in asset stripping rather than revitalization due to prevailing operating circumstances.

Over the years, the number of operating textile mills in the country dwindled, due to outdated machinery, inconsistent cotton supply, and higher production costs. The processing and manufacturing was characterized by closures, scaling down of operations, relocation outside the country, and deferring of investment decisions due to an uncertain future business outlook, thus reducing the operating and installed capacity. This reduced

Co-funded by the European Union

the annual demand for cotton lint, against an increasing clothing demand from the increasing Kenyan population. Kenya is therefore losing out on the massive opportunity of sustaining the textile requirement locally.

By 2023, lint production in the country had dropped to 1,254 MT against an annual demand of 8,840 MT based on operating annual lint processing capacity for industries outside the EPZ zones. This is about 44% of the installed spinning capacity of about 20,080 MT (100,000 bales). The yearly lint deficit of 7,586 MT is imported from Uganda and Tanzania at a cost of about KES.1.7B. Although the number of operating mills reduced, three main factories, namely Rivatex East Africa Ltd, Thika Cloth Mills, and Sunflag, had modernized their processing machinery sustaining the 100,000 bales annual lint demand. Rivatex had undergone ultra-modernization, thanks to a structured government support initiative. Woven fabric production was less than 12 million square meters per year, estimated at 7% of the potential market. The major reasons attributing to this include competition from unregulated imports, high utility costs (power and water), poor quality production, lack of competitiveness hence unable to supply to the EPZ industries. [NAVCPD]

4. Government Initiatives and Policies

To revive the industry, the government has reintroduced support programs such as the promotion, coordination, monitoring, regulating, and directing of the cotton industry in Kenya through the Cotton Development Authority (CoDA) (Cotton Development Authority, 2006), the financial prioritization of the Cotton, Textile, and Apparel (CTA) value chain under the fourth Medium Term plan (MTP IV), that guides Kenya's development between 2023-2027 (Ministry for Investments, Trade and Industry, 2024), as well as the Buy Kenya Build Kenya presidential directive, a campaign strategy that incentivizes consumption of locally produced textiles and apparel (Ministry of Industry, Trade and Cooperatives, 2017). This directive seeks to revamp the cotton industry. Recently, strategic policies, including the Draft CTA Policy 2024, aimed at enhancing cotton production, improving value addition, and increasing employment opportunities (Ministry for Investments, Trade and Industry, 2024). This policy promotes seed quality improvement, modernization of ginneries, and establishment of integrated textile parks. The focus is on value addition, which ensures that raw cotton is processed domestically rather than exported in its raw form.

The Ministry of Industrialization and Enterprise Development (2015) also highlighted key reforms such as promoting public-private partnerships, improving farmer support systems, and leveraging trade agreements to expand Kenya's export markets. These interventions

Co-funded by the European Union

align with Kenya's Vision 2030 (The Kenyan Vision 2030, 2007), which identifies the textile and apparel industry as a key driver of economic growth.

In addition, many policies and legal frameworks such as the National Agricultural Mechanization Policy (2021), Sessional Paper No. 9 of 2012, National Industrialization Policy Framework for Kenya, National Trade Policy, Crops Act (Cap. 318), Warehouse Receipt System Act (Cap. 350), County Governments Act (Cap. 265), among others, have been adopted to promote, streamline, and support the CTA sector's productivity and sustainability.

Moreover, other government initiatives to spur growth in the CTA sector include approval of Bt cotton to boost cotton production, enhancement research on the cotton value chain, modernization of a government-owned mill, periodic capacity building of small-scale apparel producers, and introduction of incentivized programs such as the Export Processing Zones (EPZs) and Special Economic Zones (SEZs) (Ministry for Investments, Trade and Industry, 2024).

iii. 3.1.3. Employment Potential

The cotton, textile, and apparel (CTA) sector holds significant employment potential. In fact, by 2030, the government targets the sector to provide about 2.1 million direct jobs (Ministry of Industrialization, Trade and Enterprise Development, 2021), and many more informally, up from the current 51,000 people (Ministry for Investments, Trade and Industry, 2024). Out of these, Wario and Njoroge (2020) identified that the industry could absorb skilled, semi-skilled, and unskilled workers, particularly in rural areas where cotton farming is prevalent. Additionally, the sector's expansion could support downstream activities, including garment design, tailoring, and distribution.

Apparently, most of the employees in the clothing and apparel sector are women who otherwise struggle to find decent work. As in other developing economies, research has shown several positive effects for women as a result of working in the textile and apparel industry, such as training and education of employees on topics related to family planning, sexual health, and other life skills further impact on women's welfare. Further, some companies do offer creche facilities for mothers with young children (ages of 4 months to 3 years) during work hours, thus facilitating an easier return to work for mothers from maternity leave besides other incentives [Nuford website].

iv. 3.1.4. Challenges

Despite its potential, the Kenyan textile industry faces major challenges, including:

Co-funded by the European Union

2. **Competition from Imports**: The influx of second-hand clothes (mitumba) has stifled local production and discouraged investment in textile manufacturing (KIPPRA, 2020).
3. **High Production Costs**: High energy costs, limited access to quality cotton seeds, and outdated machinery hamper competitiveness (Ministry for Investments, Trade and Industry, 2024).
4. **Skills Gap**: There is a mismatch between industry needs and workforce skills, necessitating investments in training and capacity building.

1. Textile firm productivity

The status of textile machinery in Kenya highlights significant challenges due to outdated and inefficient equipment. Most textile firms operate with machinery installed decades ago, resulting in low productivity, high energy consumption, and poor product quality (Ministry for Investments, Trade and Industry, 2024). Limited investment in modern technologies has exacerbated this problem, as firms lack the capital to upgrade equipment to meet international standards (Ministry of Industrialization and Enterprise Development, 2015). Furthermore, inadequate technical expertise for machine operation and maintenance further reduces efficiency and competitiveness (Wario & Njoroge, 2020). Modernizing machinery is critical to revitalizing Kenya's textile sector.

2. Skills Gap in Kenya's Textile Industry

The skills gap in Kenya's textile and apparel industry remains a major challenge, hindering its competitiveness and growth. While the sector has immense potential for employment and economic development, a lack of relevant skills, inadequate training facilities, and outdated curricula limit its progress. Addressing these gaps requires identifying the critical skills needed, proposing areas for training, and enhancing curricula to meet industry demands.

Necessary Skills for Textile and Apparel Industry in Kenya

The textile and apparel industry requires a wide range of skills spanning farming, production, manufacturing, design, and marketing. Critical areas include:

- **Agronomic Skills:** Knowledge in cotton farming, including seed quality management, soil preparation, pest control, and sustainable farming techniques (Ministry for Investments, Trade and Industry, 2024).
- **Technical Skills:** Machine operation, textile processing (spinning, weaving, knitting), dyeing, printing, and quality control (Wario & Njoroge, 2020).

Co-funded by the European Union

- **Design and Innovation Skills**: Fashion design, garment construction, pattern-making, and use of computer-aided design (CAD) software (Ministry of Industrialization and Enterprise Development, 2015).
- **Managerial and Entrepreneurial Skills:** Supply chain management, financial management, marketing, and export documentation (Wario & Njoroge, 2020).
- **Sustainability Skills:** Eco-friendly manufacturing processes, waste management, and organic cotton certification processes (Ministry for Investments, Trade and Industry, 2024).

To address the skills gap, training should focus on both technical and soft skills across various levels of the value chain. Suggested interventions include:

- **Cotton Farming Techniques:** Training farmers on best practices for seed selection, pest management, and organic cotton farming to improve yields and sustainability (Wario & Njoroge, 2020).
- **Textile Production:** Short-term technical courses on machinery operations, maintenance, and fabric processing to modernize local production. Incorporating training on advanced textile machinery, digital design software, and automation processes (Ministry for Investments, Trade and Industry, 2024).
- **Fashion and Design:** Short modular programs focusing on garment making, CAD software usage, and innovative fashion techniques (Ministry of Industrialization and Enterprise Development, 2015).
- **Focus on Sustainability:** Introducing modules on sustainable textile production, circular economy practices, and eco-friendly manufacturing (Wario & Njoroge, 2020).
- **Industry-Academia Collaboration:** Curricula should align with industry needs through collaboration between training institutions and textile manufacturers to ensure relevance (Ministry of Industrialization and Enterprise Development, 2015).

Limitations of Existing Curricula in Kenya

Kenya's existing education and training systems have notable deficiencies in addressing the textile industry's needs. These include:

- **Insufficient Practical Training:** A significant gap exists between theoretical knowledge and practical application, leaving graduates unprepared for industry challenges (Ministry of Industrialization and Enterprise Development, 2015).
- **Lack of Industry Integration:** Limited engagement between training institutions and the textile industry results in curricula that fail to address current market demands and emerging trends (Ministry for Investments, Trade and Industry, 2024).

Co-funded by the European Union

- **Limited Focus on Innovation:** The absence of modules on digital technologies, fashion innovation, and sustainability limits graduates' competitiveness in the global market (Wario & Njoroge, 2020).
- **Resource Constraints:** Most institutions lack modern equipment and facilities for training on advanced textile machinery and tools (Ministry of Industrialization and Enterprise Development, 2015).

3.2 Regulatory landscape for sustainable practices in the textile industry in Kenya

ii. 3.2.1 Introduction

The strong Kenyan textile and apparel industrial infrastructure built from the 1960s to date, has been due to deliberate actions based on different policies, regulations, protocols, guidelines, standards, etc. developed over the period to streamline, support and sustain the sector. Kenya has made a raft of policy shifts nationally, regionally and internationally in relation to the textile and apparel sector. Some of these policies have resulted in positive impact, negative impact, or have had no impact or effect at all. At the dawn of independence in 1963, the new government implemented the import substitution policies that helped anchor the textile manufacturing industry, supported by extensive institutional support mechanisms, public sector participation and elaborate subsidy programs (KIPPRA, 2020). During that period up to late-1980s, the sector flourished across the entire integrated value chain – cotton production through to garment manufacture. The sector being a heavy capital investment venture, the subsidies helped develop a competitive cotton-textile sector growing into the early 1980s (Ministry for Investments, Trade and Industry, 2024). However, the growth of the sector started to decline in the late 1980s mainly due to global economic meltdown, the Global Economic Reforms under the Structural Adjacent Program's (SAP) and Trade Liberalization of the '80s/'90s,, ageing non-competitive manufacturing technologies, inflow of second-hand used clothes, lack of policies to protect the sector, shortage of skilled labor, etc.(Ministry for Investments, Trade and Industry, 2024).

iii. 3.2.2 Regulatory Framework

The other policy environments [2,3] in which the textile industry continued to perform can be classified under:

National level: The government initiated industrial-oriented policies through:

- Export Promotion Council, Manufacturing Under Bond (MUB), Export Processing Zone
- Authority (EPZA), Export Promotion Council (EPC), Special Economic Zones Authority (SEZA), Kenya Investment Authority (KenInvest), etc;

Co-funded by the European Union

- The Kenya Vision 2030 – that identified the Textile Sector as flagship and key contributor to the central economic pillar;
- Kenyan Government Policy directives on Second hand clothing, Domestic Sourcing etc.;
- The big 4 Agenda
- The Bottom-up Economic Transformation Agenda (BETA)

Regional level: The Kenya Government participation under various regional integration initiatives incorporating industrial and trade liberalization policies, including:

- Common Market for Eastern and Southern African Region (COMESA);
- Common Market Protocol under the East African Community (EAC);
- EAC-COMESA-SADC Tripartite protocol

Global level: The preferential market access provision entrenched into the:

- African Growth Opportunity Act (AGOA 2000) – An initiative by the US Congress to provide, among other economic activities, an opportunity to revive the textile industry in Sub-Saharan Africa (SSA) [AGOA 2000].
- European Partnership Agreements (EPAs) - Provisional status;
- Bilateral Agreements;

In the implementation of the above, some intermittent recovery and good performance of the sector has been witnessed. Some of those initiatives impacting positively are briefly discussed further.

Since the start of the new millennium, Kenya has had varied policy changes with significant implications for industrial development and trade. Incentives to support the growth of the textile industry, include financial assistance to textile manufacturers and promoting the use of locally-made textiles. These policies have impacted the textile and apparel industry more, especially after the United States of America (USA) government enacted the African Growth and Opportunities Act (AGOA), which allowed selected African countries to export textiles and apparels duty-free and without import quota restrictions to the US market. Locally, the AGOA initiative was anchored under The Export Processing Zones (EPZ) program, managed by The Export Processing Zones Authority (EPZA), a State Corporation established in 1990 by the EPZ Act CAP 517, Laws of Kenya, under the then Ministry of Investments, Trade & Industry (MITI) (Ngui et al. 2016; Olweny & Karuiki, 2013). The Export Processing Zones Authority (EPZA) provides sufficient autonomy and coordination capacities, which enable a conducive business environment resulting in a rise in direct foreign investment in the clothing industry (Tyce, 2019).

In pursuit of improved performance of the manufacturing industry, the Kenyan government developed a National Industrial Policy (NIP) meant for operationalizing

Co-funded by the European Union

industry development. However, the policy was never implemented, which had a negative effect on the industry, especially the cotton value chain (Ngui et. al., 2016)

Another regulation that has not yielded the desired results and yet has had a devastating negative effect on the textile and apparel sector for decades is the one on second hand clothing. The second hand (used) clothes were inadvertently brought into the country as humanitarian aid/donations (duty free) for refugees from the conflict-prone neighboring countries only to infiltrate into the local market, significantly limiting the growth of the sector. Even consignments designated for those war-torn countries were diverted into the local market. These are cheap clothes collected from Western countries by charitable organizations for free, and imported duty free. Unfortunately, about 40% of the same end up in dump sites as waste. Although in the initial years the second-hand clothes provided access to clothing for the less privileged in the society, over time unscrupulous traders started importing new clothing disguised as second hand. This further eroded the competitiveness of the locally manufactured textiles and apparels through unfair competition.

Attempts to ban the import of used clothing and textile goods in 2015 and 2016 under the East Africa Community (EAC) protocol were not successful. This led to an increase in importation of second-hand clothing from 121,778 to 183,830 tons in 2020 and 2021, respectively. This was a sharp increase of imported used clothing from 111,000 to 185,000 tons between 2015 and 2019, respectively (Institute of Economic Affairs, 2019; 2021). The value of the imported second-hand clothes rose to Kshs 18 billion (almost equivalent to US$ 170 million) as at the end of 2019 (KAM).

A major disadvantage for Kenya in the implementation of the EAC Protocol lies in the fact that while promoting free movement of goods and services, Kenya (part of the developing countries) is globally ranked above the other community members that are ranked under least developed countries (LDC).

Under the policy environment, the Kenya government has a vision for the textile and apparel sector. Over the last two decades, the sector has been integrated into the development plan for the country under different policies. In view of the fact that cotton is a strategic crop in Kenya and has been the basis for industrial transformation the world over for many centuries. Kenya's Vision 2030, its Medium-Term Plans, the Agricultural Sector Development Strategy (ASDS) 2010-2020 (2009), and Big Four Agenda, the Bottom-up Economic Transformation Agenda (BETA) have prioritized Textile and Apparel as a key industry of focus to deliver the industrialization and social transformation for investment attraction, creation of multiple jobs, and growth of export earnings.

Nevertheless, the Kenyan textile and apparel manufacturing sector has suffered poor productivity growth where the industry has had challenges due to the unfavorable labor

Co-funded by the European Union

and business practices, which include high costs of labor, energy, credit, and technology, leading to outdated manufacturing practices leading to low-quality products and a small market share (KIPPRA, 2023; Ian, 2022; Olweny & Karuiki, 2013).

Additionally, there are also private sector initiatives aimed at promoting the development of the textile industry in Kenya, such as the establishment of textile clusters and the use of modern technology in textile production.

iv. 3.2.3 Policies for the textile and apparel industry in Kenya

Different policies on the performance of the textile industry in Kenya fall on different segments of the value chain, which include the cotton farmers, the cotton ginneries producing cotton lint, the textile firms producing yarn and fabrics, clothing firms producing apparel and garments, and those doing merchandising.

The Kenya Ministry for Investments, Trade, and Industry in the State Department for Industry has consolidated all relevant policies for the textile and clothing industry under the National Cotton Textile and Apparel (CTA) Policy. This policy seeks to rejuvenate the cotton industry in various ways, which include increasing production, enabling value addition, creating employment and supporting skills development, enhancing market access, promoting sustainability, innovation, research and development (Ministry for Investments, Trade and Industry, 2024).

The National CTA Policy document (Ministry for Investments, Trade and Industry, 2024) cites policies and legal frameworks relevant for cotton, textile, and apparel production as follows:

1. Cotton production policies

The Kenyan cotton policies include:

- National Agricultural Insurance Policy of 2024 which seeks to promote investments in agriculture by promoting affordable, accessible and innovative agricultural insurance safeguarding farmers.
- Agricultural Policy of 2021 which promotes agricultural production using appropriate, good quality and affordable inputs.
- Kenya Agricultural Sector Extension Policy 2023 which provides guidelines for efficient capacity utilization in agricultural extension services.
- The draft 'The Crops (Fibre Crops) Regulations (2024) which provides guidelines for growing, aggregation, value addition and marketing of fibre crops through the value chain.

Co-funded by the European Union

- National Agricultural Mechanization Policy (2021) which provides for access, distribution, adoption and regulation of agricultural machinery.
- Agricultural Soil Management Policy (2020) which Promote efficient and sustainable use of soil for increased agricultural productivity.
- Seed and Plant Varieties Act (Cap. 326) which establishes systems for seed certification and quality control as well as regulate seed trade while protecting plant breeders.
- Crops Act (Cap. 318) which promotes cotton as a scheduled crop as well as licensing of cotton farmers and advocating on value addition.
- Agriculture and Food Authority Act (Cap. 317) which provides a regulatory framework on various agricultural laws, market regulations and research and development.
- Cooperative Societies Act (Cap. 490) which guides the registration and regulation of cooperative societies involved in cotton production and marketing.
- Constitution of Kenya, 2010 which provides a framework for sustainable land use and management.
- Bio safety Act (Cap.320) which provides regulations for Genetically Modified Organisms (GMO) hence genetically modified cotton for sustainable cotton farming practices.
- Climate Change Act (Cap. 387A) which provides mechanisms to enhance climate resilience and low-carbon development hence sustainable resource management and social development.
- Warehouse Receipt System Act (Cap. 350) which provides a legal framework for access of credit to farmers.

2. Textile and Apparel production Policies

The Kenyan textile and apparel production policies include:

- Sessional Paper No.9 of 2012, National Industrialization Policy Framework for Kenya, 2012- 2030 that promotes linkages between industrial sub-sectors and other productive sectors along the value chain.
- Competition Act (Cap. 504) that safeguard on competition while protecting consumers.
- County Licensing (Uniform Procedures) Act, Act No.8 of 2024 that provides for licensing procedures by the County governments.
- County Governments Act (Cap. 265) that provides for setting up County Industrial Centers Parks (CIDCs) and the County Aggregated Industrial Parks (CAIPs) meant to support value addition.

Co-funded by the European Union

- Energy Act (Cap. 314) which consolidates energy laws, promotes renewable energy as well as regulation, production, supply and use of electricity.
- Environmental Management and Coordination Act (Cap. 387) which provide legal and institutional framework for environmental protection key to a sustainable industrial value chain.
- Export Processing Zones Act (Cap. 517) that provide for the establishment of export processing zones and the Export Processing Zones Authority; as well as promotion and facilitation of export-oriented investments.
- Industrial Property Act (Cap. 509) that provide for the promotion of inventions and innovations hence facilitate the acquisition of technology as well as regulating intellectual property rights.
- Trade Marks Act (Cap. 506) that provides registration and protection of trademarks.
- Industrial Training Act (Cap. 237) that regulates training of the industrial workforce.
- Investment Promotion Act (Cap. 485) which promote and facilitate investment licensing and provision of relevant incentives.
- Sustainable Waste Management Act (Cap. 236) which provide a legal and institutional framework for sustainable management of waste.
- Water Act (Cap. 372) that provide for the management, conservation, acquisition, use, regulation and control of water resources.
- Occupational Safety and Health Act (Cap. 236A) that provide for the safety, health and welfare of workers and all persons at workplaces hence chemical and machinery safety, and health protection.
- Standards Act (Cap. 496) that provides standard specifications for commodities and codes of practice.
- Tax Procedures Act (Cap. 469B) that provides uniform procedures for consistency and efficiency in the administration of tax laws ensuring tax compliance.

3. Marketing of cotton, textiles and apparels

This is facilitated by signed Kenya's Trade Agreements including:

- African Growth and Opportunity Act (AGOA) - Kenya qualifies for duty free access to the U.S. market under this initiative and products include textiles, apparels, and handicrafts.
- ACP/Cotonou Partnership Agreement - Exports from Kenya entering the European Union are entitled to duty reductions and freedom from all quota restrictions.
- United Kingdom - The UK-Kenyan Economic Partnership Agreement (EPA) - provides for duty-free access to the UK market.

Co-funded by the European Union

- Generalized System of Preferences (GSP) - products are entitled to preferential duty treatment and non-quantitative restrictions in the United States, Japan, Canada, New Zealand, Australia, Switzerland, Norway, Sweden, Finland, Austria, and other European countries.
- Multilateral Trade System (MTS): - under the World Trade Organization (WTO) adopted trade decisions on agriculture, cotton, and issues related to least-developed countries (LDCs).
- African Continental Free Trade Area (AfCFTA): - Kenya signed for the creation of AfCFTA, marking a historic milestone in the economic integration of the continent
- U.S. – EAC Trade and Investment Framework Agreement (TIFA): - The United States signed a Trade and Investment Framework Agreement (TIFA) with the EAC and COMESA of which Kenya is a member of both regional organizations.

4. Regional markets

- Kenya is a member of the East African Community (EAC) with a population of approximately 145 million - having signed a Protocol to establish a common Customs Union
- It is also a member of the Common Market for Eastern and Southern Africa (COMESA)with a population of approximately 400 million. Exports and imports within member countries enjoy preferential tariff rates.

v. 3.2.3 Application of sustainability policies in the textile and apparel industry

Research, Manufacturing, and Industrialization Policy in the Ministry of Investments, Trade, and Industry under the State Department for Industry is responsible for, among other functions, coordinating the development of industrialization policies and strategies, including those guiding the CTA sector in Kenya.

The textile and clothing industry is among the prioritized industries towards Kenya's Vision 2030, emphasizing job creation in the manufacturing sector and uplifting of quality of life. To respond to changes in the global textile and clothing markets, the Kenyan government has established policies meant to support the manufacturing sector towards a sustainable textile and clothing industry. These policies are meant to conform with the new market requirements through a circular textile industry more specifically geared towards the European Union (EU) Sustainable and Circular Textiles rules, which require eco-designed products that are more durable, reusable, and repairable, and include a certain degree of recycled content (European Commission, 2022; European Centre for Development Policy Management, 2022).

Co-funded by the European Union

Various challenges have been cited that have an impact on the sustainability of the textile and apparel value chain in Kenya on the basis of water, energy, and chemical use, and waste management (Mwasiagi et.al. 2023). This has led to low recycling and reuse of textile and clothing waste; insufficient handling of hazardous waste; lack of waste reduction or utilization incentives; lack of Extended Producer Regulations on used clothes; and lack of skills and capacity to process industrial waste or upcycle and recycle products (UNEP, 2023; Ministry for Investments, Trade and Industry, 2024).

The National CTA policy document is one of the key references that reflects on sustainability in cotton production, textile, and apparel value addition. As per this policy document, sustainable cotton production focuses on the reuse of cotton byproducts and responsible use of production resources such as fertilizers, pesticides, and water; hence the adoption of organic farming, integrated pest management, and drip irrigation for water efficiency and supply of quality cotton seeds. On the other hand, the sustainable textile and apparel value chain focuses on industry waste management with proposals for incentives towards the reduction of generated waste, the use of greener chemicals, cleaner energy, and the reuse of wastewater (Ministry for Investments, Trade and Industry, 2024; UNEP, 2023; Mwasiagi et.al., 2023).

In addition, the National Treasury and Planning has developed a Green Fiscal Incentives Policy Framework for different sectors that seeks to guide Kenya's economy into a low-carbon emission development pathway enhancing environmental sustainability. In the manufacturing sector, this policy framework aims to promote efficient production through the use of energy-efficient machinery as well as the development of green standards and eco-labeling for products and services (National Treasury and Economic Planning, 2022). In waste management, the policy seeks to establish a waste management fund mechanism to incentivize sustainable approaches and encourage private sector firms into waste management (EY Global, 2023). Also, the framework promotes the reduction, reuse, recycling, recovery, and repair of waste consistent with the sustainable waste management agenda (National Treasury and Economic Planning, 2022).

The Kenya Association of Manufacturers (KAM) hosts the Centre for Green Growth and Climate Change (CGGCC) which provides a one-stop solution to deepen industry level interventions, promote a circular economy, promote climate change actions, and financial linkages that prioritise people and planet; resource efficiency services (energy, water & wastewater audits, waste, and circular economy resource mapping), capacity building and green financing; and awareness on energy efficiency, sustainability, renewable energy, and circular economy through recognition and best performing awards [Kamau, 2021].

Besides, the government has also developed a green economy strategy and implementation plan for the years 2016-2030 geared towards supporting a competitive

Co-funded by the European Union

low-carbon economy development. This results in economic resilience and resource efficiency, sustainable management of natural resources, development of sustainable infrastructure, and provision of social support that aligns with the Kenya Vision 2030 (Ministry of Environment and Natural Resources, 2016). This is coupled with the National Sustainable Waste Management Policy meant to enable delivering sustainable waste management services to the Kenyan public by reducing pollution, improving public health, and promoting green entrepreneurship, hence green jobs, as a result of waste collection, reuse and recycling, and compost production (Ministry of Environment and Forestry, 2021). The National Environment Management Authority (NEMA) has also provided guidelines, standards, and permits to promote circular economy practices towards waste reduction, recycling, and sustainable resource management. This is through the compliance assistance program, which has helped in the development of policies that assist the manufacturing companies in identifying environmental risks in their operations and building capacity for responding to the risks (NEMA, 2024). Also, the Kenya National Climate Change Action Plan (NCCAP) which came to effect in 2023 and aims to promote sustainable industrial practices, augment sustainability in the CTA sector as well.

vi. 3.2.4 Policy Gaps in Kenya's Sustainability Measures in the Textile and Apparel Industry

From the reviewed policies it can be noted that there is limited infrastructure and incentives to handle textile and apparel waste, leading to low recycling rates, insufficient hazardous waste management, and inadequate up-cycling capabilities. This can be addressed by:

1. Developing and implementing Extended Producer Responsibility (EPR) regulations for textile to ensure producers are accountable for managing waste from their products.
2. Providing financial incentives or tax relief to companies adopting circular economy practices in textile industry, such as recycling and up-cycling.
3. Establishing public-private partnerships to invest in advanced waste management facilities tailored for textiles.
4. Availing of reliable data to guide in the development and implementation of policy, as well as sensitizing sustainability principles among the CTA stakeholders

In addition, the existing policies do not sufficiently promote eco-designed products with durable, reusable, and recyclable properties, which are essential for meeting global market requirements, particularly EU standards. This can be addressed by:

Co-funded by the European Union

1. Creating mandatory green standards and eco-labeling for textile products in alignment with international guidelines (e.g., EU Sustainable and Circular Textiles Rules).
2. Encouraging the adoption of eco-certifications through technical assistance and subsidies for manufacturers.
3. Integrating eco-design principles into local manufacturing processes by providing training and resources for companies.
4. Developing and implementing green procurement guidelines for sustainable sourcing in public procurement, including in the CTA sector.

Despite having policies aimed at sustainability, enforcement remains inconsistent, particularly regarding hazardous waste management and adherence to environmental standards. Some of the recommended measures that can be considered to addresses this gap include:

1. Introducing penalties and rewards to ensure compliance and encourage sustainable practices among textile manufacturers.
2. Developing a comprehensive tracking system for waste and emissions in the textile sector, enabling better accountability and transparency.
3. Collaboration with academia and research institutions to develop innovative curricula and solutions for sustainable CTA.

The existing policies are not explicit on skills and capacity creation to adopt sustainable technologies and practices in the textile sector. Therefore, there is a need to invest in research and development to explore innovative, eco-friendly production methods and materials (e.g., chemical recycling of textiles). In addition, collaboration with academic institutions and international partners is needed to establish centers of excellence for sustainable textile innovation.

vii.3.2.5 Other interventions for a sustainable textile and apparel industry in Kenya

1. Energy-based interventions

In the textile and apparel sector, energy costs constitute a significant percentage (20 -30%) of the total production costs depending on the installed manufacturing facilities. Kenya has prioritized renewable energy generation, with 89.6% of its total electricity generation coming from renewable sources (International Trade Administration, 2024). Kenya is a leader of green growth (renewable energy) in Sub-Sahara Africa, and therefore can effectively respond to the changing EU textiles market. Since the majority of textiles in the EU are imported, businesses in producing countries need to comply with the evolving requirements of the EU market. A booming textiles and apparel sector in Kenya could

Co-funded by the European Union

position itself as a frontrunner in the field of sustainable and circular textiles (Revolve, 2022).

The KAM in conjunction with the Ministry of Energy and Petroleum Development established the Centre for Energy Efficiency and Conservation (CEEC) in 2006. The Centre runs energy efficiency and conservation programs designed to help industries identify energy wastage, determine saving potential and give recommendations on measures to be implemented. The Centre provides professional technical services for developing, designing and implementing energy efficiency projects to suit the needs of commercial, institutional and industrial consumers, therefore reducing costs thus enhance competitiveness and profitability while promoting a clean and healthy environment [Behman G., 2024]

Energy Audits – the CEEC offers subsidized energy auditing services with the support from the government of Kenya (Ministry of Energy and Petroleum Development) and the Danish International Development Agency (DANIDA). The Centre runs an energy audit program which is open to all companies doing business in Kenya interested in reducing their energy consumption. Through this initiative, industries have recorded savings of up to 20% of their energy budget [Behman G., 2024].

Specialized Training - The CEEC offers energy related training at subsidized fees. The training programs cover a wide scope of courses with practical approaches to energy management by offering hands-on approaches to assist industries successfully implement energy management programs in the current energy scenario. These trainings ensure sustained reduction in energy consumption and cost savings [Behman G., 2011].

Moreover, the Kenyan government vision 2030 has a provision for increased education and training under Technical, Vocational Education, and Training (TVET) through improved infrastructure and equipment. The textiles and clothing programs are among the supported programs meant to give a skilled workforce for the industry, leading to a sustainable, innovative textile and apparel industry through research and technical expertise (Valarie N. 2022).

Digitization and high-speed ICT infrastructure - Kenya has a well-established, efficient and cost-effective optical fibre broadband network connecting all major centers. Fibre to the Premises (FttP) services are widely available ensuring excellent connectivity to customers and suppliers internationally. In the current national government dispensation, it has a dedicated Ministry of ICT and Digital Economy that ensures continuity and sustainability [Ministry of Information, Communication and Digital Economy, 2022]. These offer opportunities for globalization and advancement of technologies in the production, manufacturing, research and marketing domains.

Co-funded by the European Union

To support the cotton sector, the Kenyan government has validated the Better Cotton Initiative (BCI). The BCI initiative aims to improve the quality of cotton production by linking national public and private institutions involved in the Kenyan cotton sector that is meant to identify priorities in the cotton value chain while promoting better cotton production (Geraldine J., 2023). For example, there has been adoption of chemical recycling technology, developed by a U.S.-based company, PurFi, aiding the recycling of textile waste into high-quality products that can be reused in new manufacturing, which has enabled sorting and processing of 36,000 kg of cotton waste per month (Ian, 2022).

In addition, the Kenyan government established a Cotton Investment Fund whose capital is contained in a levy from the used textiles imports and is intended to support price stabilization for cotton seeds to caution the farmers from price fluctuations, fund certified seed production, refurbish ginneries, and provide funds to buy seed cotton from farmers (African Cotton and Textile Federation, 2013). Furthermore, the government has also partnered with other companies and organizations like Base Titanium, Cotton on Group, the Australian Government, and Business for Development to promote ethical cotton production by building sustainable cotton projects in Kwale County. This has equipped smallholder farmers with the necessary skills and training to produce high-quality cotton for the export market (Geraldine J., 2023).

Through the Export Processing Zone Authority (EPZA), the Kenya government is engaging private partners to manage the textile waste that is being generated in these zones where 450 new production lines are being developed, which will lead to more post-production waste, thus enabling the recycling of post-production waste. Additionally, the partnership is integrating the supply chain where the supply chain partners have signed sourcing agreements with waste management companies and manufacturers in Kenya, leading to traceability of production waste throughout the supply chain (Ian, 2022).

Furthermore, the legal framework on importation and trade of second-hand/used clothes in Kenya has undergone several changes after the ban in the 1960s to early 1980s, with the then restrictions eased in the mid-1980s. Even though there is no express statutory framework specifically regulating the trade of used clothes in Kenya today, regulation of the trade is implied under both regional and domestic laws on trade. Such trade laws include the East African Community Customs Management Act; acts of Parliament in Kenya under the Customs and Excise Act (2004, revised in 2009) providing the specific rates to be imposed on different categories of goods, including textiles and textile articles; as well as the Standards Act, CAP 496 of the Laws of Kenya with provision for the examination and testing of all goods and commodities traded for public consumption (Institute of Economic Affairs, 2019).

Co-funded by the European Union

To support local industries and limit the import of used textiles, there is an ongoing initiative by the Government of "Buy Kenya, Build Kenya". This initiative is meant to support domestic sourcing where the Ministry of Trade and Industry is advancing the presidential agenda of promoting domestic reliance (import substitution), initiated and propagated under the Big Four Agenda and BETA, respectively. The Ministry has used its regulatory authority to limit imports with the concern of public health as a result of imported used clothes into Kenya (Institute of Economic Affairs, 2019). Hence, during the outbreak of the COVID-19 virus, the Kenyan government under the Ministry of Industrialization, Trade, and Enterprise Development (2020) in reference to the Kenya Bureau of Standards (KEBS) outlined the protocol meant to provide the best practices on the importation and sale of used textiles and used shoes and how the supply chain operators conduct their operations while ensuring the health and safety of the sellers, importers, wholesalers, and buyers. These protocols outline the requirements for used textiles and shoes, responsibilities, and obligations of wholesalers, retailers, and buyers of used textiles and shoes.

2. Conclusion

Though there is not a single textiles and apparel value chain policy in Kenya, the segments of the value chain have been regulated independent of each other, often in response to external market requirements based on different available and relevant policies. However, the launch of Kenya's Vision 2030 with the textile sector prioritized as a flagship and important contributor to the central economic pillar, and the government policy directives on secondhand clothing and domestic sourcing, are key for a sustainable textile and clothing industry in Kenya. The Kenyan government has been instrumental in initiating industrial-oriented policies influencing the textile and clothing industry through the Ministry of Trade, which is keen on import substitution strategy and the presidential agenda for domestic manufacturing and focus on the economic value of the industry; the Ministry of Health, which is concerned about the health of Kenyans, thus signals the Ministry of Trade and imposes a standard of care and precautionary measures on consumable goods; the Kenyan Parliament, which responds to the regulatory intent of the executive arm of government; and the Kenya Revenue Authority, which influences revenue collection from textiles trade. All these policy interventions have supported the awakening of the Kenyan textile and apparel industry. However, there has been duplication of efforts and uncoordinated interventions, resulting in limited impact. Hence, National CTA Policy has given a comprehensive approach and preferable path towards a sustainable textile and apparel value chain.

Other main industry and government-related agencies with a role in policy development for the textile and clothing industry include the Kenya Export Promotion and Branding

Co-funded by the European Union

Agency, Export Processing Zone Authority (EPZA), Cotton Development Authority (CODA) that has since been replaced by the Fibre Crops Directorate (established under the Agriculture and Food Authority Act of 2013), and Kenya Association of Manufacturers. All the efforts of these institutions are geared towards meeting the Sustainable Development Goals (SDGs) of the textile and apparel industry.

3.3 State of the textile industry in Ethiopia

viii. 3.3.1 Introduction

The textile and apparel industries are significant for the least developed nations because they serve as a link in the process of moving the nation's economy from resource-based to process-based development. Furthermore, the textile and apparel sector may help nations expand economically quickly by producing export goods and create millions of job opportunities. By 2025, the worldwide commerce in textile and clothing items is predicted to surpass $1 trillion. Products from the textile industry alone make up 28% of the worldwide textile and apparel market share, with fiber products accounting for 6%, yarn for 3% and fabric goods for 19%.

The textile industry's range of goods consists of fabric, yarn, and fiber. Man-made fibers, which are classified as synthetic and regenerated fibers, are one of the output of the textile industry. Natural fibers, the products of agricultural goods including cotton and other raw materials are used in the textile industry to make yarns and fabric goods that are produced. Although synthetic fibers are less breathable and biodegradable than natural fibers, they are often stronger, more resilient, and less costly.

Thus, in the textile and apparel value chain, the textile industry connects agricultural output to the apparel industry and fashion industry. It is crucial for the sector to establish both forward and backward links in the value chain. The textile industry's nature makes it significant for nations with an agricultural economy that aspire to transition to a manufacturing one. In light of this, Ethiopia as a country deliberately embraced agriculture-led industrialization prior to two decades of embracing labor-intensive industrial growth models of the Asian nations, giving priority to textile apparel sector industry development. Currently, cotton is the primary raw- material used in Ethiopia's textile industry, while blends of polyester and cotton have lately been practiced in the country’s textile production processes.

ix. 3.3.2 The Ethiopia's Textile Industry Scenario

Ethiopia's socioeconomic status now places it in the list of least developed nations. Accordingly, Ethiopia has recognized and prioritized the textile and apparel manufacturing

Co-funded by the European Union

sector as a crucial area for economic development and reduction of poverty over the past 20 years.

1. Textile Industry Establishment and Development in Ethiopia

Ethiopia's textile manufacturing history began in 1939 when the Dire Dawa Textile Industry was established in the country's eastern region (Ethiopian Textile Industry Development Institute, 2018). According to data from Ethiopia, the textile and clothing sector has expanded by 51% on average over the past ten years. Around 65 international textile investment projects have been granted licenses for foreign investors during this time. There are 52 textile and 176 clothing industries at the moment. As a result, the country earned $126 million from textile and apparel product export in 2021 (https://newbusinessethiopia.com). Currently, the nation's textile and apparel sectors employ about 80,000 workers. The Ethiopian textile industry is dependent on cotton as an essential natural textile fibre source and thus significantly impacts sustainability and the circular economy in the textile sector manufacturing in Ethiopia.

2. Cotton production and Development in Ethiopia

More than 500,000 households in Ethiopia make their living from the cotton sector. The complete cotton value chain (CVC) provides 60% of the domestic textile industry's needs and adds 0.55% to the agricultural GDP and 0.18% to the national GDP. Ethiopia's CVC chain consists of the textile, agricultural, and edible oil processing industries; the latter are byproducts of manufacturing of cotton. Accordingly, the main participants in CVC include producers of edible oils, wholesalers, retailers, cotton farmers, merchants, ginners, and textile manufacturers. Farmers in the CVC are mostly disadvantaged when selling lint and seed cotton due to lack of incentives, for competitive prices, and provision of high-quality planting seeds.

The ginners in the CVC face challenges because of antiquated technology, underutilized operations, a shortage of skilled workers, and precarious agreements with farmers. They thus create lint, which raises the price of producing it accordingly. Similar issues with outdated and archaic machinery, a lack of market expertise, underutilization of existing capacity, and strained seller-buyer relationships plague the textile industry in the CVC.

Cotton farming in Ethiopia is classified into: small-scale, medium-scale, and large-scale. Cotton cultivated by small-scale farmers is transported to the market via intermediaries. A small number of large and medium-sized farms control the majority (70%) of seed cotton production. The majority of them use irrigation and limited crop rotation, both of which have an adverse effect on soil fertility.

Co-funded by the European Union

Less than 10 years ago, the nation's cotton lint could not be processed by spinning mills; however, in the last decade, demand has increased, especially from international brands, forcing textile manufacturers to import(European Commission, 2021). Due to poor agricultural practices and high production costs occasioned by expensive inputs (fertilizer, seeds, and pesticides), Ethiopia's ability to produce cotton is severely constrained.

3. Biotechnology Cotton Cultivation and Its Practices in Ethiopia

The growing need for cotton lint in the textile sectors cannot be satisfied by depending only on conventional plant breeding and pest control techniques. To improve the cotton production system, it is important to investigate ecologically friendly alternative technologies and management techniques. As a result, the cotton breeding program has undergone a revolution due to the recent developments in biotechnology, which has made it possible to use genetic resources more effectively (Maqbool A, Abbas W, Rao AQ, Irfan M, Zahur M, Bakhsh A, Riazuddin S, Husnain T, 2010). Utilizing contemporary biotechnology methods, including genetic engineering, molecular markers, high-throughput phenol typing, and genomic selection, has been essential in creating cotton cultivars with desired traits (Ma Z et al ,2018). In this regard, the application of biotechnology via recombinant DNA technology and molecular breeding holds promise for improving significant economic characteristics of cotton.

Currently, the adoption of genetically modified cotton, specifically designed to address various production challenges, particularly insect and herbicide tolerance, is increasing worldwide. In Ethiopia, cotton accounts for approximately 65% of the total pesticide purchase (Abate T,1997). Specifically, in the case of cotton, the two traits, Bt cotton (named after Bacillus thuringiensis) and herbicide-tolerant cotton (HT-cotton), serve as effective alternatives for controlling pest and weed issues that often plague cotton production. As a result, this technology keeps farmers safe from harmful chemical exposure, ensures environmental safety, and maximizes potential economic gains by reducing pest infestation during the early boll formation stage and minimizing pesticide expenses.

This raises concerns about the future production of cotton under the current circumstances, as similar cases of resistance are likely to occur. Therefore, exploring alternative options and investing in demand-driven, high-tech cotton technologies can help Ethiopian farmer’s lead sustainable lives and secure their basic needs. In this regard, Bt cotton, named after Bacillus thuringiensis, which provides resistance to H. armigera in cotton, is considered as a viable alternative to address the current challenges in cotton production caused by this pest.

Co-funded by the European Union

In the years 2015/16, two Bt cotton varieties, namely JKCH-1947 and JKCH-1050, underwent two years of confined field trials and received official approval for commercial release in 2018. However, it has not been formally reported if these cotton cultivars are in the production stage or not. These hybrids demonstrated superior yield performance and reduced yield losses from bollworm damage. Furthermore, the cry protein gene, which is effectively expressed and protects against bollworms, provides an additional advantage by significantly reducing the need for chemical sprays compared to non-Bt cotton varieties. This suggests that the utilization of these two Bt cotton varieties improves efficiency and excellence in the cotton industry of Ethiopia.

Co-funded by the European Union

4. Adapting Sustainable Cotton Production Practices in Ethiopia

Recently , manufacturers are urged to use sustainable cotton by textile suppliers. The most well-known brands for sustainable cotton are Organic, Better Cotton Initiative (BCI), Cotton Made in Africa (CmiA), Fair-trade, My Best Management Practices (MyBMP), and Committee on Sustainability Assessment (ABR). The sustainability certifications that have been implemented in Ethiopia include CmiA, BCI, and Organic.

Conventional cotton cultivation uses 6.2% of all pesticides used globally and accounts for 14.1% of insecticide sales, even though cotton only makes up 2.5% of total crop production (PAN UK ,2016). Inappropriate application, and overuse of particularly dangerous pesticides can have a significant impact on ecosystems as well as the well-being of farmers and their communities. Deforestation and land expansion have a negative effect on the ecosystem by reducing biodiversity and creating soil erosion and pollution. For 73% of cotton farms globally, irrigation is essential; However, this leads to significant water consumption (depletion), water pollution (pesticide, fertilizer, etc.), and salinity.

Furthermore, a number of disasters related to cotton farming or processing gi ve rise to the idea of sustainable cotton production. Certain sustainability certifications are developed by major manufacturers and merchants that want to protect their brand from possible adverse circumstances. The majority of sustainability certificates encourage, among other things, more equal profit distribution, more ethical treatment of employees, and ecologically sustainable operations. In the end, this would encourage customers to buy apparel made in a more ethical manner (SOFRECO, 2016).

As a result, sustainable cotton offers an innovative approach that can successfully address the various socioeconomic and environmental problems associated with conventional cotton cultivation. Despite long-term ecological constraints and socioeconomic demands, it may also sustain the livelihoods of communities and farmers. In 2020, over 23% of total cotton production utilized more sustainable techniques (BCI,2020). However, only 25% of the supply is actively procured by businesses, while the remaining 75% is traded as conventional cotton (SCR, 2020). Table 3.3.1. displays the globally produced sustainable cotton from various initiatives.

Co-funded by the European Union

Table 3.3.1: The sustainable cotton produced in 2020/21 production season

Types of initiatives	Year of production	Quantity of production (Metric ton)
CmiA	2020/21	690,000
MyBMP	2020	31,000
ABR	2020	832,000
BCI	2020	6,000,000
Faire trade	2020/21-	2,334,000
Organic label	2020/21	112,000

Africa's textile sector is expanding, and most significantly, the Ethiopian government has developed a 15-year plan that calls for the progressive phase-out of traditional cotton between 2018 and 2032. Sustainable cotton manufacturing is a necessary factor of the National Cotton Development Strategy of Ethiopia NCDS (SOFRECO, 2017). NCDS strongly encouraged the manufacturing of identification cottons (organic, BCI, and CmiA) and enlarged cotton exports to primary markets.

Ethiopian cotton producers, ginners, and exporters organization collaborated with the Aid by Trade Foundation (owner of the CmiA standard) to promote CmiA sustainable cotton production in the 2014 production season. It was active in the Ethiopian districts of Metema and Quara (now West Gondar Zone) until 2019. Following training and workshops, farmers' and Extension Agents' understanding of and support for sustainable cotton cultivation grew.

Good agronomic practice (GAP), integrated pest management (IPM), fiber quality training, social issues, health and safety issues, biodiversity and forest issues, and soil and water conservation issues have all been effectively addressed with CmiA. The CmiA's sustainable cotton production approach and Ethiopia's Extension system worked well together. Farmers achieved 89% sustainability, according to an assessment conducted in August 2022, by the International Trade Center (ITC) program (https://www.sustainabilitymap.org/). However, in addition to the CmiA need of a trusted management body in Ethiopia, third-party verification became impractical because of COVID-19 and the security problems in that region of the nation.

PAN Ethiopia has supported the organic cotton cooperative in its efforts to reduce the negative effects of chemical pesticides and fertilizers. PAN assists the cooperative by providing better seed and technical assistance for improving soil fertility and implementing IPM, which includes encouraging the activity of beneficial insects with plant protection, food sprays and other bio pesticides such as neem extract. In contrast to other nations where organic farmers receive higher prices, organic producers in this nation receive the same compensation as nearby conventional growers. Around 200 farmers from the Shelemela cooperative in the Gamo Zone, South Nationalities, and Nations People

Co-funded by the European Union

Regional States' Arba Minch Zuria region have begun. Persuading new farmers proved to be quite challenging and both the number of farmers and production had stagnated. According to Oko-Institut e.V., the cooperative has been certified organic since 2017 and generates 176 tons of lint annually (Oko-Institut e.V ,2018).

Since 2015, Ethiopian producers have been exploring implementing BCI. Ethiopia's government commercial cotton farms, corporations, and non-governmental organizations (NGOs) have all worked together to boost BCI adoption. It originates from the fact that BCI allows large-scale cotton producers, irrigation, and GMO cotton seeds, whereas CmiA restricts farms larger than 20 ha, irrigation, and GMO cotton seeds. In 2016, a research conducted by Solidaridad and ECPGEA established a compelling rationale for the use of BCI alongside CmiA in Ethiopia. With amazing results, Solidaridad has been helping pilot farms in Afar and Tigray, which together grow cotton on 5,000 hectares, implement BCI principles. An internal evaluation that used the ITC tool (https://www.sustainabilitymap.org/) found that funded farms meet or above BCI guidelines by over 90%. However, because Ethiopia is not a BCI member, third-party certification and verification are not feasible. Therefore, in order to get Ethiopia recognized as a BCI nation, the Ethiopian government, brands, commercial cotton farms, non-governmental organizations (NGOs), and other partners need to put in a lot of effort.

5. Spinning Unit Textile Industry in Ethiopia

In Ethiopia, eight independent spinning industries generate around 357.3 tons of open-end, rings, and combed yarn daily. Furthermore, seven integrated textile industries and 19 semi-integrated textile industries also include spinning unit of textile (Textile and Clothing Value Chain Roadmap 2016-2020, 2016). The quality of cotton determines the quality of yarn, and it has been noted that Ethiopian cotton contains large volumes of trash and waste, which has a major impact on the spinning and ginning processes. Consequently, it results in a poor classification process and higher working capital expenses for spinners and ginners to handle cotton waste.

Sourcing cotton locally is a major issue; due to high prices, low quality (due to contaminations) and insufficient supply and thus also needs to be imported. The trade situation presents the paradox of having a cotton producing country with a large untapped potential that imports continuously over 70,000 tons in 2020 (European Commission, 2021). This trend constitutes a major setback compared with the original objective of the previous Ministry of Agriculture and Rural Development (MoA) which planned to increase the cultivated land of cotton to 125,000 hectare and produce 107,000 tons of cotton since 2015.

The national cotton production covers about 60% of the in-country needs and demand for the textile industry. The local cotton quality may appear as another issue regarding textile

Co-funded by the European Union

production, since it is contaminated during harvesting, transportation, storage and even in packaging. The majority of Ethiopian cotton production is not certified and international production standards do not apply to the domestic production. The spinning unit of the textile industry produces a very limited count of yarn, which is used for limited type's fabric production.

6. Fabric Production Situation in Ethiopia

The country's annual fabric production is estimated at 207 million meters of woven fabric and 50 million kg of knitted fabric. Despite this impressive data, capacity utilization remains unsatisfactory with only 50% which means that profitability is limited. Low revenues may have a direct impact on wages, and also on technology acquisition. Most of the textile sector uses old or obsolete machinery. Most of the fabric production is devoted to domestic garment production (bed sheet, working cloth etc..,). Ethiopian stand-alone textile producers do not offer up-to standard fabrics in terms of quality and delivery time. However, domestic fabric production may acknowledge a significant transformation with the emergence of the Industrial Parks and FDI in the production capacities.

Ethiopia's textile sector is now unable to meet the country's apparel industry's need for the fabric. Consequently, the country's apparel industry mostly imports the materials needed to make clothing for the domestic and international markets. Furthermore, the domestic textile industry that produces inputs offers a restricted selection of low-quality accessories. And hence most of the clothing accessories are imported and this can be perceived as a price disadvantage compared with most of its competitors in Asia more particularly, who benefit from a dense industrial landscape and technical knowledge. In general Ethiopia has limited availability of locally produced fabrics, trims or usable cotton that need to be imported from countries like China, India, Turkey and Pakistan. This increases the lead-time of the ready-made cloth products.

Such constraints affect the flexibility with which Ethiopian producers can respond to buyer demands. Importing inputs could take weeks or months. Despite the influx of FDI and the need for accessories within the growing clothing industry sector, there was no major investment in input industries until now. Buyers ask for fabric and accessories from outside of the country, but customs clearance takes a long time. Import of yarn, fabric spare parts and chemicals is similarly affected. Ethiopia often lacks locally made fabrics, trimmings, or usable cotton; instead, items must be imported from nations like China, India, Turkey, and Pakistan. This lengthens the ready-made items' lead time. The high cost of raw materials is a significant barrier to industrial expansion in the absence of vertical integration.

7. Backward Linkage Challenges of Textile Industry in Ethiopia

Co-funded by the European Union

Getting input like fiber and accessories (spare parts) into Ethiopia proves difficult. Sourcing cotton locally is a major issue; due to high prices, low quality (due to contaminations) and insufficient supply and thus also needs to be imported. The local cotton quality may appear as another issue regarding textile production, since it is contaminated during harvesting, transportation, storage and even in packaging.

8. Employee Related Challenges in Ethiopian Textile Industry

Manufacturing at high speed is crucial within the global competitiveness of the apparel industry. Especially locally owned factories in Ethiopia have a lack of knowledge on how to maximize production efficiency. Efficiency levels around 70% could be considered above average in Ethiopia. Employee attrition is a problem in the textile and clothing industry, with a high rate of turnover. In some textile and clothing industries absenteeism rate accounted for 23%. On the other hand, finding skilled workers that will stay in the industry is a biggest issue. Most workers have an agricultural background; there is no industrial work culture.

The textile and clothing industry needs to be well managed, if the management doesn't understand what he/she is doing there, and then the industry will not be competitive at global level. The management has to work on continuous improvement of the workforce through training both on hard and soft skills. Without a training center or government assistance, there was no coordination, and every industry conducted its own training. Lower salaries have both advantages and disadvantages. On the one hand, they draw foreign direct investment (FDI), while on the other; they lead to staff turnover and attrition. Ethiopian textile and clothing workers must be paid a minimum wage in order to address labor-related issues. Ethiopian textile and clothing workers must be paid a minimum wage in order to address labor-related issues. A complex situation with a negative feedback loop occurs when employees leave due to the pay and working conditions, employers blame low productivity and a high attrition rate for the wages they offer, and workers with the necessary skills and knowledge move to another lucrative industry in order to increase their pay.

In general, the textile and clothing industry frequently faces issues with logistics, inadequate local management capabilities, and workers' lack of technical skills and awareness of their rights. The issues facing Ethiopia's textile and clothing industry sector include high absenteeism and attrition rates, a lack of collective bargaining and worker representation, no public health care or public transportation, and inefficient methods to stop sexual harassment and discrimination at work. Because the value chain players of manufacturers, importers, and retailers depend heavily on labor stability in the textile and

The measures that need to be taken to increase efficiency in factories as: training of factory management (about planning and putting operators on jobs that match their talents e.g.

Co-funded by the European Union

using a skill matrix); hiring experienced foreign consultants or management staff to professionalize the workforce including to Ethiopian owned factories; training on enhancing productivity and efficiency includes; workers training on technical as well as soft skills, measuring productivity per worker, performance related payments per line as well as per individual worker, rights and responsibilities of the worker, investing in automation.

Low wages can be compensated with different incentive mechanisms arranged both by the factor owners and the government, particularly for industries partly or fully engaged in export oriented production. Additionally the government has employed and assigned an extension worker for textile and clothing industries engaged in export-oriented factories for the purpose of arranging and implementing continuous training and coaching the workers for they cope up with industrial working culture and ever improving efficiency through time.

9. Overall Textile industry Development Situation in Ethiopia

The nation's textile and apparel industry sector has developed slowly during the past 20 years, despite the immense opportunities the country has for the sector industry development. In this context, 13 public industrial parks have been set up around the nation, together with over 176 clothing industries and over 54 private independent, semi-integrated, and fully integrated textile enterprises. Over time, the sector's assets from both domestic and foreign direct investment (FDI) increased in terms of both industrial establishment and production. As a result, the nation's exports of textiles and apparel generated $126 million in 2021 (https://newbusinessethiopia.com), creating over 80,000 new jobs.

3.4 Regulatory landscape for sustainable practices in the textile industry in Ethiopia

Like numerous vulnerable nations, Ethiopia encounters considerable developmental obstacles stemming from the effects of climate change. In light of these challenges, the country implemented the Climate-Resilient Green Economy Strategy in 2011, which emphasizes the importance of continuous economic growth while simultaneously addressing climate resilience and sustainable development. The strategy is designed to fulfill three primary objectives: fostering ongoing economic advancement, curtailing greenhouse gas emissions, and bolstering climate resilience to mitigate the adverse impacts of climate change on both human populations and the environment. As part of its aspiration to attain middle-income status by 2030, Ethiopia has prioritized agriculture as a pivotal element in driving industrialization and overall economic progress.

The regulatory landscape for sustainable practices in the Ethiopian textile industry is evolving, driven by both domestic and international pressures. National regulatory frameworks for sustainability encompass the legal structures and guidelines established

Co-funded by the European Union

within a country to foster environmental conservation, social accountability, and economic development.

3.4.1. Environmental Regulations

The Ethiopian Environmental Protection Authority (EPA) serves as the federal agency responsible for overseeing environmental management in Ethiopia. Its mandate includes the promotion and protection of environmental goals, objectives, and fundamental principles outlined in the constitution. This body focuses on the following activities:

Emission control: targets regulating water and air pollution from the textile industry. This sets limits and targets on the emission of pollutants and hazardous chemicals. Additionally, the factory facilities are furnished with facilities for the treatment of these pollutants. Besides, building wastewater treatment and its capacity for the removal of chemicals before discharge is mandatory.

Resource conservation: encourages or mandates efficient water usage and recycling, promotes the use of renewable energy improves energy efficiency, and incentivizes or mandates reduction, reuse, and recycling of textile wastes.

Chemical restrictions: Ethiopia has banned the import of several hazardous chemicals aligned with international agreements like the Stockholm Convention on persistent organic pollutants (POPs). Accordingly Azo dyes, heavy metals (lead, mercury, cadmium, etc..,) formaldehyde, phthalates, perfluorinated compounds tetrachloroethylene, etc., and limiting the usage of some chemicals.

3.4.2. Social and labor regulations

These are legal frameworks that government employment, industrial relations, and social policies, which work focusing on the following issues. Additionally, laws that protect consumers from unfair practices and promote fairer markets. This mainly focuses on product labeling and product safety standards.

Workers safety and health: address workplace safety hazards, occupational health risks (exposure to chemicals), and fair labor practices including minimum wage laws, maximum working hours, prohibitions on child labor and forced labor.

Product labeling: this insists on providing clear and accurate labeling of textile products, including fiber content, care instruction, and country of origin.

Product safety standards: set safety standards for textile products to protect consumers from hazards like flammability, chemical residues, and harmful chemicals (dyes).

International Labor Organization (ILO): Ethiopia is a member of the ILO and is expected to comply with its core labor standards, which include rights to organize collective bargaining,

Co-funded by the European Union

and safe working conditions. ILO plays a significant role in promoting decent work and improving conditions in Ethiopia. The ILO and its tripartite constituents (government, employers, and workers) have developed a five-year Decent Work Country Programme to address the impact of COVID-19 and promote decent work in general. Mainly, the Decent Work Country program addresses improving industrial relations, meeting labor standards, and promoting investment and employment. ILO was involved in different projects focusing on occupational health and safety, addressing forced labor, eliminating child labor, and creating opportunities for vulnerable groups.

Ethical Trading Initiative (ETI): This initiative advocates for ethical and sustainable practices within global supply chains, particularly in the textile sector. Numerous international purchases mandate that their suppliers comply with the standards set forth by the ethical trading initiative (ETI). While ETI itself does not have a physical presence in Ethiopia, its principles and standards applied to businesses operating in the country such as the Forum for Ethical Trade in Ethiopia (FNET), promote and support the implementation of ethical trade principles. FNET works with businesses, trade unions, and civil society organizations to raise awareness, provide training, and conduct audits to ensure compliance with ethical standards.

3.4.3. Economic regulations

The investment proclamation in Ethiopia serves as a regulatory framework that oversees foreign direct investment (FDI) within the nation. It delineates the entitlement, responsibilities, and incentives available to foreign investors. The key features of this regulation are:

Openness to FDI: the regulation allows foreign investors to engage in most of the Ethiopian economy with some exceptions.

Investment incentives: the government stated different incentive schemes to attract FDI, including tax breaks, duty-free imports, and access to industrial parks.

Investment protection: the proclamation provides legal protections for FDI, including guarantees against expropriation without compensation.

Repatriation of profits: foreign investors are generally allowed to repatriate their profits and capital.

Global Reporting Initiative (GRI): is an autonomous international standards body that assists businesses, governmental entities, and various organizations in comprehending and articulating their effects on essential sustainability matters. Including climate change, human rights, corruption, and a range of other significant issues. In Ethiopia, there is growing interest in sustainability reporting, and the GRI Standards are becoming

Co-funded by the European Union

increasingly relevant. Some Ethiopian organizations are already using the GRI Standards to report on their sustainability performance.

3.4.4. New cotton development strategy (NCDS)

NCDS is a significant initiative in Ethiopia aimed at boosting cotton production and the textile industry. Launched in 2017, it sets ambitious goals for the next 15 years, aiming to make Ethiopia a major cotton producer. The main objective of this strategy focuses on enhancing cotton production, and competitiveness of the cotton sector and establishing the Ethiopian cotton authority to oversee implementation. The initiative aims to create jobs, reduce poverty, and increase foreign exchange earnings through cotton exports. Similar to these other initiatives are in action which are not government-le initiatives Better Cotton initiatives (BCI) and Solidaridad Better Mill initiatives.

Better Cotton Initiative (BCI): operates in Ethiopia, promoting sustainable cotton practices among farmers.

Solidaridad Better Mill initiative: focuses on improving labor conditions and environmental practices within the Ethiopian textile industry.

3.4.5. Challenges and Opportunities

Harmonization of Standards: The diverse range of regulations across countries can create challenges for businesses operating globally.

Enforcement and Monitoring: Effective enforcement of regulations is crucial to ensure compliance and drive meaningful change.

Innovation and Technology: Advancements in technology, such as blockchain and artificial intelligence, can improve traceability, transparency, and sustainability in the textile industry.

Consumer Engagement: Educating consumers about sustainable textile choices and empowering them to make informed decisions is essential.

Global Demand for Sustainable Products: The growing global demand for sustainable products presents an opportunity for Ethiopia to position itself as a responsible and ethical supplier.

3.5 State of the textile industry in Uganda

3.5.1 Introduction

Uganda's textile sector, once a prominent part of the nation's economy, has experienced significant transformation over the last six decades. This section explores its historical

Co-funded by the European Union

background, current sector players and the major challenges hampering the sector's performance to its full potential.

3.5.2 Historical overview

Uganda's textile industry can be traced back to the times when the country became a British protectorate in 1894. Cotton, introduced by the British colonial government in 1903, remains one of the country's top five cash crops. By 1930, the annual cotton production had reached 60,000 tons and was mainly consumed by the British textile industry.(Baffes, 2009)

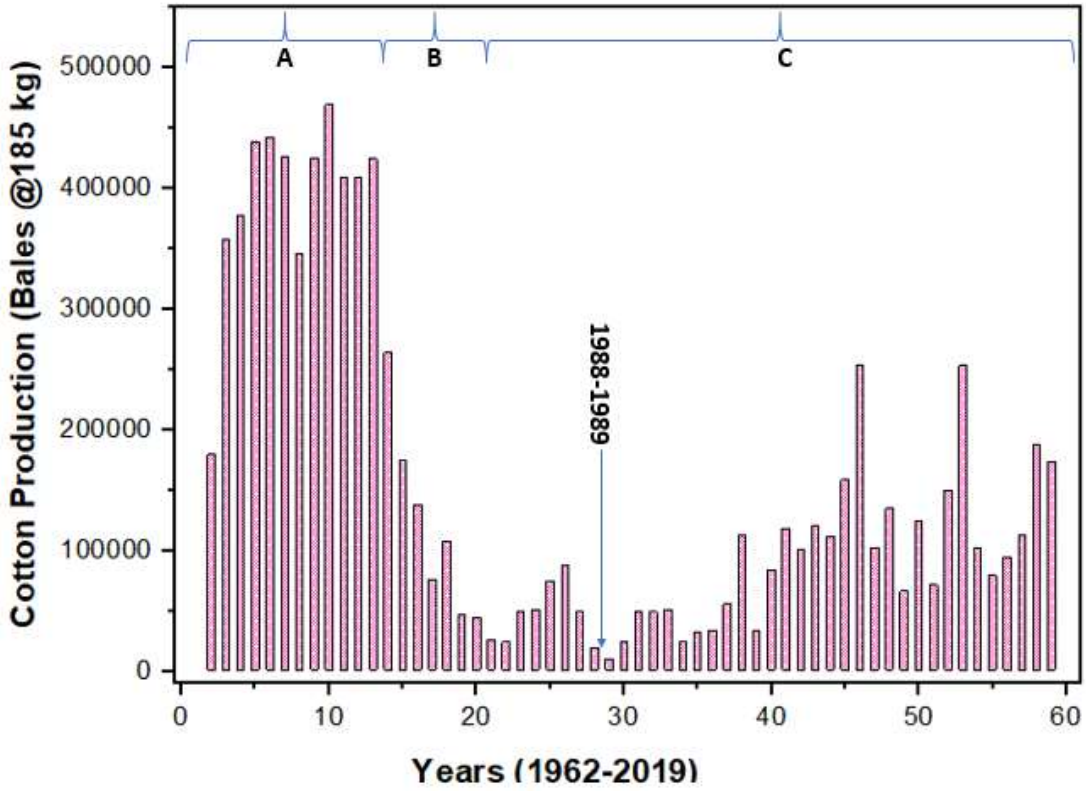

Figure 3.5.1: Cotton production in Uganda from 1962 – 2019. Regions "A" and "B" represent the peak and the onset of the decline in cotton production, respectively, while region "C" highlights the struggling cotton subsector's efforts to regain the production levels seen between 1962 – 1972. (Lugojja, 2017)

According to Uganda's National Textile Policy,(MTIC, 2018) the textile subsector began to take shape in the 1950s and 1960s. During this period, Nytil (now Southern Range Nyanza Textile Limited), the first vertically integrated textile mill, was established to promote value addition within the sector. The highest levels of cotton production were recorded in the decade following Uganda's independence in 1962. However, the subsector faced significant challenges beginning in 1972, primarily due to political instability, and

Co-funded by the European Union

continued to decline until 1987. By the 1988-1989 season, cotton production had plummeted to its lowest point, with only approximately 2,000 bales registered, Figure 3.5.1. This period was characterized by a neglect of research and extension services, inefficient processing, marketing and export monopolies, collapse of the ginning industry, poor management of cooperatives, a lack of production inputs as well as general insecurity in the country.

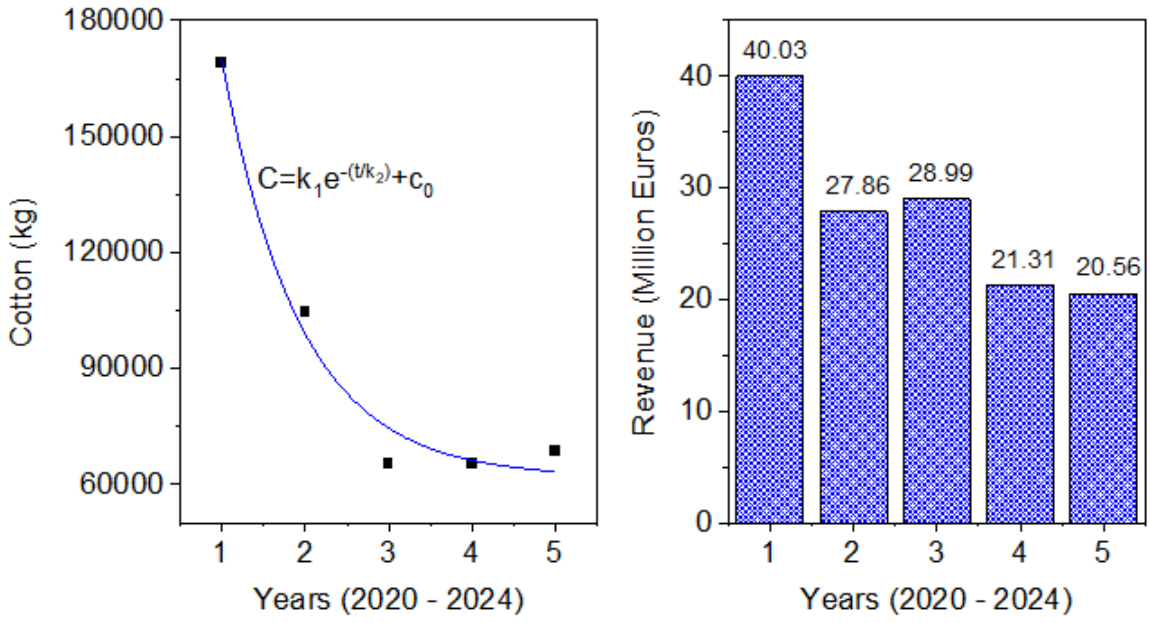

Figure 3.5.2: Cotton exports and earnings over the last 5 years: (a) Cotton exports reflecting 90% of the cotton produced in Uganda annually (b) Cotton export earnings

Following the establishment of the Cotton Development Organization (CDO) in 1994 to oversee cotton production in Uganda, several significant reforms were introduced to enhance the performance of the cotton subsector. These included the implementation of a cash-on-delivery payment system, expansion of ginning capacity, improvements in quality control, the training of technical personnel, and increased mechanization. Despite these efforts, achieving the production levels seen during the industry's peak in 1962 remains a significant challenge. In fact, Uganda's cotton exports to international markets have exponentially declined over the past five years, Figure 3.5.2(a). This decline can be attributed primarily to the government's shift in policy, which has encouraged a move from subsistence cotton farming, the major cotton contributor in the country, to commercial cotton farming. As a result, Uganda's export earnings from cotton remain relatively low, Figure 3.5.2 (b). (Nakaweesi, 2024)

3.5.3 Current market dynamics and key sector players

Co-funded by the European Union

The areas contributing to Uganda's textile sector are mainly six, that is, farming, ginneries, vertically integrated textile mills, small and medium-scale garment manufacturers, importers, and academic and research institutions (Figure 3.5.3). In addition to sericulture (silk farming), there are four main crops that contribute to the textile fiber base in Uganda: cotton, plantain (banana), pineapple, and sisal. Among these, cotton farming remains dominant. Over the last decade, approximately 250,000 household farmers have been directly involved in cotton cultivation, each capable of contributing one bale (185 kg of cotton) annually. There are about 22 operational ginneries in Uganda that directly purchase household seed cotton and further process it into lint (cotton fibers) and cotton seeds.

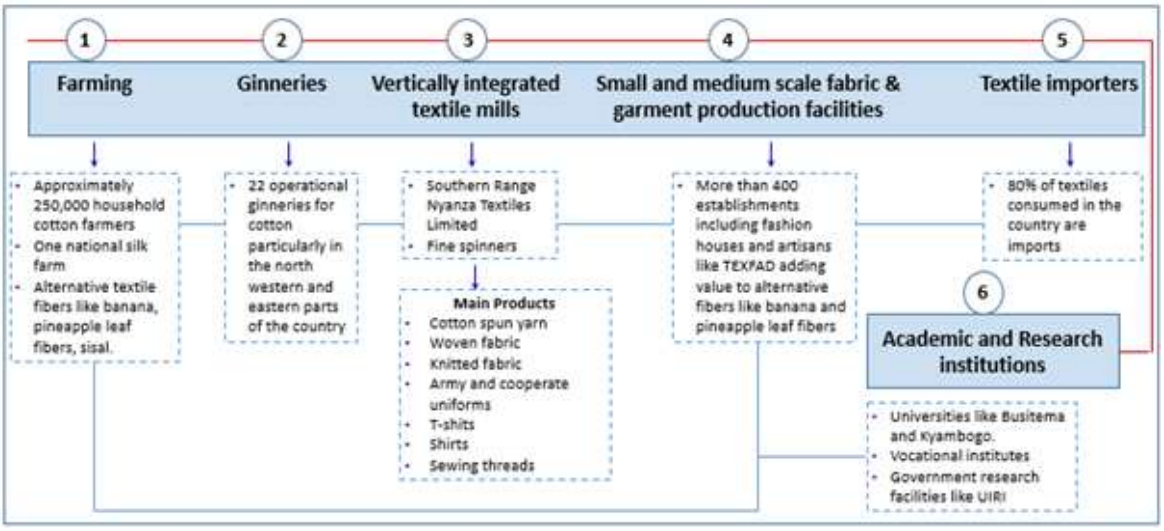

Figure 3.5.3: Textile sector players in Uganda.

Lint is sourced from local ginneries and used as the main raw material for the two operational textile mills - Southern Range Nyanza Textiles Limited and Fine Spinners Limited Uganda (Table 1). While these two vertically integrated textile mills use only 10% of the locally produced lint, the remaining 90% is exported raw (Martin Luther Oketch, 2023).

Table 3.5.1: Operational vertically integrated textile companies in Uganda.

Company	Installed capacity		Utilization Capacity	Products
	No. of spindles	Garments (pieces per month)		

Co-funded by the European Union

Southern range Nyanza Textiles Limited	11,000	More than 520,000	More than 61%	Knitted and woven fabric Garments
Fine spinners Uganda Limited	10,000	More than 384,000	More than 65%	Cotton spun yarn Sewing thread Knitted fabric and garments

In terms of revenue, the 90% of lint exports have generated an average annual turnover of 27.75 million euros over the last five years. In comparison, the total turnover for textile products generated from the 10% of lint that undergoes value addition domestically was estimated at 48.01 million euros per year—almost twice the amount Uganda earns from the export of raw cotton. This highlights the need to encourage domestic investment in value addition to locally produced lint in Uganda.

From Figure 3.5.4, Uganda's textile sector relies heavily on imports, with an annual turnover of approximately 220.87 million euros. Such a value well surpasses the country's sector exports by more than four fold. Uganda's textile imports come in the form of cheap textiles from Asia (notably China and India) and second-hand clothing, particularly from the United States and Europe. Nevertheless, a combination of imported and locally produced fabrics from the two vertically integrated textile mills supplies the necessary raw materials to Uganda's small and medium-sized enterprises (SMEs) in garment production. These more than 400 SMEs spread across the country mainly produce custom-made clothing for the local population, including corporate wear and school uniforms (Rupiny, 2021).

Co-funded by the European Union

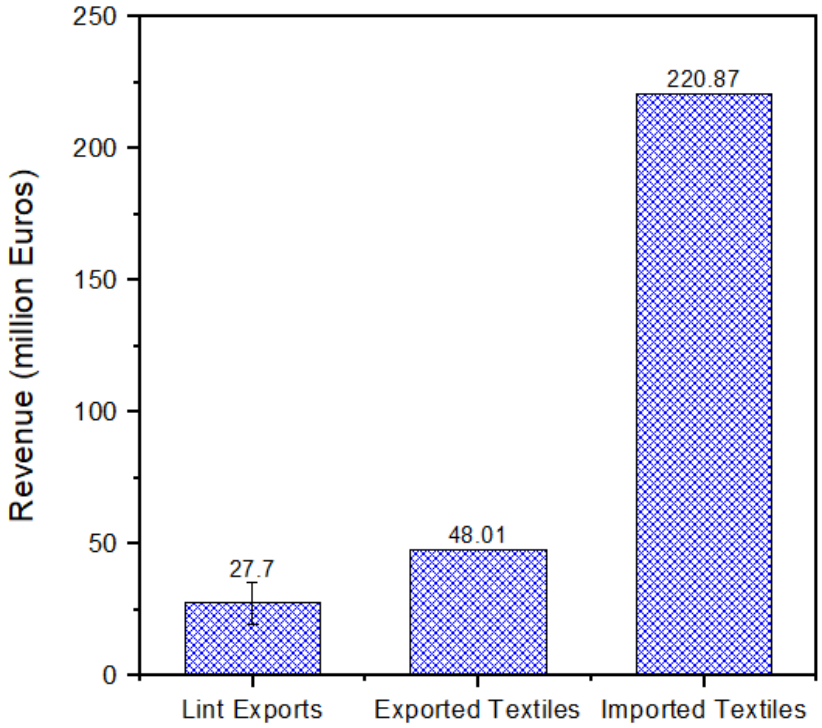

Figure 3.5.4: Comparison of Annual revenue generated from lint exports and textile exports versus the amount of money spent on importing textiles to Uganda.

3.5.4 Challenges Facing the Textile sector in Uganda

From the above discussion, it is evident that Uganda's textile sector is performing below her full capacity. To unlock her full potential, several challenges have to be overcome. These include;

- High cost and unstable power supply, thus limiting value addition and raising the cost of doing business locally. Ugandan electricity tariffs are the highest in the East African region, at approximately 0.11 Euros per kilowatt-hour (kWh). With increasing fuel prices, the cost of energy accounts for up to 20-30% of the total cost of production, particularly in mechanized operations, including ginning and spinning. Such deficiencies in power supply disrupt productivity for the already existing industries in the sector, increase production costs, and also discourage new investors in the sector who would have improved value addition on the locally available textile fiber base.
- Competition from second hand clothing and imported cheap textiles (fabric and garments). As already highlighted in Figure 3.5.3, more than 80% of textiles consumed in Uganda are imports from Asia, Europe and the United States. The influx of cheaper imported products and second-hand clothing has undercut the

Co-funded by the European Union

competitiveness of domestic textile manufacturers. With their limited purchasing power, many consumers are attracted to cheaper imported clothing, which sells at a discount of 25-30% below domestically produced textiles. As a result, many mills have cut production or closed. Counterfeits and second-hand clothing are also cheap substitutes for domestic textiles. More generally, many Ugandans perceive that domestically produced textiles are of lesser quality and, therefore, prefer imported ready-to-wear garments (Lugojja, 2017; Sumo et al., 2023; Wandera, 2021)

- Obsolete processing technology and dilapidated infrastructure. Most of the textile infrastructure in the Ugandan textile mills was built during colonial days or soon after independence and the technology is obsolete for a modern textile industry. In some cases, the focus was to produce lint as an intermediary product for the development of the textile sectors in importing countries. This situation has not changed much and requires redress.
- Predominance of household cotton production. The production of cotton in Uganda is characterized by small-holder producers. In most cases, farmer groups are not well organized and the organizational structures are weak. This aspect impacts capacity building for farmers and also their ability to adopt new technology. Due to weak organization, farmers have limited influence on policy decisions. Consequently, poor farming practices are characteristic among small-holder cotton farmers in the region. However, the Uganda government is now putting in efforts to discourage small scale farming and promote commercial cotton farming.

3.6 Regulatory landscape for sustainable practices in the textile industry in Uganda

Uganda's textile industry operates within a regulatory framework designed to promote sustainable practices, encompassing environmental protection, industrial development, and quality assurance. Key components of this framework include:

3.6.1. National Textile Policy (2009)

The National Textile Policy (2009) is a key part of Uganda's regulatory landscape for the textile industry, as it provides a strategic framework for developing and managing the sector in a sustainable and competitive manner. Formulated in 2009, the National Textile Policy aims to revitalize Uganda's textile sector by encouraging value addition to cotton and reducing reliance on imported textiles, particularly second-hand clothing. The policy emphasizes the development of local industries to enhance economic growth and sustainability. The policy outlines government interventions aimed at promoting value addition, environmental responsibility, and economic growth, aligning with global

Co-funded by the European Union

sustainability trends. However, its implementation has faced delays due to funding constraints and other challenges, hindering the industry's progress toward sustainability.

The National Textile Policy works alongside other regulations such as:

- **The National Environment Act (2019)** – Ensuring environmental compliance in textile production.
- **The Uganda National Bureau of Standards (UNBS) Act** – Regulating quality standards for textiles.
- **The Investment Code Act (2019)** – Attracting sustainable investments in the textile sector.
- **The National Industrial Policy (2008)** – Encouraging industrial development with sustainability measures.

The policy promotes sustainability in Uganda's textile sector through the following approaches:

1. **Encouraging local production and value addition**
    - The policy supports processing Ugandan-grown cotton into yarn, fabrics, and finished products instead of exporting raw cotton.
    - This reduces reliance on imported textiles and second-hand clothing, which contribute to textile waste.
    - It aligns with **circular economy principles** by maximizing the use of local materials.
2. **Environmental protection and pollution control**
    - The policy advocates for environmentally friendly textile production by enforcing sustainable manufacturing processes.
    - Industries are encouraged to adopt cleaner production technologies, such as water recycling, energy-efficient machinery, and eco-friendly dyes.
    - It aligns with NEMA's environmental regulations to reduce industrial pollution.
3. **Investment in research and innovation**

Co-funded by the European Union

- Promotes R&D in sustainable textiles, including banana fiber, organic cotton, and other eco-friendly materials.
- Supports partnerships with universities and research institutions to develop biodegradable fabrics and alternative fibers.
- Aligns with Uganda's Science, Technology, and Innovation policies for sustainable industrialization.

4. **Job creation and fair labour practices**
    - The policy promotes domestic textile production, which generates employment under regulated working conditions.
    - Encourages textile companies to comply with labor laws, ensuring fair wages, safe working environments, and gender inclusivity.
    - Supports capacity building and skills development in sustainable textile production.
5. **Trade policy and sustainable market access**
    - Proposes export incentives for Ugandan-made sustainable textiles.
    - Aligns with regional trade agreements (EAC, COMESA) to support eco-friendly textile trade.
    - Advocates for banning second-hand clothing imports, which disrupt local industries and contribute to waste.

Despite its sustainability goals, the policy faces challenges, including:

- Weak enforcement due to financial and administrative constraints.
- Limited investment in green textile technologies.
- Competition from imported textiles and second-hand clothing.
- Slow adoption of sustainable practices by local textile firms.

Experts have suggested some remedies, including: Strengthening regulatory enforcement and funding for sustainability programs, supporting public-private partnerships for green manufacturing, providing subsidies and incentives for eco-friendly textile production, promoting consumer awareness and sustainable fashion initiatives.

3.6.2. National Textiles Board Act (1974)

Co-funded by the European Union

The National Textiles Board Act established the National Textiles Board (NTB) to oversee the management and control of Uganda's textile industry. The Board's functions include promoting research, supervising textile companies, and advising the government on industry-related matters. While the Act was enacted before sustainability became a global priority, its regulatory function supports sustainable practices through industrial oversight, research promotion, and policy coordination.

While the Act provides a foundation for industry regulation, its effectiveness in enforcing sustainable practices has been limited.

The National Textiles Board Act supports sustainability in the textile industry through the following mechanisms:

1. Regulation and oversight of the Textile Sector. The NTB was mandated to monitor and regulate textile companies, ensuring compliance with government policies. Although enforcement has been weak in recent years, the Act provides a legal basis for regulating environmental and labour standards in textile production.
2. Promotion of local textile production. The Act was designed to support local cotton processing and textile manufacturing, reducing reliance on imported textiles and second-hand clothing. Encouraging domestic value addition aligns with sustainability by reducing the carbon footprint of textile imports and promoting local supply chains.
3. Encouraging Research and Development (R&D). The NTB was tasked with promoting research into textile production, which can be extended to sustainable innovations such as: Eco-friendly fibers (e.g., banana fiber, organic cotton), water-efficient dyeing techniques, recycling and waste management in textile production.
4. Industrial planning and policy coordination. The Act provides for long-term planning in the textile industry, ensuring that growth strategies incorporate sustainability. The NTB can work with agencies like the National Environment Management Authority (NEMA) and UNBS to enforce sustainable production standards.
5. Employment and fair labour practices. By fostering the growth of the local textile industry, the Act indirectly supports job creation under fair labour conditions. This contrasts with imported fast fashion and second-hand clothing, where labour conditions and environmental impacts are harder to regulate.

Despite its potential to promote sustainability, the National Textiles Board Act (1974) has faced several challenges:

Co-funded by the European Union

- The NTB has been largely inactive, limiting its ability to enforce sustainable practices.
- Weak coordination between the NTB and other regulatory bodies.
- Outdated provisions that do not directly address modern sustainability challenges.
- Lack of investment in green textile technologies due to weak enforcement of industrial policies.

Proponents have suggested that to enhance sustainability under the Act, the government should revive and strengthen the NTB to actively regulate and promote sustainable textile practices, update the Act to include explicit provisions on environmental sustainability, enhance coordination between the NTB, UNBS, NEMA, and investment authorities and support R&D funding for eco-friendly textiles and circular economy initiatives.

3.6.3. Uganda National Bureau of Standards (UNBS)

The Uganda National Bureau of Standards (UNBS) is a key part of Uganda's regulatory landscape for the textile industry. It is responsible for developing, enforcing, and certifying standards to ensure quality, public health, safety, and sustainability in manufacturing and trade. UNBS, under the Ministry of Trade, Industry and Cooperatives, UNBS plays a crucial role in promoting environmental sustainability, consumer protection, and industrial development.

UNBS operates under the UNBS Act (1983, amended 2013) and works in coordination with other regulatory bodies, including: The National Environment Management Authority (NEMA), The National Textile Policy (2009), The Investment Code Act (2019), The National Industrial Policy (2008).

UNBS contributes to sustainability in Uganda's textile sector through the following mechanisms:

1. Setting and enforcing textile standards

- UNBS establishes mandatory standards for textile products, ensuring they meet quality and safety requirements.
- It prevents the importation of substandard textiles, reducing textile waste and promoting sustainable consumption.
- The bureau enforces standards for eco-friendly materials, including organic fibers and biodegradable textiles.

2. Regulating hazardous substances in textiles

Co-funded by the European Union

- UNBS ensures compliance with standards on chemical use in textile manufacturing, including dyes and finishing agents.
- It restricts toxic substances such as formaldehyde, heavy metals, and azo dyes, which can harm the environment and human health.
- It works with NEMA to regulate the disposal of textile waste and chemical pollutants.

3. Promoting eco-friendly and sustainable textile production

- UNBS supports research and adoption of sustainable textile materials, such as banana fiber, organic cotton, and recycled polyester.
- It provides certification for eco-friendly products, helping Ugandan textile firms access international green markets.
- The bureau encourages energy-efficient production processes, reducing carbon emissions in the textile industry.

4. Supporting the ban on second-hand clothes and Fast Fashion waste

- UNBS works with the government to restrict the importation of second-hand clothing, which often contributes to textile waste and undermines local industries.
- By enforcing quality standards for locally produced textiles, UNBS helps boost domestic textile manufacturing as a sustainable alternative.

5. Consumer awareness and product labelling

- UNBS mandates proper textile labelling, including fiber content, care instructions, and eco-certifications.
- It promotes consumer education on sustainable textiles, encouraging Ugandans to choose long-lasting and environmentally friendly fabrics.
- The bureau collaborates with retailers and manufacturers to reduce counterfeit and low-quality textile imports.

6. Ensuring Fair Trade and ethical production

- UNBS monitors compliance with international labour and environmental standards, helping Uganda's textile industry align with global sustainability goals.
- It provides certification for exported textiles, ensuring they meet the standards required by international markets (e.g., the East African Community (EAC) Standards and ISO certifications).
- It encourages fair trade practices, ensuring that textile production respects worker rights and environmental regulations.

Co-funded by the European Union

Despite its critical role, UNBS faces challenges in enforcing sustainable practices in Uganda's textile industry:

- Limited resources for inspection and monitoring of textile factories.
- Weak enforcement of eco-friendly textile production standards.
- Low awareness among manufacturers and consumers about sustainable textile standards.
- Competition from imported textiles, making it difficult to regulate all textile products entering Uganda.

Proponents have suggested the following, to strengthen UNBS's role in promoting sustainability:

- Increase funding for monitoring and enforcement of textile standards.
- Enhance collaboration with textile industry stakeholders to implement green manufacturing practices.
- Promote public education campaigns on sustainable textile consumption.
- Support local textile producers with incentives for adopting eco-friendly production methods.

3.6.4. National Environment Management Authority (NEMA)

The National Environment Management Authority (NEMA) is a key regulatory body responsible for overseeing and enforcing environmental laws in Uganda, including those affecting the textile industry. Established under the National Environment Act (1995, revised 2019), NEMA ensures that textile manufacturers comply with environmental regulations, pollution control measures, and sustainable resource management practices. NEMA oversees environmental regulation in Uganda, ensuring that industries, including textiles, comply with environmental laws and standards. Reports have highlighted instances where textile industries have been implicated in polluting water bodies like Lake Victoria, underscoring the need for stringent enforcement of environmental regulations. NEMA operates under the Ministry of Water and Environment and works alongside other regulatory bodies to promote sustainable industrialization.

NEMA supports sustainability in the textile sector through various regulatory and enforcement mechanisms:

1. Regulating industrial pollution and waste management

- Monitors textile factories to ensure they comply with pollution control standards.

Co-funded by the European Union

- Enforces wastewater treatment requirements for textile manufacturers to prevent discharge of untreated dyes and chemicals into water bodies.
- Works with industries to promote clean production technologies, reducing air, water, and soil contamination.

2. Enforcing compliance with environmental impact assessments (EIAs)

- Requires all textile factories to conduct Environmental Impact Assessments (EIAs) before setting up operations.
- EIAs help identify and mitigate environmental risks associated with textile production, such as water pollution, chemical waste, and deforestation.
- Ensures textile companies adhere to sustainable land-use practices and do not disrupt fragile ecosystems.

3. Promoting sustainable resource use

- Encourages textile companies to adopt water-efficient dyeing and processing techniques to minimize freshwater consumption.
- Supports the use of eco-friendly fibers such as banana fiber and organic cotton, reducing reliance on synthetic materials that contribute to microplastic pollution.
- Promotes energy-efficient production methods, reducing the textile industry's carbon footprint.

4. Regulating the use of hazardous chemicals in textiles

- Works with UNBS and the Ministry of Trade to enforce bans on hazardous dyes, synthetic chemicals, and toxic finishing agents used in textile processing.
- Ensures compliance with global environmental standards, such as restrictions on azo dyes, heavy metals, and formaldehyde.

5. Encouraging circular economy and textile recycling

- Promotes initiatives for recycling textile waste to reduce landfill accumulation and environmental degradation.
- Supports textile upcycling and sustainable fashion movements, encouraging local designers and manufacturers to adopt circular economy principles.
- Collaborates with industries to develop eco-friendly disposal systems for textile waste.

6. Enforcing environmental audits and monitoring

Co-funded by the European Union

- Conducts regular environmental audits of textile factories to ensure continued compliance with sustainability regulations.
- Imposes penalties and sanctions on textile manufacturers that fail to meet environmental standards.
- Works with the public and civil society organizations to monitor pollution hotspots, such as industrial areas discharging untreated effluents into water bodies.

Despite its efforts, NEMA faces challenges in enforcing environmental regulations in the textile sector:

- Weak enforcement mechanisms due to limited funding and manpower.
- Non-compliance by some textile manufacturers, especially small-scale enterprises that lack resources for sustainable upgrades.
- Limited awareness among textile producers and consumers about the importance of sustainable practices.
- Competition from unregulated imports, which may not meet Uganda's environmental standards.

To strengthen NEMA's role in promoting sustainable textiles, Uganda has been argued to:

- Increase funding for environmental monitoring and enforcement.
- Strengthen penalties for non-compliant textile factories.
- Enhance collaboration between NEMA, UNBS, and trade authorities to enforce eco-friendly textile standards.
- Encourage public-private partnerships for green textile innovation and cleaner production technologies.

3.6.5. Proposed Ban on Second-Hand Clothing Imports

The **proposed ban on second-hand clothing (locally known as "mivumba")** is part of Uganda's broader regulatory framework to promote local industrialization, sustainability, and economic self-reliance. This move aims to reduce competition for local manufacturers and encourage the consumption of domestically produced textiles. However, concerns have been raised about the potential economic impact, including job losses and reduced affordability for consumers. A phased approach has been suggested to mitigate these challenges.

The ban fits into Uganda's regulatory landscape, aligning with multiple policies and regulations, including:

Co-funded by the European Union

1. The National Textile Policy (2009) – Advocates for strengthening local textile manufacturing and reducing dependency on imported used clothing.
2. The Buy Uganda, Build Uganda (BUBU) Policy (2014) – Encourages Ugandans to purchase locally made goods, boosting domestic production.
3. The Investment Code Act (2019) – Supports investment in Uganda's textile industry to create jobs and promote industrial growth.
4. The National Environment Act (2019) – Aims to reduce textile waste and pollution from imported second-hand clothing, much of which ends up in landfills.
5. East African Community (EAC) Regional Integration Policies – Uganda, along with Kenya, Tanzania, and Rwanda, has explored phasing out second-hand clothing imports to build a competitive textile sector.

The ban is expected to support sustainable practices in multiple ways:

1. Boosting local textile production and value Addition

- Encourages investment in local cotton and banana fiber processing, ensuring more raw materials are used for domestic textile manufacturing.
- Supports job creation by reviving textile mills and promoting industries that spin, weave, and produce fabrics locally.
- Strengthens Uganda's textile value chain, reducing reliance on imported goods and boosting the economy.

2. Reducing textile waste and environmental pollution

- Many second-hand clothes arrive in Uganda in poor condition, leading to massive textile waste in landfills.
- A ban would encourage longer-lasting, high-quality local textiles, reducing fabric disposal issues.
- Promotes recycling and circular economy initiatives, where old textiles are repurposed instead of discarded.

3. Supporting sustainable and ethical fashion

- Encourages eco-friendly textile production, including banana fiber and organic cotton, reducing dependence on synthetic fabrics that contribute to pollution.
- Provides incentives for Ugandan designers and manufacturers to develop sustainable fashion brands, reducing reliance on fast fashion.

Co-funded by the European Union

- Supports fair labor practices by ensuring textile workers in Uganda get fair wages instead of relying on imported clothes produced under exploitative conditions abroad.

4. Strengthening Uganda's trade and industrial competitiveness

- Encourages local brands to expand regionally and internationally, boosting Uganda's textile exports.
- Helps Uganda compete with global markets by enforcing quality standards for its textiles.
- Aligns with East Africa's long-term industrialization strategies, reducing dependency on used clothing imports from Western nations.

While the ban has strong economic and environmental justifications, it also faces challenges:

- Consumer affordability – Second-hand clothing is cheap and accessible; locally made textiles might be more expensive.
- Weak local production capacity – Uganda must scale up textile manufacturing to meet domestic demand before fully implementing the ban.
- Resistance from traders and importers – Many businesses depend on second-hand clothing, and transitioning to new industries will require support.
- Enforcement difficulties – Smuggling and black-market sales of second-hand clothing could emerge if strict regulations are not enforced.

To ensure the ban successfully promotes sustainability without harming consumers and businesses, experts have advised Uganda on the following:

- Strengthen local textile production capacity through subsidies, infrastructure investment, and technology adoption.
- Gradually phase out second-hand clothing imports while increasing the supply of affordable local alternatives.
- Support small businesses and traders in transitioning to new opportunities in the local textile industry.
- Promote consumer awareness about sustainable and ethical fashion to encourage the adoption of locally made products.

Co-funded by the European Union

4 Existing Sustainability Practices

In this section we present the existing sustainability practices adopted by textile companies in the target region. We give global trends, and focus on some use cases

4.1 Kenya

The Technical University of Kenya Identified two main Textile Manufacturing companies in kenya (Thika Cloth Mills and Sunflag Kenya) and sought to establish and document their sustainability practices. The key operations by the two companies include; spinning, weaving, knitting and finishing processes of textiles. In addition, a short summary on sustainability practices carried out in four other companies is provided specifically on the management of off cuts/ cut pieces and disposal of used uniforms.

Moi University identified and proposed working with Rivatex East Africa Ltd (REAL) based in Eldoret and Spinners and Spinners Ltd, based in Ruiru in the outskirts of Nairobi for the purpose of documentation of sustainability practices within the textile and apparel sector.

4.1.1 Thika Cloth Mills – TCM

Established in 1958, Thika Cloth Mills has grown to become one of Kenya's leading textile manufacturers. For over six decades, the company has been committed to producing high-quality fabrics while supporting local communities through initiatives such as the "Buy Kenya Build Kenya" campaign. They proudly contribute to the Kenyan economy by sourcing cotton from local farmers and ensuring the highest standards in their production process. With a production output of over 1 million meters of fabric per month in their fully integrated plant which includes spinning, weaving, and finishing processing units, the company is able to deliver a wide range of textiles, from **100% cotton** to **blended polyester fabrics**.

Their product range includes **School uniform fabrics, Khangas, Kikoys & Kitenge, Custom-made products & promotional fabrics, Suiting materials, Curtains, pillows & pillow cases**.

Sustainable practices

The company prides in its manufacturing expertise and dedication to sustainable practices to ensure that they deliver exceptional fabrics while caring for the planet.

Co-funded by the European Union

Figure 4.1.1 TCM website

Table 4.1.1: Factory waste in TCM

Factory Waste	Uses
i) Short fibres	These are collected and used as pillow fillers Part of the waste fibres are Collected & twisted to make mop yarn
ii) Cotton fibres	Waste Cotton fibres are used as fuel for boiler
iii) Short hand waste from winding & auto conner	'Fluff' is sold to the automotive industry including garages & local mechanics i.e informal sector also known as jua-kali industry and shoe companies such as BATA. This material is used for cleaning during maintenance of machines especially those with oil spills. However, there is no report beyond this point.
iv) Effluent Treatment Plant (ETP)	Water is collected in a reservoir which is lined using a dam liner. It is then treated according to set guidelines by National Environmental Management Act (NEMA) and is then released back to the county government sewer line after testing to ensure compliance. Effluent waste filtered from the water and boiler waste is then collected by certified and licensed waste collectors and taken to the county dumpsite. A tracking system is

Co-funded by the European Union

	enforced by NEMA to ensure traceability of dumping practices.

4.1.2 Sunflag Kenya

The company was founded in 1937 and has grown steadily spreading its manufacturing operations globally. They boast of 25 companies employing over 20,000 people directly. Sunflag Kenya is currently the largest Textile Group in Kenya with a workforce of 1200, attached to the following divisions: Spinning, Weaving, Knitting and Garment Manufacturing.

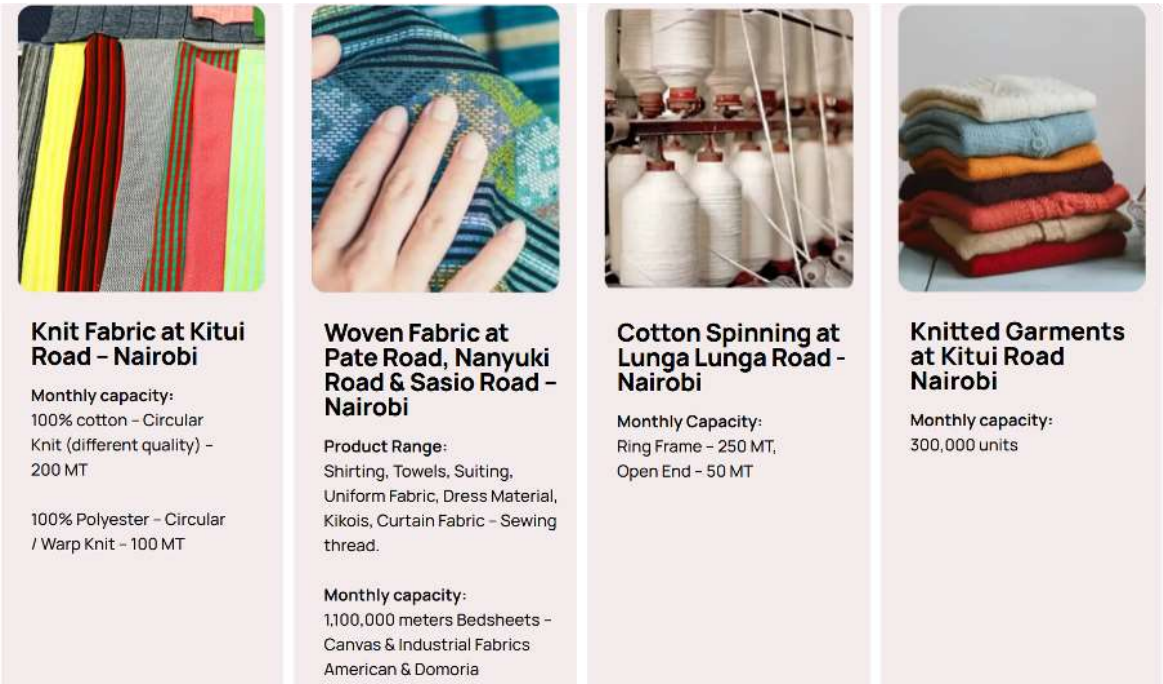

Figure 4.1.2 Sunflag Kenya website

The company has been manufacturing different types of yarns and fabrics for the last 60 years with continuous expansion, and modernization. The Spinning Mill has 25,000 Ring Spindles, and open-end Rotors with Reiter Blow Room lines, Cards, Ring frame and twisters.

Co-funded by the European Union

Weaving Division is equipped with Benninger Warping Machines and 155 double width Sulzer Weaving Machines producing approximately 40,000 meters of fabric every day. The process house is equipped with Bruckner Stenters and high temperature jet dyeing machines. For quality controls, all fabrics is inspected at grey stage and after finishing.

Their product range includes **Bedsheets, Shirting & Suiting materials, Tex for uniforms, School uniforms, Cotton Dill & Twill, Curtain fabric, Printed fabrics, Raincoat materials, Flannel fabric, and Kikoi 100% combed cotton**.

Table 4.1.2: Sustainable practices

Factory Waste	Uses
i) Cotton fibres	Waste Cotton fibres are used as fuel for boilers
ii) Cut Pieces	Pieces are sorted according to size – big & small. These are then sold at discounted prices to encourage reuse and upcycling for economic gain
iii) Short hand waste from winding & auto conner	'Fluff' is sold to automotive industry including garages & local mechanics for use in cleaning during maintenance of machines especially those with oil spills
iv) Effluent Treatment Plant (ETP)	Water is collected in a reservoir lined with dam liner. It is then cleaned according to set guidelines by National Environmental Management Act (NEMA) and the neutralized waste water is released back to the county sewer line. Effluent waste filtered from the water and boiler waste is then collected by certified and licensed waste collectors and taken to the county dumpsite. A tracking system is enforced by NEMA to ensure traceability of dumping practices.

Co-funded by the European Union

Figure 4.1.3 Image of repurposed denim jeans from an EPZ company at Sunflag Kenya reception area

4.1.3 Sustainable Practices in Kenyan Organizations using Textile Products

In this section we give some further sustainable practices.

Company	Practices
i) Kenya Kazi Security – KK Secuity	With a team of over 25,000 staff across Africa and approximately 4,000 staff in Kenya, the amount of used uniforms is enormous. The company has a partnership with Africa Collect Textiles (ACT) – which is focused on building circular eco-systems for fashion in Kenya and Nigeria, by: - Collecting, sorting and redistributing used and unwanted clothing to provide vulnerable communities with decent outfits. - Preparing large quantities of sorted materials (acrylic, wool, cotton, etc), suitable for repurposing, upcycling and recycling by Africa's creative scene, furniture and textile industry.

Co-funded by the European Union

	- Designing and producing circular products from sorted textile waste. - Safely processing sensitive uniforms, workwear and corporate logos.

Fig. 4.1.4 Upcycled khaki – ACT products (website)

Co-funded by the European Union

ii) Kenya Airways - KQ	This state corporation has a team of approximately 2,000 staff. It is noteworthy that the uniforms purchased and later disposed of is enormous. The company mentioned that is faced numerous challenges when used uniforms were collected by disposal companies due to inappropriate use of company branded items which was beyond their control. To curb this, KQ has since introduced an innovation hub where they first collect all used uniform from staff which is stored in an internal warehouse, and thereafter repurposed to develop creative products such as bags and various crafts which they sell in their shop at their HQ offices. However, they are keen to learn different ways in which they can use their textile waste.
iii) Full Care Medical Ltd	With a team of approximately 1,000 staff and plans to expand operations in Kenya to a potential staff number of over 5,000, Full care a general medical products supplier runs its production facility under the Special Economic Zone (SEZ) area in TATU City, Kenya. Their textile waste is classified as *Bonded Waste,* which means that the company has to pay some duty to the Kenyan government for the off cuts/ cut pieces to be sold locally. The non-woven textile waste is collected by Certified and licensed waste dealers, and is then recycled and mainly used to produce non-woven shopping bags. Other wastes include include PET waste is sold to recycling companies and raw material packaging material which is mainly repurposed to end product packing material.

Co-funded by the European Union

(a) (b)

Fig. 4.1.5 FullCare Medical Ltd: (a) the facility in Tatu City, (b) Production

iv) Blanket Industries - Mombasa	Blanket industries has been in operations for over 30 years in mombasa, Kenya. The company uses off cuts/ cut pieces from apparel manufactures in and around Mombasa such as Export Processing Zone (EPZ) companies to make blankets using the non-woven fabric manufacturing technique. The company uses all types of fabric such as 100% cotton to blends such as poly cotton, poly viscose among others. The company is faced with lack of governement support to expand operations due to the high demand for sustainable management of textile waste.

Fig. 4.1.6 Recycing of textile waste into non-woven rugs at Blanket Industries - Mombasa

Conclusion

Co-funded by the European Union

It is important to note that there is a growing concern on the management of textile waste among textile manufacturers as well as textile consumers such as uniformed organizations. Although many of these organizations adhere to the regulations around waste management, introducing inhouse sustainable practices in textile waste management is a critical aspect of business development. Unfortunately, the technical know-how and financial constraints pose a huge challenge, with the existing organizations promoting sustainability in the textile industry being overwhelmed. This challenge is compounded by lack of locally well trained manpower on sustainability in the textile industry.

4.1.4 Rivatex East Africa Ltd (REAL)

Moi University identified Rivatex East Africa Ltd (REAL) based in Eldoret City, Kenya. REAL is a vertically integrated textile factory that converts lint and fibres through various processes into finished fabrics. It further converts fabrics into garments and clothing. It is a limited company fully owned by Moi University and was incorporated as Rivatex East Africa Limited on 16th August 2007 after being acquired from the old Rift Valley Textiles (RIVATEX). The main objective of the acquisition was to utilize the facility for training, research, product development, extension and commercial purposes. It was officially opened on 4th Aug 2007 by the then President of Kenya, Mwai Kibaki. The factory has undergone modernisation and expansion to include apparels and garments making unit that is well equipped with state-of-the-art machinery that make all kinds of outfits from cotton and cotton blend fibres.

(a) (b)

Fig. 4.1.7 A modern machines at REAL: (a) folding machine, (b) inspection machine

4.1.5 Spinners and Spinners Ltd.

Spinners & Spinners Ltd (S&S) is a leading textile design and manufacturing company in Kenya, established in 1979 and located in Ruiru town in the outskirt of Nairobi city. As a vertically integrated firm, S&S controls the entire production process, ensuring quality and efficiency. The company employs over 1,500 people and emphasizes sustainability through Kaizen principles, technological innovation, and adherence to international standards, including ISO 9001, ISO 14001, and SMETA compliance. Committed to continuous improvement, S&S invests in employee training and cutting-edge technology. Their diverse product range includes blankets, Masai Shukas, Kikoys, baby products, school uniforms, knitwear, yarns, fashion wear, and beddings. The company values long-term partnerships with suppliers and customers, serving a Pan-African market with a global perspective.

Co-funded by the European Union

Through sustainable manufacturing and responsible business practices, S&S aims to drive growth in Africa's textile industry while maintaining ethical and environmental standards.

4.1.6 Sustainability practices

Among the notable sustainability practices in REAL is the involvement of farmers to grow cotton. The company provides Bt seeds and offers extension services to the farmers in order to enhance their yield, an initiation that ensures a sustainable supply of raw cotton material. Also, REAL is known for reuse of waste materials and grade B fabrics to make other products. This initiative isn't just about creating beautiful textiles; it's about redefining what's possible in the realm of sustainable fashion. The process isn't just about recycling; it's about upcycling, since hitherto landfill destined materials are elevated into high-quality, fashion-forward fabrics. Furthermore, apart from installation of new and more efficient equipment and sustainable fashion, the firm endeavors to use eco-friendly dyes, such as the Tamy bio-dye, innovated by Moi University together with the company researches, to minimize water and energy consumption. Thus, the company cares about the entire chain of their products, from production to runway.

(a) (b)

Fig. 4.1.8 (a) waste at REAL, (b) designed fabric for models made from waste/ grade B materials

Spinners and Spinners on the other hand has a wide range of sustainability practices it adheres to. The main one is the adoption of Kaizen production philosophy to improve processes and hence reduce environmental impacts. Also, the company invests in an advanced wastewater treatment process that breaks down dye compounds before further treatment thus improving efficiency of dye removal from used water. Furthermore, the company is both ISO 9001 and ISO 14001, and SMETA certified which covers among others, the environmental care reflecting its commitment to clean production.

4.1.7 Conclusion

Thus, the two companies demonstrate their dedication to sustainable practices in the textile industry. By adopting new and energy efficient equipment, advanced wastewater treatment, using bio-dyes, and adopting Kaizen, the companies reduce resource consumption, wastage and pollution. The use of waste materials encourages circularity. Also ISO and SMETA certification of the companies proves their commitment to a positive

Co-funded by the European Union

environment impact. All these practices drive sustainable production and cleaner tomorrow.

4.2 Ethiopia

4.2.1 Sustainable Cotton Production Practices in Ethiopia - BDU

Conventional cotton farming affects ecosystems and farmer's health in several ways as with less ethical consideration as described below:

- The conventional cotton cultivation largely uses pesticides, and insecticides which have a significant impact both on ecosystems, and health of farmers and their communities,
- With expansion of cotton farming deforestation will be resulted having a negative effect on the ecosystem by reducing biodiversity and creating soil erosion and pollution,
- For large scale cotton farming irrigation is essential, this leads to significant water consumption (depletion), water pollution (due to use of pesticide, fertilizer, etc.), and salinity.
- Unfair benefit share and less ethical consideration mostly accompanied with conventional cotton farming.

Due to these reasons now-a-days textile industries are commended to use sustainable cotton for their production by international textile buyers. The Ethiopian textile industries are praised by their international buyers to use sustainable cotton for their production. In this regard Ethiopian textile industries are challenging in getting sustainably cotton with quality and sufficient quantity for their processing. Cotton Made in Africa (CmiA), one of the most well-known sustainable cotton brands, is produced in Ethiopia on a scale that is comparatively substantial to the volume of industry supply. Therefore, currently the majority of textile industries in Ethiopia use cotton produced with the CmiA initiative. Although Ethiopia is implementing organic and BCI-based sustainable cotton production, small-scale cotton growers produce them in smaller quantities.

Large manufacturers and retailers who wish to safeguard their brand from potential adverse circumstances have created sustainable cotton farming along with credible sustainability certificates. More fair profit distribution, added moral treatment of workers, and environmentally sustainable operations are among the things that most sustainability certifications promote. Customers would ultimately be encouraged to purchase clothing that is produced in a more ethical way as a result [1].

Co-funded by the European Union

Therefore, sustainable cotton presents a novel solution that can effectively tackle the different environmental and social issues related to conventional cotton production. Conventional cotton growing may also be able to support farmers' and communities' livelihoods in spite of long-term ecological constraints and socioeconomic demands. Currently, only 25% of the supply to the textile industry is actively procured by sustainable cotton farming, while the remaining 75% is supplied from conventional cotton farming [2].

The most important aspect of Ethiopia's National Cotton Development Strategy (NCDS) is sustainable cotton production [3]. In light of this, Ethiopia has created a 15-year strategy that intends for gradually eliminating conventional cotton between 2018 and 2032. In spite of expanding cotton exports to primary markets, NCDS actively promoted the production of identifying sustainable cotton production approaches of organic, BCI, and CmiA. Nevertheless, this plan is not making significant progress until 2024, with the exception of CmiA sustainable cotton farming.

Ethiopian Cotton Producers and Ginneries Exporters Association (ECPGEA) collaborated with the Aid by Trade Foundation (owner of the CmiA standard) to promote CmiA sustainable cotton production in the 2014 production season in Ethiopia. This collaborative initiative was active in the districts of Metema and Quara, the main cotton producing area in the Amhara National Regional State northwest, Ethiopia until 2019. The cooperation activities include, conducting training and organizing workshops for extension workers in order to practice CmiA sustainable cotton production in Ethiopia.

Good agronomic practice (GAP), integrated pest management (IPM), improving fibre quality, social issues (health, safety, and ethical consideration), and environmental issues (biodiversity, forest, soil and water conservation) are all important sustainable issues that are successfully addressed with CmiA in Ethiopia in the early mentioned period. Ethiopia's extension system and the CmiA's sustainable cotton production approach coordinated effectively. As a result, an evaluation carried out in August 2022 by the International Trade Centre (ITC) program revealed that farmers had attained 89% sustainability practices [4].

The expansion of CmiA sustainable cotton production is challenging because of recent security issues in the primary cotton-producing region, which also made third-party verification impracticable there.

Compared to CmiA, organic and Better Cotton Initiative (BCI) cultivation experiences are fewer in Ethiopia. Ethiopian growers have been exploring the use of BCI since 2015. To increase the adoption of BCI, Ethiopian government, companies, and non-governmental organizations (NGOs) have collaborated. It stems from the fact that CmiA excludes farms greater than 20 ha, irrigation, and GMO cotton seeds, while BCI permits large-scale cotton producers, irrigation, and GMO cotton seeds. BCI farming promises that more than 90% of farms will meet or surpass BCI requirements. However, third-party certification and

Co-funded by the European Union

verification are not possible because Ethiopia is not a member of BCI. The Ethiopian government, brands, commercial cotton farmers, non-governmental organizations (NGOs), and other stakeholders must thus work hard to establish Ethiopia as a BCI nation.

4.2.2 The Prerequisites for a Sustainable Approach to Textile Production - BDU

The process of producing textiles with eco-friendly materials and methods is known as sustainable textile production. Creating textiles that are safe for both people and the environment at every stage of their life cycle is the aim of sustainable textile production. Textile production takes a lot of water for production, plus land to grow cotton and other fibers. To make a single cotton t-shirt,2700 liters of fresh water are required according to estimates, enough to meet one person's drinking needs for 2.5 years [5]. About 20% of the world's clean water pollution is said to be caused by the dyeing and finishing of textiles. There are 700,000 microplastic fibers that can enter the food chain from a single cycle of laundry containing polyester clothing.

Most textile-related microplastics are discharged during the initial washings. High sales volumes, low pricing, and mass manufacture are the foundations of fast fashion, which encourages multiple initial washes. Over half a million tons of microplastics end up on the ocean floor each year as a result of washing synthetic textile products. In addition to this worldwide issue, the pollution caused by the clothing industry has a terrible effect on the ecosystems, wildlife, and local population in the areas where the factories are situated[5].

The European Environment Agency estimates that in 2020, each person's purchases of textiles in the EU produced roughly 270 kg of CO_2 emissions. The EU's use of textile products resulted in 121 million tonnes of greenhouse gas emissions.

4.2.3 Sustainable Textile Production Practices in Ethiopia - BDU

The United States and the European Union are the primary consumers of Ethiopian textiles and clothing products. The sustainable textile production in Ethiopia is being driven by international buyers (mostly EU countries & USA). Sustainable textile production is challenged with several factors. These include the use of environmentally friendly supplies, eco-friendly processing, and eco-friendly products. Significant challenges also include the handling of chemicals used in processing, waste treatment, waste disposal, and general waste management situations. All of these things are tracked down to meet the needs of the branded international buyer. Furthermore, while making acquisitions, international purchasers now consider ethical concerns and unfair benefit sharing. Thus, the primary drivers behind the manufacture of sustainable textiles are global consumers.

Accordingly, now-a-days textile industries are starting to work as partner with cotton farmers, by financing the farmers to have money for purchasing inputs to words producing

Co-funded by the European Union

sustainable cotton mostly with CmiA initiative. The majority of textile industries and the recently built 13 industrial parks across the nation have effluent treatment plants (ETP). However, the obstacles to Ethiopian textile industries' transition to sustainable manufacturing include adopting eco-friendly processes, managing chemicals effectively, operating ETP efficiently, ensuring fair distribution, and, to a lesser extent, taking ethics to workers into account.

Ethiopia's sustainable textile production thus turns into a competitive strategy to draw international customers. Because before placing an order, purchasers from around the world track textile products from the source of sustainably produced raw materials to the point of wastewater treatment and release. Furthermore, overseas customers, especially the major buyers of the USA and EU, are also compliant with fair compensation, incentives, and worker safety. Some industries in this sector have nearly completed certification about their production method, laboratory facilities, and final product.

However, the textile industry still faces challenges in sourcing enough locally produced sustainable cotton to meet the demands of their global customers. On the other hand , the textile industries still do not fully understand the importance of sustainable textile production when it comes to the aspects of textile manufacturing and processing. In this sense, textile industries that receive foreign direct investment are more effective than those controlled by domestic investors in implementing sustainable textile production. Furthermore, textile industries owned by local investor's lack the resources, expertise, and know-how necessary to embrace and execute sustainable textile production.

4.2.4 MNS Textile Manufacturing Industry - BDU

Globally, it has been estimated that only 1% of used clothing is recycled into new clothing. The average European uses around 26 kg of textiles annually and discards about 11 kg of them. Although used clothing can be transported outside of the EU, the majority of it (87%) is either landfilled or burned. The rise of fast fashion has been crucial in the increase in consumption, driven partly by social media and the industry brining fashion trends to more consumers at a faster pace than in the past. The new approaches to address this issue include creating new clothing rental business models, designing products to facilitate recycling and reuse (circular fashion), persuading customers to purchase longer-lasting, higher-quality clothing (slow fashion), and generally influencing consumer behaviour towards more environmentally friendly choices.

In March 2022, the European Commission unveiled a new plan to address rapid fashion, promote innovation in the industry, and make textiles more resilient, repairable, reusable,

Co-funded by the European Union

and recyclable as part of the circular economy action plan. The new approach calls on companies to accept accountability and take action to reduce their carbon and environmental footprints, and it includes new ecodesign standards for textiles, more transparent information, and a digital product permit.

Ethiopia has currently 52 textile industries with varying levels of operation that are backed by both local and foreign direct investment. However, very few industries are practicing circular textile production approaches. Although the methods are varied, the recycling and reuse of textiles as a circular economy is a component of sustainability. The industries attempting recycling and reusing textiles is not directly driven by international buyers as a case discussed for sustainability textile production, but rather they are considering it as a cost-cutting strategy in Ethiopian textile industry context. Two textile industries have been chosen for a case study on textile recycling or reusing as a circular economy strategy, encompassing the entire country's textile industry. The first being MNS.

A Turkish investor founded MNS Textile Manufacturing PLC in 2012. MNS is a well-known producer of 100% cotton woven bath towels and hotel towels that are incredibly soft, luxurious, and absorbent. Bath towels, hotel towels, beach towels, pool towels, and kitchen towels are the areas of industrial specialization. Spinning, weaving, and processing units are among MNS's production facilities. Jacquard is the weaving unit of MNS. These days, MNS Textile Manufacturing PLC's ownership has been transferred to other shareholders via Ethiopian Development's bank facilitation due to an unpaid bank loan. The factory kept producing the same kinds of goods while utilizing only cotton as an input in addition to shirt fabrics. The MNS makes between $50 and $100 USD per a year from exporting 50% of its products to the global markets.

As per Mr. Deslegne Firew, an executive manager of MNS explanation, cotton waste recycling receives special attention because it is the MNS's primary raw material. In this sense, the industry buys cotton waste from other textile industries as well as recycles cotton waste internally.

Figure 4.2.1. A photo of Mr. Desalegne Fire, MNS's executive manager.

Co-funded by the European Union

In order to achieve the standards for product quality, he further described that the waste cotton that is collected from the factory and purchased from other textile companies is properly reprocessed and combined with cotton lint in predefined proportions, as illustrated in Figure 4.2.2. In order to guarantee a supply of cotton that is produced sustainably, MNS is working as a partner with cotton farmers in the country.

Figure 4.2.2. Waste cotton preparation processing and mixing with lint cotton for production, MNS Textile Factory, Ethiopia.

Figure 4.2.3. Towel and shirt fabric products of MNS textile factory, Ethiopia (Source Author).

Furthermore, MNS intends to progressively introduce recycling strategies in relevant production units; as a result, waste water recycling will begin as soon as feasible after the completion of the ETP renovation. Consequently, the industry is focusing on sustainability issues at all levels of the textile value chain. In general MNS is focusing on sustainability issues at all levels of the value chain and its production units.

4.2.5 ETUR/ ERCO Textile Manufacturing Industry

ETUR Textile PLC was founded in Adama, Ethiopia in 2010. The company ETUR Textile Plc. is a subsidiary of Yüksel Tekstil, TURKIYE, which has been a pioneer in the Turkish textile industry since 1960 and has been exporting to the global market since 1978. The company's production-based circular economy approach to textile manufacture makes it

Co-funded by the European Union

unique in Ethiopia and Africa. New rags (cuttings, clips) made of 100% cotton are recycled by ETUR and are the leftovers from knitwear producers worldwide. Prior to the recycling process, all newly purchased rags must be sorted to remove any foreign contaminants such as paper, plastics, and gums. ETUR textile was sold to another investor due to a bank loan issue; it is currently known as ERCO.

Rags (clips, cuts) were previously purchased from both domestic and international markets. But at the moment, the only place to buy rags is the local market.

(a) Rags sorting (b) Cutting machines for the sorted rags

Figure 4.2.4. Rags sorting and cutting (Source:http://www.gesamtmasche.de)

The executive manager of RECO's representative, Mr. Taferu, provides the following explanation of the industry's current state of operation:

Co-funded by the European Union

Figure 4.2.5: Photo of Mr. Taferu, representative of RECO textile executive managers

As per Mr.Taferu explanation, after cutting rags are conditioned. Then , rag recycling operations for yarn spinning began, which included properly blending rag fibre, carding, drawing, and using an open-end spinning machine to produce rag recycled yarn, as shown in Figure 6.

The open end spinning machines at RECO are able to produce yarn starting from Nm. 1/1 (Ne 0, 60/1) to Nm 50/1 (Ne 30/1) in single yarns, 2 plies and multi folds in different blends.

Co-funded by the European Union

Figure 4.2.6. Open end spinning machine at RECO textile.

The produced rag based yarn used for Circular and Flat-Bed Knitting (Sweaters, T-Shirts, Sports Wear), Hosiery (Sport Socks, Men's, Lady's and Children's Socks), Weaving (Warp and Weft), Home Textile (Curtains, Bath and Door Mats, Bed sheets). Upholstery Fabrics (Carpets, Tufting, Floor Mops, Cotton Blankets, Bed and Sofa covers, Tablecloths and Napkins.

As shown in Figure 4.2.7, a circular knitting machine is one of the important machines using rag recycled yarn for producing knitted fabric..

Co-funded by the European Union

Figure 4.2.7. Circular Knitting machines in different gauges, at RECO Textile.

RECO Textile also includes a garment unit that uses recycled rags to make cloth, mostly, knitted clothes. It has 550 sewing machines, and 8- lines for garment manufacture and 12 heads of Embroidery machines as shown in Figure 4.2.8.

Figure 4.2.8. The garment unit of RECO Textile.

RECO produced yarn, household textile and clothing products for sale. Figure 4.2.8 depicts a collection of clothes prepared for sale.

Co-funded by the European Union

Figure 4.2.8. RECO collection of cloths made from rags that have been recycled.

Obtaining polyester and other synthetic fibre rags presents difficulties for recycling and manufacture. One of the difficulties facing RECO Textile in continuing production of recycled textiles is the low cost of recycled clothing in selling.

4.2.6 Sustainability Practices Adopted by Textile Companies in Ethiopia: A Focus on Adama & Akaki Town- Jimma

Sustainability Practices in Ethiopia's Textile Industry: A Case Study of Textile Factories in Adama and Akaki Town

The textile industry in Ethiopia is a critical sector contributing significantly to the country's economy. In recent years, the industry has been under increasing pressure to adopt sustainable practices to align with global environmental and social standards. Adama town, located in the Oromia region, serves as a hub for textile manufacturing, with both private and government-owned factories playing essential roles in promoting sustainability. This document explores the various sustainability practices adopted by these factories and their impact on the local and national economy.

Co-funded by the European Union

The Role of Adama Spinning Factory

Adama Spinning Factory, a privately-owned enterprise established in 2008, is one of the key players in the textile sector in Adama town. The factory specializes in producing 100% cotton yarn and has strategically positioned itself to utilize the region's reliable electric power, proximity to cotton-growing areas, and access to transportation infrastructure (Ethiopian Textile Industry Development Institute, 2022).

The factory's commitment to sustainability is evident in its compliance with international standards. It holds the ISO 9001 Quality Management System certification and adheres to the principles of WRAP (Worldwide Responsible Accredited Production), which ensures ethical and environmentally responsible manufacturing processes (World Bank, 2023). Additionally, the factory prioritizes waste management and energy efficiency, aiming to reduce its ecological footprint.

In 2020, the factory expanded its operations by establishing Nazmed Medical Textiles, focusing on producing medical-grade textiles such as surgical gauze. This move not only substitutes imports but also promotes environmental sustainability by using 100% locally sourced cotton (African Development Bank, 2022). The integration of medical textile production showcases the factory's dedication to innovation and its contribution to Ethiopia's self-sufficiency in essential goods.

Figure 4.2.9. 100% cotton bandages for medical use

Government-Owned Textile Factories

While private enterprises like Adama Spinning Factory have led the way in sustainability, government-owned textile factories, such as the Defense Foundation Garment Industry in Adama and the Adama Textile Union Cooperation, have also made strides in adopting sustainable practices. These factories have benefited from national initiatives aimed at

Co-funded by the European Union

improving the textile sector's environmental and social standards (Ethiopian Ministry of Environment, 2023).

The Ethiopian government has partnered with international organizations to implement programs such as the Sustainable Textile Program (eTex), facilitated by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The eTex program provides advisory services, capacity development, and technical support to Ethiopian textile companies, including those in Adama. By focusing on resource efficiency, pollution reduction, and worker welfare, the program aims to position Ethiopia as a competitive player in the global textile market (United Nations Industrial Development Organization [UNIDO], 2021).

Broader Sustainability Initiatives

Nationally, Ethiopia's textile sector is undergoing a transformation driven by sustainability. Key areas of focus include:

- **Water Management:** Factories in Adama and beyond are investing in water treatment and recycling technologies to reduce water consumption and pollution. Given the water-intensive nature of textile manufacturing, these measures are critical for sustainable operations (African Development Bank, 2022).
- **Energy Efficiency:** Many factories are transitioning to renewable energy sources, such as solar and wind, to power their operations. Adama's proximity to renewable energy projects provides an added advantage for local factories (World Bank, 2023).
- **Social Responsibility:** Both private and government-owned factories are adopting fair labor practices, ensuring worker safety, and providing training programs to enhance skill development. These initiatives contribute to improving the overall quality of life for workers and their communities (International Labour Organization [ILO], 2021).

Challenges and Opportunities

Despite the progress, the textile sector in Adama faces challenges in fully implementing sustainable practices. Limited access to advanced technology, financial constraints, and insufficient awareness among stakeholders hinder the widespread adoption of sustainability initiatives. However, opportunities exist to address these challenges through

Co-funded by the European Union

increased investment, public-private partnerships, and international collaborations (Organisation for Economic Co-operation and Development [OECD], 2022).

The Ethiopian government's focus on industrial parks, such as the Adama Industrial Park, presents a unique opportunity to promote sustainability on a larger scale. These parks are designed with eco-friendly infrastructure, emphasizing waste management, energy efficiency, and social compliance (United Nations Environment Programme [UNEP], 2023).

Sustainability practices in Adama town's textile industry reflect a growing commitment to environmental stewardship and social responsibility. Private enterprises like Adama Spinning Factory and government initiatives such as the eTex program play pivotal roles in this transformation. By continuing to invest in sustainable technologies and fostering collaborations, Adama's textile sector can serve as a model for other regions in Ethiopia and beyond, contributing to a more sustainable and competitive industry.

4.2.7 Sustainability Practices Adopted by DH Geda Textile Factory - Akaki Town

DH Geda Textile Factory, one of Ethiopia's leading producers of institutional and military blankets, has integrated various sustainability practices into its operations to minimize its environmental impact and promote social responsibility. Established in 2002 in Akaki, approximately 20 kilometers east of Addis Ababa, the factory produces over 4,000 high-quality blankets daily (DH Geda, 2023). By employing advanced technology, skilled workers, and high-quality raw materials, DH Geda ensures efficiency and sustainability throughout its production process.

Figure 4.2.10. Blanket produced by DG Geda Factory

Co-funded by the European Union

Sustainable Sourcing of Raw Materials

DH Geda prioritizes the use of eco-friendly raw materials in its blanket production. The factory sources wool and other fibers from suppliers who adhere to sustainable farming and ethical labor practices (Ethiopian Textile Industry Development Institute, 2022). By selecting high-quality, responsibly sourced materials, the company ensures durability while reducing waste and environmental impact.

Energy Efficiency and Renewable Energy Use

The factory has implemented energy-efficient machinery to reduce electricity consumption. By upgrading to modern weaving and finishing equipment, DH Geda minimizes energy waste and optimizes production (United Nations Industrial Development Organization [UNIDO], 2021). Additionally, the factory has explored the use of renewable energy sources, such as solar power, to further decrease reliance on fossil fuels (World Bank, 2023).

Water Conservation Measures

Textile manufacturing is a water-intensive industry, but DH Geda has adopted water conservation measures to mitigate its impact. The factory has installed water recycling and filtration systems to reduce freshwater consumption (African Development Bank, 2022). By treating and reusing water within the production cycle, DH Geda minimizes waste discharge and protects local water resources.

Waste Management and Recycling Initiatives

Waste reduction is a key focus for DH Geda. The factory has introduced waste segregation and recycling programs to ensure that fabric scraps, defective blankets, and other by-products are either reused or repurposed (Ethiopian Ministry of Environment, 2023). Non-recyclable waste is disposed of responsibly to prevent environmental pollution. Additionally, the company works to minimize packaging waste by using biodegradable and recyclable materials.

Worker Welfare and Social Responsibility

Sustainability extends beyond environmental initiatives; DH Geda also prioritizes the well-being of its employees. The factory provides fair wages, safe working conditions, and continuous training programs to enhance worker skills and productivity (International Labour Organization [ILO], 2021). By fostering a supportive work environment, the company ensures long-term job security and employee satisfaction.

Co-funded by the European Union

Eco-Friendly Production Practices

To reduce its carbon footprint, DH Geda has adopted sustainable dyeing and finishing processes that use non-toxic, environmentally friendly chemicals (Organisation for Economic Co-operation and Development [OECD], 2022). These practices lower water and chemical waste while ensuring that the blankets remain safe for consumers and the environment.

Commitment to Continuous Improvement

DH Geda regularly assesses and updates its sustainability initiatives to align with global environmental standards. By investing in research and development, the factory explores innovative methods to enhance efficiency, reduce waste, and promote sustainability in textile manufacturing (Ethiopian Investment Commission, 2023).

In conclusion, DH Geda Textile Factory demonstrates a strong commitment to sustainability by integrating eco-friendly sourcing, energy efficiency, water conservation, waste management, and ethical labor practices into its operations. These efforts contribute to environmental preservation while ensuring the production of high-quality blankets that meet diverse customer needs (United Nations Environment Programme [UNEP], 2023).

4.2.8 Sustainable Practice Adopted by Almeda Textiles PLC

Introduction

The Ethiopian textile and garment industry is experiencing significant rapid growth and transformation with a strong focus on sustainable practice, as several domestic and multinational firms are being engaged in the production of textile and apparel for domestic and global markets. In the path to industrialize Ethiopia, the sector is given a prominent position by the Ethiopian government in boosting export, creating job opportunities, and as a model to other sectors. The sector has become a top priority as part of Ethiopia's goal to become a middle-income country by 2025(Ettner & Haosi, 2020). The key objective is to make the sector globally competitive and to bring the necessary structural transformation to the nation's economy(Woldeyohannes & Alebachew, 2020). This entails the export of industrial outputs, creation of thousands of jobs, attracting much needed foreign investments and above all, contributing to poverty reduction. The Government of Ethiopia aims to achieve $30 billion in textile and apparel exports by 2025., with a vision

Co-funded by the European Union

to lead the African textile and garment sector in global competitiveness by realizing a sustainable, diversified, and conducive business environment(Report, 2018).

Background of Almeda Textile PLC

The company is located at 7 km from the center of the Adwa town on the main road to Axum and around 1,000 km from Addis Ababa the capital city of Ethiopia, Almeda Textile Plc is standing proudly in the middle of beautiful Mountains. It is located 20 km away from Axum airport and is directly linked with the main seaport of Djibouti for import/export incidentals.

The company has been established since 1994 G.C and is owned by EFFORT group having integrated production areas starting from spinning, weaving, circular knitting, knit dyeing, woven processing, and garment productions. The new expanded garment section has the capacity to produce both woven and knitwear products with the design capacity 30,000 pcs and 20,000 pcs on a daily basis respectively and the production section of the garment department has more than 1500 machines to produce a variety of product mix before the conflict. Five years ago the industry was working on different product varieties for both local and export markets, but now it is only involving production for domestic products.

The company is established with the primary objective of contributing to the textile industry by producing high-quality threads, yarns, and a wide range of fabrics made from cotton, polyester, and cotton-polyester blends. Besides, the company is working to manufacture clothing materials designed for both personal and household use, ensuring comfort, durability, and sustainability in our products. Additionally, the company recognizes the importance of agricultural activities in supporting the business operations and engages in such initiatives when necessary to secure raw materials and enhance supply chain efficiency.

The company's mission focuses on boosting its assets, supporting societal development, and engaging in regional and national development efforts. Almeda Textile PLC is dedicated to understanding and meeting customer needs and expectations, maintaining a motivational environment, and enhancing quality through appropriate information systems.

The size of the company is categorized under large industries because it employs more than 2500 people and has a significant market presence, both locally and globally and their main products include a diverse range of textiles and garments. Some of their key products are producing babywear; kids wear, casual wear, outerwear, nightwear, and work wear.

The textile industry is regarded as one of the industries that faces the biggest challenges in incorporating sustainability in its business practices (Harsanto et al., 2023). Some of its key sustainability efforts of the company include:

Co-funded by the European Union

Environmental Sustainability

The textile and garment industries cause environmental damage at every stage of manufacturing, from the cultivation of raw materials through the disposal of finished goods (Islam et al., 2022). It causes various types of pollution due to extensive utilization of resources, resulting in harmful impacts on the natural environment and people's health. As a result, many environmental organizations and countries are implementing various environmental safety policies (Sardar et al., 2022). Almeda Textile PLC has an Environmental Sustainability Policy that guides the operations to minimize environmental impact while promoting responsible resource management and implementing several sustainable practices in its operations, particularly focusing on environmental responsibility, energy efficiency, and social development.

Almeda has integrated several sustainable practices into the production process, including water conservation, energy efficiency, the use of eco-friendly raw materials, and waste reduction and recycling. The company's commitment to water conservation is reinforced using water-efficient machinery, which helps reduce water consumption in their manufacturing processes.

In terms of energy use, Almeda Textile PLC adopts a mixed approach, utilizing both renewable and non-renewable energy sources while continuously working toward increasing the reliance on sustainable energy solutions. To further sustainability efforts, the company actively manages textile waste by repurposing materials into new products and making them available for sale, reducing overall waste and contributing to a more circular economy.

Social Sustainability

CSR (Corporate Social Responsibility) is a self-regulatory corporate model which allows a company to be socially accountable to itself, its customers, and the broader population (Islam et al., 2022). Almeda Textile PLC is committed to corporate social responsibility (CSR) and actively integrates ethical, social, and environmental considerations into their business operations. They have a CSR program that focuses on fair labor practices, community engagement, and workplace safety.

To ensure fair labor practices throughout their supply chain, they have implemented a fair wage policy, ensuring that employees receive equitable compensation for their work, recognizing the importance of ethical employment practices and continuously striving to uphold labor rights and improve working conditions.

Co-funded by the European Union

Almeda is also engaging with local communities in the regions where their production takes place, participating in initiatives that contribute to social and economic development occasionally. Providing a safe and healthy working environment for the employees is a priority. While they are currently partially compliant with safety standards, the company responded that they are actively working toward enhancing workplace safety measures, ensuring that all employees operate in a secure and well-regulated environment.

Supply Chain and Procurement

Supply chain management refers to a company's relationship toward upstream (raw material) and downstream (distribution) processes, which in the textile industry are highly complex and involve complex local and international networks (Harsanto et al., 2023). The textile and apparel (T&A) supply chain consists of a wide variety of raw materials, facilities for ginning, spinning and extrusion processes, processing facilities, weaving, knitting sectors and garment manufacturing for supplying products to a vast distribution channel. The T&A supply chains are one of the most diversified regarding usage of raw materials, technologies/techniques employed and the production of final products (Raut et al., 2019). Almeda Textile PLC is responsible for sourcing the raw material and ensuring sustainability throughout the supply chain. The source of some of the raw materials are from certified sustainable sources, including internationally recognized certifications such as GOTS (Global Organic Textile Standard), Fair Trade, and OEKO-TEX, which guarantee environmental and social responsibility in textile and garment production.

To enhance supply chain transparency, they have implemented traceability systems that track materials from their source to the final product. This process enables us to verify ethical sourcing, ensure compliance with sustainability standards, and maintain accountability at every stage of production.

Additionally, the company rigorously assesses the sustainability of their suppliers through regular sustainability audits and certification evaluations. To ensure suppliers adhere to environmental, ethical, and social responsibility standards, Almeda requires their suppliers to hold recognized sustainability certifications, such as ISO, GOTS, and OEKO-TEX, to validate their commitment to responsible sourcing and eco-friendly practices.

Product Lifecycle and Consumer Engagement

The products of Almeda Textile PLC are designed to be recyclable and reusable to ensure minimal waste at the end of their lifecycle. The company engages consumers in sustainability by providing clear product information on sustainability efforts through labels and their website. Additionally, they have implemented design improvements to

Co-funded by the European Union

enhance sustainability, such as optimizing material use to reduce waste during the fabric cutting process.

=Innovation and Future Goals

Almeda Textile PLC is planning to advance sustainability through continuous investment in R&D for sustainable textile innovation, ensuring ongoing improvements in eco-friendly production. The future sustainability goals include achieving carbon neutrality, becoming a zero-waste operation, transitioning to 100% renewable or sustainable materials, increasing product circularity through closed-loop systems, and enhancing worker welfare and supply chain transparency. To track the effectiveness of the sustainability initiatives, they conduct regular sustainability audits, allowing to continuously refine the company sustainability strategies.

Challenges and Barriers of Almeda Textile PLC

Implementing sustainable practices in the textile industry presents several challenges that impact the ability to transition fully toward environmentally responsible production. One of the primary obstacles Almeda Textile PLC faces is the high cost of sustainable materials, which makes it difficult to maintain affordability while ensuring eco-friendly sourcing. Additionally, there is a lack of a skilled workforce, as specialized knowledge and expertise in sustainable textile production remain limited. This challenge is further compounded by limited supplier availability for sustainable materials, restricting the ability to source the necessary raw materials consistently and cost-effectively.

Technological barriers also pose a significant challenge for Almeda Textile PLC, as the transition to more energy-efficient and low-impact manufacturing processes often requires advanced technology, which may not be readily available and economically viable for immediate implementation. Moreover, the lack of consumer demand for sustainable products creates market uncertainty, making it difficult to justify large-scale investments in sustainability without strong assurance of returns. Furthermore, regulatory challenges add complexity to the company sustainability efforts, as varying policies and compliance requirements across different regions create obstacles in standardizing sustainable practices throughout the supply chain.

To overcome these challenges and accelerate the transition to sustainability, Almeda Textile PLC requires greater support from government incentives and regulations that encourage eco-friendly production through financial assistance, tax benefits, and policy alignment. Additionally, better access to sustainable materials and technologies would allow the firm to implement greener alternatives more efficiently and affordably.

Co-funded by the European Union

Education and training programs for employees and suppliers are also essential in developing the necessary expertise to drive sustainable innovation within the industry workforce and the supply chain. Finally, increased consumer demand for sustainable products would create stronger market incentives, encouraging businesses to invest more in environmentally friendly practices and ensuring that sustainability becomes a fundamental industry standard rather than a niche market trend.

4.2.9 Sustainable Practice Adopted by MAA garment and textile

Background of MAA Garment and Textile

The company KEBIRE ENTERPRISES is a privately owned company established and registered in April 2001, under the commercial laws of the Federal Democratic Republic of Ethiopia. MAA Garment and Textile Factory, established in June 2004 in the northern part of Ethiopia-Mekelle is wholly owned by Kebire Enterprises Plc(MAA Garment & Textiles (Kebire Enterprises PLC.)Latest Profile Video - YouTube, n.d.).

Figure 4.2.11. The company building (MAA Garment - Home, n.d.)

Co-funded by the European Union

The factory is fully equipped with state of art production facilities acquired from the most reputable manufacturers of the world such as JUKI, Japan sewing machines. The newly established project (MAA TEXTILE) which comprises Spinning, Knitting, dyeing & finishing is started since 2007. Kebire Enterprises PLC (Maa Garment & Textiles) produces both woven & knitted garments. It is designed to produce Men's shirts & women's blouses, trousers for men from light, medium & heavy weight & sets of jeans trousers & jackets.

Some of the main products are Suits, Shirts, Trousers, T-shirts, Polo shirts, Jackets, Dresses & blouses, Gowns, Trousers, Overall & others. The vision of MAA garment and textile is to become an exemplary organization in both the local and international textiles and apparel markets with a mission is to realize vision by generating a reasonable return to the shareholders through proper utilization of resources and continuous customer satisfaction (MAA Garment - Home, n.d.).

According to an official report of Ethiopian Textile industry development institute, while still performing far under its plans, MAA garment and textile factory is one of the top contributors of the hard currency earnings of the country. This is evident from the fact that the company has been among the top five factories that contributed to the export of the country between 2015 and 2017. Following the operationalization of the Industrial Parks in different parts of the country, especially that of Hawassa, more FDIs have joined the sector's investment and MAA garment, and the textile factory has once again shown its competitiveness (Woldeyohannes & Alebachew, 2020).

Maa Garment and Textiles has a strong commitment to environmental sustainability, leading impactful green initiatives and pioneering eco-friendly manufacturing practices. Through its flagship program, the company actively promotes sustainability education and conservation efforts to create a greener future.

Social and environmental responsibility: - the company supports community social development programs and protects the environment and the natural resources where the company does their business. The company is involved in many social responsibilities and complies with international social and technical compliance standards as witnessed by WRAP, OEKO-TEX and BSCI (MAA Garment - Social Compliance, n.d.) (MAA Garment - Technical Compliance, n.d.).

Co-funded by the European Union

Figure 4.2.12. Certificates of Compliance MAA

The Business Social Compliance Initiative (BSCI) is a leading supply chain management system with a Code of Conduct that supports companies to drive social compliance and improvements within the factories and farms in their global supply chains. BSCI provides companies with a social auditing methodology and report. It provides a framework for companies to assess and enhance social compliance within their supply chains by promoting ethical business practices and respect for workers' rights. BSCI focuses on labor standards, worker safety, and fair working conditions (MAA Garment - Social Compliance, n.d.).

SMETA stands for SEDEX Members Ethical Trade Audit and is one of the most widely used ethical audit formats in the world. It combines the best practices in the field of corporate social responsibility. SMETA audits can be conducted against either two or four pillars, depending on the needs of supply chains. The two mandatory pillars are Labor Standards and Health & Safety. The two additional pillars of a 4-pillar audit are Business Ethics and Environment.

Compliance with national and international labor laws: the company considers its workers to be the key secrets of our business and to its effect, the company will comply with both the international and national labor standards (MAA Garment - Social Compliance, n.d.).

4.3 Uganda

In Uganda, two textile mills were contacted. Fine spinners Uganda Limited and TEXFAD.

4.3.1 Fine spinners (U) Limited

Co-funded by the European Union

Fine spinners (U) Limited, was commissioned in 2014 after a take over from Phoenix Logistics (U) Limited. It is one of the two vertically integrated textile mills in Uganda located at Bugolobi, Kampala, Uganda. Their business model is based on production of 100% organic cotton t-shirts as well as blends. It employees more than 1800 employees, majority of which are youths and women.

Sustainability practices at Fine spinners (U) Limited

Sustainability at Fine spinners starts with farmers who supply the mill with cotton as their prime raw material. All cotton bales supplied by farmers are Cotton made in Africa (CmiA) branded and certified. CmiA is an internationally recognized standard for sustainable cotton from Africa. Since 2005, CmiA has been committed to protecting the environment while improving working and living conditions for smallholder farmers and ginnery. With more than 750,000 tons of ginned cotton harvested annually, about 900000 smallholder farmers involved, and 66 trading pattern, CmiA standards include sustainability criteria for cotton, with independent auditors regularly monitoring for compliance. As soon as CmiA branded bales arrive at the facility, several practices have been put in place at every stage of production to ensure sustainability at Fine spinners. These include;

- Blowroom - reusing the machine rejects as input raw cotton, sort bale wires to recyclers, reusing bale covers to cover waste bales.
- Spinning - the rejected material which cannot be reused is collected in its category, and cumulatively sold to people who are use it for cleaning, stuffing furniture, among other applications.
- Knitting – Fine spinners ensures that production is order based. It also does maintenance of machines to ensure that the fabric is knitted to the required specifications.
- Wet processing – use of eco-friendly dyes and chemicals to promote dyeing at low temperatures and quality dye fixation. As a result, the load on the effluent to be treated remains low.
- Garment construction – Fine spinners deploys of Computer Aided Design (CAD) which allows the company to maximize fabric usage with the least amount of offcuts generated during cutting as well as amount of trimmings during stitching..

4.3.2 TEXFAD

Uganda is one of the world's largest banana producers and a world leader in banana consumption. However, after the harvest, banana stems are usually discarded as waste.

Co-funded by the European Union

TEXFAD textile industry located in Mukono district, focuses on sustainable and biodegradable textile production, transforming waste banana pseudo stems and other waste materials into high quality sustainable and biodegradable handwoven textile products. Such products include banana fibers, banana fabric, banana fiber handicrafts, banana fiber covers for eye glasses, among others (Figure 4.3.1). Their mission is to mitigate waste, promote sustainability, and empower local Ugandan communities through vocational training.

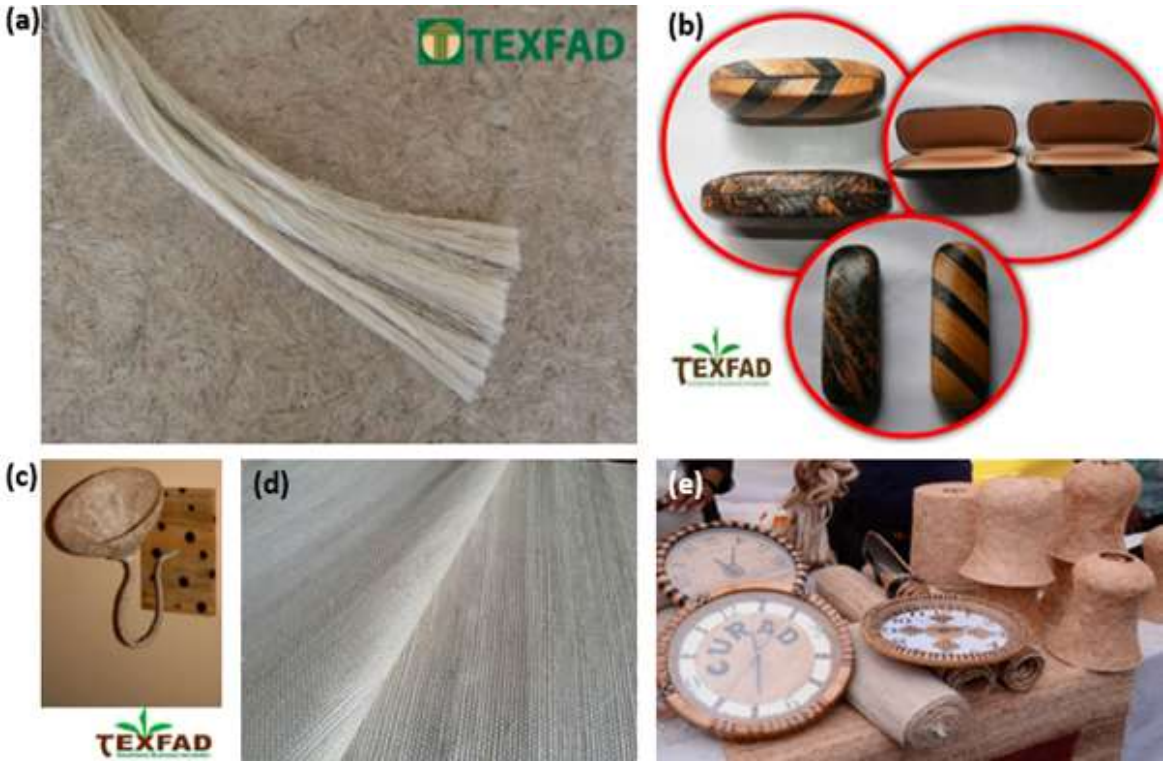

Figure 4.3.1: Sustainable green products from banana fibers developed by TEXFAD. (a) Extracted banana fiber, (b) banana fiber eye covers, (c) banana fiber lump shade (d) hand woven banana fabric (e) assortment of banana fiber handicrafts, TEXFAD website

Co-funded by the European Union

4.3.3 TEXDA (Textile Development Agency)

Figure 4.3.2: TexDa website

Background

TEXDA is a cottage industry and SME based in Ntinda, Kampala, specializing in handwoven textiles, batik fabrics, and handmade home décor items. The business promotes traditional textile techniques while incorporating sustainable innovations.

Sustainability practices

1. **Use of natural and locally sourced materials**
    - TEXDA primarily works with banana fiber, organic cotton, and plant-based dyes, reducing reliance on synthetic materials.
    - Supports local farmers and artisans by sourcing raw materials within Uganda.
2. **Low-carbon production methods**
    - Utilizes handweaving and traditional fabric-making techniques, reducing reliance on industrial energy-intensive processes.
    - Promotes solar-powered dyeing and drying methods, cutting down on fossil fuel usage.
3. **Waste reduction and upcycling**
    - Repurposes fabric scraps into accessories, rugs, and reusable shopping bags, reducing landfill waste.
    - Works with local designers to promote upcycling and sustainable fashion trends.
4. **Empowering women and youth in sustainable textile production**

Co-funded by the European Union

- Provides training programs for women and young artisans, equipping them with skills in sustainable textile manufacturing.
- Focuses on small-scale production and fair-trade models, ensuring artisans receive fair wages.

Impact

- Preserves Uganda's rich textile heritage by promoting handmade, eco-friendly textiles.
- Creates jobs for women and artisans in rural and urban areas.
- Reduces textile waste and environmental harm through upcycling and sustainable materials.
- Enhances Uganda's green economy by producing environmentally friendly textile products for local and export markets.

4.3.4. Southern Range Nyanza Limited – Uganda's largest textile manufacturer

Figure 4.3.3: Southern Range Nyanza

Background

Southern Range Nyanza Limited (also known as Nytil) is Uganda's largest textile and garment manufacturing company, located in Jinja. Established in the 1950s, the company produces fabrics, school uniforms, corporate wear, and military clothing.

Sustainability Practices

1. **Vertical integration for sustainable production**
    - Controls the entire textile value chain from fabric production to garment manufacturing, ensuring sustainability at each stage.

Co-funded by the European Union

- Reduces Uganda's dependence on imported fabrics, promoting local value addition.

2. **Eco-friendly production methods**
   - Implements wastewater treatment systems to prevent pollution from dyeing processes.
   - Invests in energy-efficient machinery, reducing carbon emissions and water consumption.
   - Uses natural fiber blends to minimize reliance on synthetic materials that contribute to environmental degradation.
3. **Sustainable labor and economic impact**
   - Employs thousands of Ugandans, ensuring fair wages and safe working conditions.
   - Provides training programs for textile workers, encouraging skill development in sustainable manufacturing.
4. **Recycling and circular economy initiatives**
   - Repurposes fabric waste into lower-grade textiles for secondary markets.
   - Supports initiatives to upcycle and recycle textile waste into usable products such as mats and reusable bags.

Impact

- Strengthened Uganda's textile sector by reducing reliance on imports.
- Reduced industrial waste and pollution through wastewater management.
- Created sustainable employment for thousands of Ugandans.

These cases of large-scale industry and SME/cottage industry demonstrate how different textile businesses in Uganda are adopting sustainability. Nytil integrates industrial sustainability through wastewater treatment and energy efficiency, while TEXDA focuses on low-carbon, traditional weaving and natural fiber textiles. Such initiatives are crucial for making Uganda's textile industry more eco-friendly, competitive, and sustainable.

Co-funded by the European Union

5 Opportunities and Global Sustainability practices

In this section we focus on global best practices in sustainable and circular business models within the textile industry. We consider case studies and initiatives worldwide.

5.1 EU Green Deal and REACH

5.1.1 EU Green Deal

Europe and the rest of the world, face an existential threat from climate change and degradation of the environment. The **European Green Deal (EGD)** will try to turn the EU into a modern competitive economy and resource-efficient, ensuring (European Green Deal, 2020): a) no net emissions of greenhouse gases by 2050, b) economic growth decoupled from resource use, and c) no person and no place left behind. Additionally, it is an essential component of the EU's strategy to fulfill the **2030 Agenda for Sustainable Development** (Fetting, 2020).

On December 11, 2019, Commission President Ursula von der Leyen introduced the EGD, the current European Commission's Flagship Initiative. It consists of several programs, plans, and laws that are meant to work together to improve the European economy and society in a fair, sustainable, and inclusive way. It was crucial that the climate issue and other ecological crises not be ignored, even while Europe was dealing with significant difficulties related to the COVID-19 pandemic. One may even argue that the potential to expedite a sustainable change was presented by the recovery from the COVID-19 catastrophe. Accordingly, many of the measures suggested in the EGD are reinforced by the European Union's recovery plan, "Next Generation EU," which was enacted in July 2020. The EGD is funded with one-third of the €1.8 trillion investments from the EU's seven-year budget and NextGenerationEU Recovery Plan (European Green Deal, 2020).

Decoupling economic growth from resource usage and achieving a net carbon neutral European Union by 2050 are the primary objectives of the EGD (European Commission, 2020). The EGD is a comprehensive policy strategy that outlines the objectives and aims in many policy sectors; it is not a law in and of itself. Over the coming years, new laws and directives will be created and put into effect, and current standards and regulations will be updated. The Green Deal is divided into eight main areas (Figure 5.1.1):

1. Increasing the EU's climate ambition for 2030 and 2050
2. Supplying clean, affordable, secure energy
3. Mobilising industry for a clean and circular economy
4. Building and renovating in an energy and resource efficient way

Co-funded by the European Union

5. A zero-pollution ambition for a toxic-free environment
6. Preserving and restoring ecosystems and biodiversity
7. Farm to Fork: a fair, healthy and environmentally friendly food system
8. Accelerating the shift to sustainable and smart mobility

Figure 5.1.1: The European Green Deal and its eight key areas. Source: European Commission 2020.

The shift to a green, climate-neutral economy will be made possible by the Sustainable Europe Investment Plan (Figure 2). According to European Commission, 2020, the Plan will use the EU budget to raise at least EUR 1 trillion in sustainable investments over the course of the following ten years. Climate and the environment will receive a larger share of public spending in the EU budget than in the past. Through guarantees, it will attract private investment, and through the Just shift Mechanism, it will facilitate public sector investments in the areas most impacted by the shift, contributing to a just transition.

Secondly, it would provide a structure that will facilitate both the public sector and private investors. It will seek to guarantee an economical, equitable, and socially balanced transition. To correctly identify sustainable investments, financial institutions and private investors must have the necessary instruments. Specifically, the EU taxonomy, the first principle of energy efficiency, and sustainability proofing will be crucial in maximizing their potency. The European Semester, the Environmental Implementing Review, the Energy

Co-funded by the European Union

Union's National Energy and Climate Plans, and the plans mandated by sectoral environmental laws (such as those pertaining to waste, water, biodiversity, and air) will enable the public sector to accurately determine the needs for investment.

Third, the Plan would offer customized assistance to project promoters and public administrations in selecting, organizing, and carrying out sustainable projects. Direct assistance to public and private project promoters will be strengthened, as will help for public authorities in determining the financial needs and planning the next investment.

Third, the Plan will provide tailored support to public administrations and project promoters in identifying, structuring and executing sustainable projects. Support for public authorities to assess the financial needs and plan the subsequent investment as well as direct support to public and private project promoters will be reinforced.

Figure 5.1.2: The Sustainable Europe Investment Plan. Source: European Commission 2020.

5.1.2 REACH

Key factors

The European Commission plays a crucial role in ensuring the implementation of legislation and directives related to the use of chemicals. It also adopts the following

Co-funded by the European Union

measures for the updating and completion of the REACH Regulation: authorization decisions, new restrictions to address risks from specific substances, the establishment of testing methods, and the determination of fees that companies pay to the European Chemical Agency (ECHA) (European Chemicals Agency, 2025).

ECHA is based in Helsinki, Finland, and was established in 2007 as the driving force behind the implementation of the REACH Regulation. The main responsibilities of ECHA are:

1. 1The effective management of the technical, scientific, and administrative aspects of REACH.
2. Providing information about the REACH Regulation to companies and the general public (also through its website, where a wide range of information is available, including legislative texts, summaries of legislation, press material, brochures, guidance documents, FAQs, and links to the national helpdesk).
3. Developing IT tools and guidance documents to support industry and public authorities in fulfilling their obligations under the REACH Regulation.
4. Managing publicly available databases covering hazardous properties, classification, and information on the safe use of registered substances.

National authorities are required to enforce the REACH Regulation through official inspections, audits, and sanctions in cases of non-compliance. Additionally, they exchange information and coordinate enforcement activities through the Forum for Exchange of Information on Enforcement (Forum).

The competent authorities for the REACH and CLP regulations are called CARACAL and consist of a group of experts who advise the European Commission and ECHA on matters related to the implementation of the REACH and CLP regulations (the regulation on classification, labeling, and packaging) (Stewart, 2012).

REACH Regulation (EC 1907/2006)

The REACH Regulation (EC 1907/2006) is an EU regulation aimed at continuously improving the protection of human health and the environment from risks that may arise from chemicals while also enhancing the competitiveness of the chemical industry within the EU. Additionally, the REACH Regulation promotes alternative methods for assessing the hazards of substances, with the goal of reducing animal testing. It also prioritizes the gradual phase-out of some of the most hazardous chemicals in products once suitable alternative substances are found to replace them. This is achieved through the application of the four REACH processes: registration, evaluation, authorization, and restriction of chemicals (Georgiou et al, 2019).

Co-funded by the European Union

The European REACH Regulation was established in December 2006 and came into force in June 2007, replacing the previous EU chemical legislation framework. The regulation affects nearly every product manufactured or imported into the European Economic Area (EEA), covering not only chemicals used in industrial processes but also those present in everyday consumer products. As a result, REACH applies to a wide range of businesses across various sectors beyond the chemical industry, influencing the use and sale of an extensive variety of goods, including industrial products, cleaning products, clothing, furniture, household appliances, and more. Thus, the responsibility for assessing and managing the risks associated with chemical substances lies with industry rather than public authorities. Furthermore, industries are responsible for providing appropriate safety information to users and consumers (Penman et al., 2015).

Below are some key definitions to facilitate the implementation of REACH and ensure a common communication framework between regulatory authorities and businesses:

- Article (object): An object that, during production, is given a specific shape, surface, or design, which determines its function to a greater extent than its chemical composition.
- Substance: A chemical element and its compounds in their natural state or obtained through any manufacturing process, including any necessary additives for maintaining its stability and any impurities resulting from its production process, but excluding any solvent that can be separated without affecting the stability or composition of the substance.
- Mixture (formulation): A combination of two or more substances in which each substance retains its individual chemical properties.
- Producer of articles: Any company that manufactures objects within the EU, regardless of how the objects are produced or where they are marketed.
- Importer of articles: Any company based in the EU that imports objects from countries outside the EU.
- Suppliers of articles: Any company (including producers and importers of objects) that makes objects available on the EU market.

Registration of Substances

According to REACH, manufacturers and importers are required to register their substances with ECHA. This obligation applies to both pure chemical substances and those contained in mixtures. However, a different registration regime applies to substances in articles. Without the registration process, chemical substances cannot be manufactured or imported into the EU (Führ and Bizer, 2007).

Co-funded by the European Union

All businesses that produce or import chemical substances into the European Economic Area (EEA) in quantities exceeding one ton per year must register these substances with ECHA and demonstrate their safe use. Manufacturing companies must compile a registration dossier, which includes information on the physicochemical properties of the specific substance, as well as properties related to environmental and human health.

Additionally, businesses that produce or import a chemical substance in quantities exceeding 10 tons per year are required to conduct a Chemical Safety Assessment (CSA) and prepare a Chemical Safety Report (CSR). Subsequently, ECHA evaluates each registration for compliance and determines whether the hazards of the substance can be adequately managed. If a risk cannot be managed, the authorities may either ban the substance from the market or restrict its use (Betton, 2007).

Evaluation of Substances

After the submission of registration dossiers, ECHA evaluates them to verify whether they comply with the REACH regulation and to determine if the registered substances pose a risk to human health or the environment (Kemmlein et al., 2009).

Additionally, ECHA must assess the testing proposals submitted in the dossiers to ensure:

- The avoidance of unnecessary testing (especially on animals) in the evaluation of chemical substances.
- The availability of sufficient information.
- Furthermore, once the evaluation is completed, authorities may select substances for further investigation if there are concerns regarding their safety.

Authorisation of Substances

The goal of the authorisation process is to ensure the **gradual replacement** of **Substances of Very High Concern (SVHC)** with **less hazardous substances or technologies** that provide more technically and economically feasible alternatives. The authorisation process can be divided into three stages, described below (Warhurst, 2006).

Stage I

Under the **REACH regulation**, the **SVHC list** includes substances that require special attention due to their harmful effects on **human health and the environment**. Initially, a proposal to identify a substance as **SVHC** is drafted by **Member States or ECHA**, based on specific data and information regarding:

- The quantities of the substance on the **EU market**.

Co-funded by the European Union

- Its **uses**.
- Possible **alternative substances** for its substitution.

If a substance is identified as **SVHC** (following a **45-day consultation** after the proposal submission), it is then included in the **Candidate List** (Zachary et al., 2014).

The inclusion of a substance in the **Candidate List** imposes **specific obligations** on its suppliers, according to **Article 33** of REACH (Stewart, 2012):

- **Notification and registration** with **ECHA** when importing an SVHC chemical under the following conditions:
  - The substance is present in **concentrations ≥ 0.1% w/w** (by weight) at the article level.
  - The total quantity of the substance is **1 tonne or more per year**.
  - **Human or environmental exposure** occurs under normal or expected use.
  - The substance has **not already been registered**.
  - **Six months have passed** since the substance was added to the Candidate List.
- **Communication with customers or downstream users** when an SVHC:
  - Is present in an article at a **concentration of ≥ 0.1% w/w**.
  - Is **immediately added to the Candidate List**.
- **Communication with end users** upon request, **within 45 days**.

Stage II

ECHA **regularly reviews** the substances included in the **Candidate List**, enabling the **European Commission** to decide **which substances should be included in the Authorisation List** (Annex XIV) based on priority (Georgiou et al., 2019).

Priority ranking is determined by the information provided during **SVHC registration**, including **uses and quantities** of the substance. If, after thorough research, a substance **remains a threat**, it will be placed on the **Authorisation List (Annex XIV of REACH)**. This list includes chemicals for which **safer alternatives or substitutes are required**. Once a substance is included in **Annex XIV**, it **can no longer be placed on the market or used after a specific date (sunset date)** unless **authorisation is granted** or its use is **exempt from authorisation requirements** (Penman et al., 2015).

The inclusion of a substance in the **Authorisation List** comes with additional **requirements and obligations**:

Co-funded by the European Union

- **EU manufacturers** must **confirm that the substance is authorised** for use in their products.
- **For EU importers**, authorisation **does not apply**.
- **Communication with customers or downstream users** when an **SVHC**:
  - Is present in an article at a **concentration of ≥ 0.1% w/w**.
  - Is **immediately added to the list**.
- **Communication with end users** upon request, **within 45 days**.

Stage III

The **REACH regulation** allows companies to **apply for authorisation** to continue or start **using and selling substances** listed in **Annex XIV (Authorisation List of REACH)** beyond their **sunset date**. Companies must submit a **specific authorisation application**, which is assessed by **ECHA** to ensure compliance with all **requirements**. The application is then reviewed by:

- The **Risk Assessment Committee (RAC)**.
- The **Socio-economic Analysis Committee (SEAC)**.

Authorisations are granted for a **limited period** and are subject to **review**.

Restriction of Substances

EU Member States or the European Commission (through ECHA) can propose restrictions on the manufacturing, use, or placing on the market of substances that pose unacceptable risks to human health or the environment. Restricted substances are included in the List of Restricted Substances (Substances restricted under REACH) and can be found in Annex XVII of the REACH regulation. According to this regulation, all uses of substances listed in Annex XVII are prohibited, except for those explicitly exempted. Additionally, the restriction applies to all producers of articles, regardless of where they are manufactured (Georgiou et al., 2019).

5.2 SOFFA – Social Fashion Factory

SOFFA is a creative tailoring production studio based in Athens, Greece (https://soffa.gr/). It is a cooperative of fashion designers and professionals aiming to create sustainable fashion garments with great social and environmental impact. They support the global ecosystem of sustainable fashion brands and designers by offering them an ethical solution to manufacture their garments. Their customers are international sustainable brands and corporate merchandising for festivals and conferences.

Co-funded by the European Union

Their mission is to create a full eco-sustainable and circular fashion manufacturing studio, that targets:

a. the social inclusion and empowerment of women survivor victims of human trafficking and refugees through vocational training
b. in circular fashion principles and zero waste processes with recycles, natural, vegan and plant-based textiles that support environmental regeneration.

The legal entity is a work integration social cooperative. 90% of its shareholders are: refugees (60%) and unemployed Greeks (30%).

Soffa is unique because they are operating within the fashion world by tackling at the same time the four main issues of fashion:

- the environmental crisis and exploitation of resources;
- human rights, fair wage and working conditions;
- waste management and approach to resources,
- and the lack of action from existing fashion brands and institutions.

They have pioneered the Green Social Fashion Factory Solution, a humanitarian manufacturing process based on "Fashion Production Islands" to help break the inhumane paradigm of working conditions in assembly-line production units.

They provide B2B service of fashion production for: a) International private labels & designers, b) Festivals and events, c) Commercial producers, d) Multinational brands and high street chains. They offer their **customers a garment that has a strong social and environmental footprint** and the tools to communicate their choice, in a full production package. SOFFA adopts a slavery-free due diligence process for the prevention of modern slavery in all tiers of its supply chains from farming to weaving. It employs recycled, plant-based or local Greek clean cotton raw materials and it implements zero-waste manufacturing processes.

SOFFA is also partner of the FABRIX project that has received funding from the European Union's Horizon Europe Programme, under grant agreement No. 101135638 (https://www.fabrixproject.eu/about). Two extremely different cities—Rotterdam, Netherlands, and Athens, Greece—are used as case studies in this EU-funded research. They identify needs, create a community, and integrate services in an innovative and interactive platform called MANTEL that supports a more local, circular, regenerative, and ethical manufacturing and consumption process. They do this by collaborating with representatives from the various sectors that comprise the textile and clothing industry, from student designers to established textile producers and everyone in between. Their

Co-funded by the European Union

strategy includes creating a network of collaboration between producers, designers, legislators, and academic institutions. They want to spark a thorough overhaul of the T&C industry in Athens and Rotterdam by encouraging ethical behavior, supporting the creation of sustainable materials, and advancing circular business models. Other towns and industries will be able to use the tools and techniques and modify them to fit their own needs.

5.3 COMO S.A

COMO S.A., based in Thessaloniki, Greece, has been a leading manufacturer of materials for the mattress and furniture industry since its establishment in 1995. With nearly three decades of experience, they have built a strong reputation for delivering high-quality products that meet industry standards and customer expectations. Como exports to more than 30 countries worldwide. Our participation in international trade fairs allows us to stay updated with global market trends and build strong relationships with partners and customers around the world.

Como manufactures high-quality materials by following rigorous safety procedures and using premium raw materials. Their product range is derived from two primary production methods:

- Needled (Needle Punched) Process
- Thermobonded Process

Their products vary in weight, ranging from 100 gr/m² to 1600 gr/m², and are available in rolls or customized cut sizes. Each product is designed to meet high-quality standards, ensuring tensile strength, cohesion, and stability to fulfill the needs and requirements of every customer.

Environmental responsibility is at the core of COMO business philosophy. They are dedicated to producing ecological and environmentally friendly materials that are recyclable and sustainable. By adhering to strict environmental policies, they ensure that their manufacturing processes minimize waste and promote sustainability. Also, COMO demonstrates its commitment to sustainability through adherence to international and European standards. The company has obtained various certifications, ensuring that its products meet stringent safety and hygiene requirements. This compliance reflects COMO's dedication to maintaining high-quality production while minimizing environmental impact. Additionally, COMO S.A. has been recognized among "The Most Sustainable Companies in Greece 2024," highlighting its holistic approach to sustainable development. This acknowledgment underscores the company's efforts in monitoring the effects of its operations in line with Environmental, Social, and Governance (ESG) criteria.

Co-funded by the European Union

Through these initiatives, COMO S.A. exemplifies a strong commitment to sustainability, balancing quality production with environmental responsibility.

5.4 reCURE - A roadmap to smart reusable healthcare

reCure was a project to help the transition towards reusable healthcare, with a focus on the business smarts of this transition. reCURE investigated the development and implementation of product reuse in this sector in order to ensure the conservation of raw materials and waste reduction. Due to risks to safety, hygiene, sterility and accuracy, innovations concerning reuse are difficult or impossible to enter the medical sector. A product must be technically reusable and cleanable. But sometimes even more important: medical staff and patients must also trust these products and want to (re)use them.

Non-invasive medical devices are a good starting point for the transition to circularity. This group includes medical textile products, such as aprons and drapes, which are the focus of this research. The challenge is to make “reusability” desirable and acceptable in the sector and in addition, the focus is also on the possibility of further optimizing these reusable products in terms of functionality and introducing intelligence, which is usually not feasible for disposable products that mainly focus on price.

Figure 5.4.1: 60 disposable versus one reusable gown

In order to reach the goal of reusable products in healthcare, innovation is needed, and this will only be a success if it falls in the **innovation crossroad**. Here the 4 domains of innovation intersect.

Co-funded by the European Union

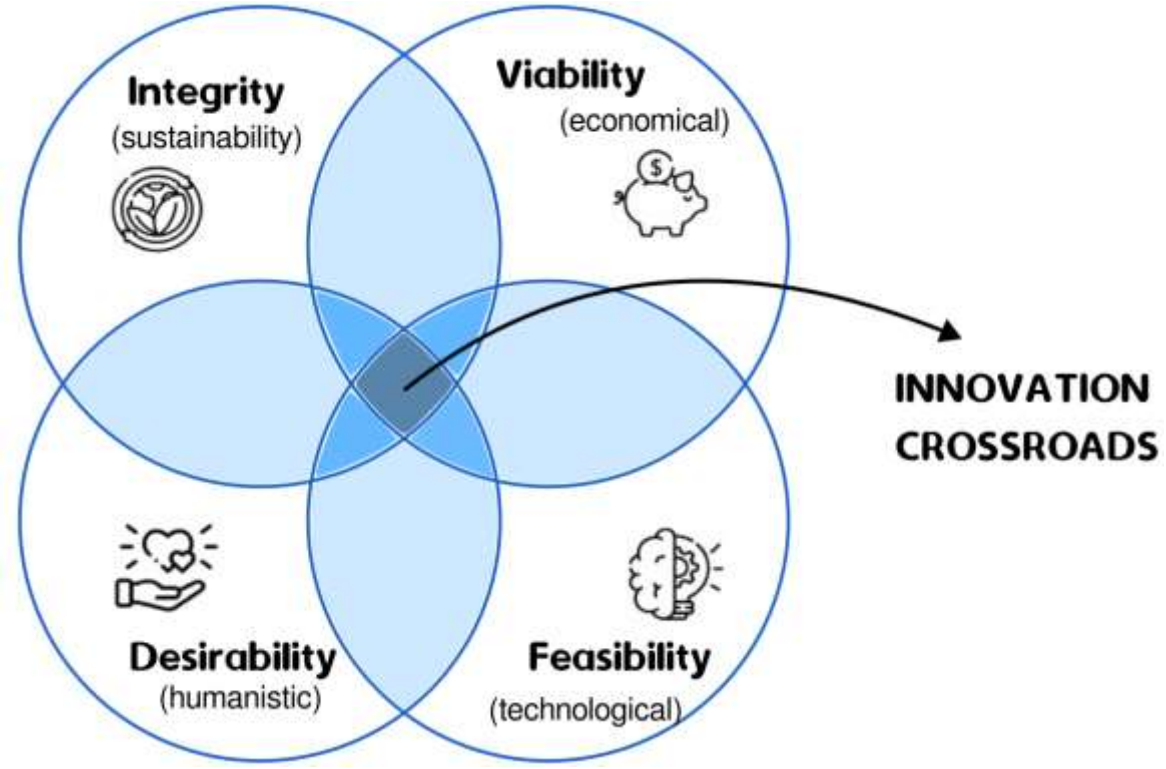

Figure 5.4.2.: The innovation crossroads includes four themes: human desirability, economic viability, sustainable integrity and technological feasibility

10. R-ladder and Circular strategies

The ecological footprint of healthcare institutions in Belgium amounts to 5.5% of the national ecological footprint (Karliner et al., 2019). For Belgium, it is estimated that around 90,000 tonnes of waste comes from healthcare. Healthcare institutions include psychiatric institutions, residential care centres and institutions for disabled care, but hospitals have a disproportionate impact in this group due to their size, energy-intensive processes, consumption of raw materials and waste production. There are 107 hospitals in Belgium. 20% to 30% of hospital waste comes from the operating room (Wu & Cerceo, 2021). This is mainly because large numbers of single-use products are used in the operating room, although it has already been demonstrated that these have a greater impact on the environment in both production and use (Drew et al., 2022a). Focusing on preventive wellbeing and healthcare also means tackling climate issues. Sustainability and healthcare are inextricably linked, especially given that climate change poses a huge health risk.

In order to be more sustainable, healthcare institutions will have to move away from the linear economy and focus on circular strategies. A linear economy moves in a straight line. We extract raw materials, process them into a product that is often discarded as waste after use. In a circular economy, we close this line into a circle and raw materials remain in the chain.

Co-funded by the European Union

These circular strategies can be presented using the R-Ladder (see Figure), which indicates the degree of circularity. The higher up the ladder, the rawer materials are saved.

- **R1 Refuse and Rethink**, can be achieved by moving away from unnecessary products or intensifying product use. Redesigning a product with circularity as a starting point is part of this. This can be done differently or redesigned so that the adapted product has a longer lifespan (or can be used better). Possible adjustments are a better modular construction and production from sustainable materials. An example where R1 is applied is a drinks machine that makes healthy carbonated soft drinks, using tap water.
- **R2 Reduce** refers to the more efficient use of raw materials. An example of this is a dispenser design that creates awareness around the use of disposable gloves, so that they are only taken when really necessary.
- **In R3 Reuse** products are being reused, here, designing for lifespan extension plays an important role in facilitating the highest possible quality reuse. This means that the product is reused in its entirety, in the same function by the same or another user, e.g., purchasing reusable insulation jackets or blankets instead of the disposable version.
- **R4, R5, R6, R7 Repair, Refurbish, Remanufacture and Repurpose** involves the repair and maintenance of the product, but also giving a new function to its components, such as ecoline from Siemens does. Here, vision systems are repaired by an OEM and put back on the market in an as-good-as-new condition.
- **R8 Recycling** is the processing of materials into raw materials in order to be able to reuse them for new applications. With downcycling, the raw material no longer achieves the same purity as the original raw material and can no longer be used for the same function, such as downcycling the polypropylene blue-wrap to package instrument sets into filling for car upholstery or plastic garden benches.
- **R9 Recover** is the lowest step on the ladder and involves the incineration of materials with energy recovery. In a circular economy, as few products or materials as possible end up in this step.

Implementing the higher R strategies has other advantages besides an ecological impact. For example, it can minimize the unpredictability of the purchase of new materials. Think of fluctuating purchase prices, long waiting times or products that are no longer in stock, for example because materials only have to be purchased once or leased and there is a return logistics in place that makes reuse possible.

Co-funded by the European Union

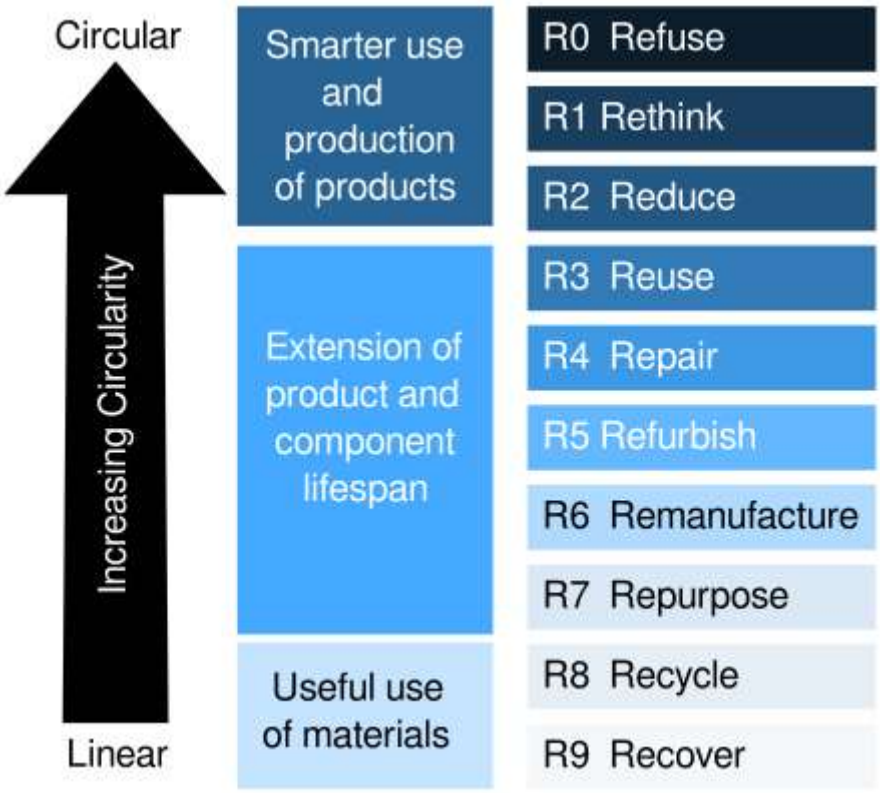

Figure 5.4.3: Visual representation of the R-ladder (Adapted from Flemish Government, 2023)

11. Sustainable entrepreneurship

Corporate Social Responsibility (CSR) means that organisations voluntarily pursue improvements in business operations in economic, social and ecological areas. We have already discussed the latter, but the goods and services must also generate added value. It is common knowledge that business model innovation is a driving force for making the transition to a circular economy. For the medical sector, the circular strategies of the R-Ladder have been translated into 9 possible Circular Business Models (CBM) that can be applied or provide inspiration (Guzzo et al., 2020a). Various value chain partners will have to work together to successfully set up these CBM. The CBM are divided over 9 Circular Business models, they are given in Table 5.4.1.

Table 5.4.1. The 9 Circular Business models

Circular Business Model	Description
CBM 1. Full maintenance equipment-as-a-service	In this model, for example, medical devices are rented or leased and the manufacturer provides a full service in the form of calibration, maintenance and repair. In addition, training and updates of the device can also be part of the service. The healthcare institution has continuous certainty about the presence and functioning of the

Co-funded by the European Union

	equipment.
CBM 2. Hospital Life Cycle Maintenance Services	In this model, services are provided on a contract basis to healthcare institutions that are responsible for the maintenance of the equipment. This maintenance can range from corrective to preventive maintenance. This will extend the lifespan of the equipment.
CBM 3. Support for reprocessing in hospitals	This model relates to the provision of materials and services to enable reprocessing of medical equipment in the hospital. This can be done at various levels of disinfection, from surface cleaning to sterilization. The cost of reprocessing medical equipment is lower than using the disposable variant but is often complex due to the use of materials by this equipment.
CBM 4. Mobile solutions	In this model, complex or expensive medical devices are shared between different hospitals. A mobile unit or temporary building allows these devices to be deployed for a short period.
CBM 5. Platforms for equipment circulation	In this model, there are two different platforms that can be used to keep used medical equipment in circulation. A first platform can be based on the sale and purchase of used materials. Another type of platform can involve the rental of medical equipment. In both cases, success depends on the willingness of healthcare institutions to use equipment that has already been used.
CBM 6. Refurbished systems	In this model, medical equipment is offered in an as-good-as-new version. The service providers make a selection of products, perform software updates, check the operation, make cosmetic adjustments and reinstall the product. The service providers must be able to present a certificate showing that the product is ready for use again.
CBM 7. Full provision for reuse of medical devices	In this model, medical products with high criticality are initially disinfected and collected in the appropriate container at the hospital. Then a service provider or external sterilization facility will collect, verify, sort, reprocess, inspect and repack the products so that the products can be put back into circulation.
CBM 8. End-of-Life (EOL) resources collection	This model involves specialized recyclers dismantling collected medical equipment and taking responsibility for

Co-funded by the European Union

	removing functional parts to reuse them in other applications, removing data from the devices, and recycling non-functional parts. This can reduce waste costs for healthcare institutions.
CBM 9. Continuous collection of disposable items	In this model, disposables are collected and taken back by the producer or services are provided to recycle them. Due to the complexity of medical waste, this is not easy, but hospitals could make both an economic and environmental impact by collecting disposables instead of discarding them.

Transition to reusable medical textile products

Reuse of products in a healthcare organization can be organized in different ways. For each way of reuse, a chain of different players will be involved. This value chain must work together to bring the common goal of 'successful reuse of the product' to a successful conclusion. We have the following players: supply chain (pre-product, logistics, laundry, …), users (surgeon, patients, hospital, …), external stakeholders (government, standard organisations, …), which all must work towards a common goal. It is important that the value proposition of the partners in the value chain are aligned. Various existing tools or canvases can be used for thisL

1. Value proposition in the Business Model Canvas and ModelH canvas
   Every company can present its activities, relationships and cost structure using the Business Model Canvas (BMC) (Strategyzer, 2023). The BMC is a well-known, universal tool for describing, visualizing, examining or changing business models. Every partner in the value chain has its own unique BMC. The value proposition is only one of the 9 boxes, so every partner still has enough room to determine its own business operations. Do you want to further develop your own BMC, specifically for a healthcare context? Then you can apply the ModelH Canvas. The 9 boxes of the classic BMC have been expanded to 17 boxes that take into account, among other things, a purchasing service, intermediary profiles, external influences and IT systems. (Riley, 2013)
2. Value proposition in the Circular Business Models

   The value proposition is of course also present in the Circular Business Models (CBM) (Guzzo et al., 2020). Central to this CBM we see the value proposition that is divided into value for: people, planet and profit. To the left of the value proposition, you will find the value creation or activities of a company and to the right is value delivery or the relationships that a company enters into, both parts are built up from the same blocks as the BMC above. In the CBM, the financial

Co-funded by the European Union

aspect is omitted, so it can be filled in for (part of) the value chain that collaborates on, for example, the supply of a product.

3. The System Value Proposition

   Finally, the System Value Proposition tool (Jones & Van Ael, 2021, pp. 124–127) can be filled in by an entire value chain together. This tool can be used to propose the value proposition for larger systems where multiple parties experience benefits. There are three levels at which value can be created; individual (for all people), at the organizational level and societal. In addition, there are four dimensions that describe the economic, ecological, psychological and social value for the system.

For the value chain of a reusable medical textile product, the value chain will organize itself around the central, shared goal, or the reason for their collaboration: to realize successful reuse of a medical textile product. The value chain is located around this, the players each deliver value to another player in the value chain. Each player has its own, unique Business Model Canvas. In order to market a reusable medical textile product, one can map out the future, desired value chain. In doing so, one must consider how the product can reach the healthcare institution and which relationships or value transfer are required between the players in the value chain.

Considering reuse of medical textile products, reCURE worked out 4 reuse models.

1. Hospital-based reprocessing

   With hospital-based reprocessing, the healthcare institution itself provides for the reprocessing of the products. For products for which disinfection is sufficient, this can be done with disinfectant wipes at the medical service itself. If the products require more thorough cleaning or sterilization, the central services of the hospital, such as a laundry or sterilization department, can be called upon. Products such as a positioning cushion or blocks or arm and leg support of the operating table can be used for different patients in succession, provided that they are cleaned between each use.

2. Hospital-based reprocessing with tracking

   Unlike ‘regular’ hospital-based reprocessing, in the case of hospital-based reprocessing with tracking the products are linked to one fixed patient/user. This can be a product tailored to a patient, such as a radiotherapy mask. Such a mask is used to fix the patient to the face during radiotherapy so that the radiation can be directed very accurately. It is important that the product is stored and can be requested when the patient returns for his next therapy. A storage system is also required for sets of surgical instruments that tracks the set so that it can be linked to the patient/surgeon via a barcode or chip. This reuse model could also be used

Co-funded by the European Union

for a product on temporary loan, such as crutches that need to be cleaned or maintained regularly.

3. Product-as-a-service

   Most reusable textile products already fall under the product-as-a-service reuse model. Think for example of service clothing or bed linen, but also of reusable diapers or absorbent underlays (also called cellulose mats). These products are used by healthcare personnel or patients, after which they need to be washed. The next day, a new uniform or duvet is made up from the hospital's pantry. This reuse model works best if these products remain in circulation or in other words: when they do not remain unused in a cupboard. In this way, optimal use is made of the available products. Because healthcare institutions generally have a high consumption of these products, they call on an additional partner in the value chain. In the case of textile products, this partner is often a laundry that takes over tasks from the healthcare institution to a greater or lesser extent. This can vary from simply performing the core task, washing, to relieving the healthcare institution of the burden of textile logistics and stock management.

4. Product-as-a-service with tracking

   With product-as-a-service with tracking, an external reprocessor is used, but each piece of textile must also be traceable to a specific, personal user. With personal use of a product, there will have to be more pieces in circulation per user than when clothing can be shared. However, for some products there is a distrust or uncomfortableness to share them with others. This often concerns products that come into contact with intimate hygiene such as a face mask or incontinence underwear. Although the cleaning process is carefully controlled and can thoroughly remove all contamination, some users will feel more comfortable with personal use of these types of products.

These four reuse models each have their own advantages and disadvantages, but can exist perfectly well next to each other in one company and hospital. When switching to reusable products, you should not choose only one reuse model. The choice of the appropriate model usually depends on the available space, the staff, the responsibility you want/can take on, the volume of the product used, the type of product, the available/required infrastructure, etc.

5.4 Dr. Green - Utexbel

Utexbel, the Belgian market leader in textile production, launched in 2021 Dr Green - a new line of sustainable hospital clothing made from recycled textile products. Utexbel aims to make 15 to 20% of its production sustainable within a few years.

Co-funded by the European Union

Dr. Green is a fully circular product: used hospital clothing is transformed into fibres on an industrial scale, before being retransformed into finished hospital clothing. Utexbel is the first European player to deploy this process on an industrial scale. The company has deliberately chosen to keep production local and works on this product with Van Moer (workwear expert), the custom-made work company Arcor (textile processing), Terre (clothing recycling specialist) and Delorge, responsible for textile detangling.

Hospital clothing is usually made of 65% polyester and 35% cotton. After about a hundred washes, the fabric no longer meets the quality standards, so it is recycled to be reused as a basic raw material for the Dr. Green line. The clothing is "fiberized" by the partners. The fabric is reduced to fine fibers of about 25 millimeters long, mainly composed of polyester, because a large part of the cotton has disappeared from the fabric during the processing procedure. These fibers are compressed into bales that are delivered to Utexbel.

Utexbel uses the bales of recycled material to make new yarns. During spinning, organic cotton and recycled polyester are added. The fabric is then dyed in the desired colour and finished according to the customer's expectations. The finishing makes the fabric water-repellent, oil-repellent or fire-resistant, for example.

"We are particularly proud of this innovative process, which we are using on an industrial scale for the first time. We recycle 65% of the base material: this is unique in the sector," says Jean-Luc Derycke, R&D Manager at Utexbel. "Van Moer supplies the used hospital clothing. Terre and Arcor take care of cutting the textiles, after which Delorge untangles the fabric so that we can use the recycled fibres to make Dr. Green," explains Jean-Luc Derycke. For its part, Utexbel manages the circular chain and is responsible, together with Van Moer, for marketing the hospital clothing. Utexbel supplies Dr. Green to Van Moer, a specialist in corporate textile products, which then processes the fabric into specialised hospital clothing. “Public authorities are asking increasingly specific questions about the origin of the fabric in the context of tenders. More and more European hospitals want to know whether the production process and supply are sustainable,” says Arie Raijmakers of Van Moer.

Co-funded by the European Union

Figure 5.4.1: A Dr. Green product from utexbel for use in healthcare.

Vertical integration, short chain and minimal emissions

Utexbel is one of the last industrial textile companies in Europe to be vertically integrated: it takes care of the entire production process. “It is entirely possible to produce and recycle textile products in Europe on an industrial scale. We must continue to opt for innovation and focus on a short chain”, continues Jean-Luc Derycke. In the production of Dr. Green, the transport of the product to the different phases is limited to a minimum because the partners are not far from each other and are perfectly complementary.

The CO2 emissions of the production process of Dr. Green are 32% lower than those of conventional textiles. Water and energy consumption are also 84% and 42% lower, respectively. "Dr. Green is the answer to the climate challenge in our sector; reducing the ecological footprint is essential," says Johan Dewulf, sales manager at Utexbel.

The entire production process of Dr. Green is certified by the international Oekotex STeP label.

Ambitions: 15 to 20% of production, focus on exports

Utexbel aims to transform 1,000 tonnes of material into two million metres of fabric by 2025. For information, this would make it possible to manufacture 750,000 pieces of textile. With this production, Dr. Green will therefore represent 15 to 20% of Utexbel's production.

Co-funded by the European Union

"In this first phase, we supply 10 tonnes of material, the amount needed for 20,000 metres of fabric. Initial discussions with hospitals and partners are underway and the reactions are already very enthusiastic," says Johan Dewulf, Utexbel's sales director.

Utexbel is targeting the entire European market, but particularly neighbouring and Scandinavian countries as export outlets for Dr. Green. “We believe in the strength of this product and we are focusing specifically on markets that have an increased focus on sustainability and the short chain,” says Johan Dewulf.

Close the Loop – The Sustainable Development Goals

Dr. Green was previewed at the Close The Loop conference organised by Utexbel, dedicated to circularity. “This is one of the United Nations Sustainable Development Goals that we are working on at Utexbel,” explains Jean-Luc Derycke. The conference, honoured by the presence of 120 international partners, provided an opportunity to discuss ECO certification, traceability, human rights, social compliance and innovative fabrics. “For us, this conference was also an ideal opportunity to build partnerships in Belgium and beyond our borders. We spoke with end customers such as hospitals, but also laundry companies, waste treatment companies, confectioners, investors... Stakeholders such as the fire brigade and the Belgian army were also present,” concludes Johan Dewulf.

6 Conclusion

This report examines the textile industry in Kenya, Ethiopia and Uganda, with a focus on sustainability and the circular economy. The document aims to outline the current state of the industry, including trends, challenges, opportunities and existing regulations. The analysis includes case studies of companies implementing sustainable practices, with a focus on waste management, energy efficiency and ethical labour. It also looks at the implementation of sustainable cotton in the countries. The report provides an overview of EU initiatives, such as the Green Deal and REACH, and circular business models, such as SOFFA, COMO S.A., reCURE and Dr. Green.

From the report, the EU case demonstrates a proactive and well-funded approach to sustainability, driven by strong regulatory frameworks, government support, and strategic public-private partnerships. The focus on modern sustainable production methods, certification, and innovative ventures such as hospital waste recycling ensures continuous progress in sustainability efforts.

In contrast, African counterparts face significant financial and technical constraints, limiting their ability to implement advanced sustainability initiatives. The reliance on traditional sustainability practices and weaker public-private collaborations further

Co-funded by the European Union

hinders progress. Additionally, the lack of strong government support and consumer awareness poses further challenges.

Overall, the EU is positioned for long-term success due to its structured and well-supported sustainability initiatives, while countries in the global south struggle with financial and institutional barriers, relying more on conventional methods and expert partnerships to drive sustainability.

7 References

Abate T (1997) Pesticide use in Ethiopian agriculture. Pest Manag J Ethiop 1:35–39

African Development Bank. (2022). *Water sustainability in textile industries: Best practices.*

African Cotton and textile Federation. (2013). Policy Research on the Kenyan Textile Industry: Findings and Recommendations. Retrieved from https://agoa.info/images/documents/5264/ACTIF%20Report%20on%20Policy%20Research%20on%20the%20Kenyan%20Textile%20Industry_Margaret%20Chemengich_2013.pdf

African Growth and Opportunity Act (AGOA) (2000). Retrieved from https://agoa.info/images/documents/15490/kenyanationalagoastrategy2018-2023.pdf

African Development Bank. (2022). *Water sustainability in textile industries: Best practices.*

Alinda, K. (2022). Sustainability Practices among Manufacturing Firms in Uganda: An Overview of Challenges and Opportunities. *Advances in Research*, *23*(1–21). https://doi.org/10.9734/air/2022/v23i130320

Apparel Recorces (2016). Delay in execution of textile policy costs Uganda's textile industry big. Retrieved from https://apparelresources.com/business-news/trade/delay-in-execution-of-textile-policy-costs-ugandas-textile-industry-big/

Baffes, J. (2009). The "full potential" of Uganda's cotton industry. *Development Policy Review*, *27*(1), 67–85. https://doi.org/10.1111/j.1467-7679.2009.00436.x

Behnam G. (2011). Textile and Apparel Sector in Kenya. Retrieved from https://kohantextilejournal.com/textile-and-apparel-sector-in-kenya/

Betton C.I. (2007). 3 - The REACH Regulation of the European Union. Global Regulatory Issues for the Cosmetics Industry, 35-47

BCI (2020) BCI Annual Report for the year 2020.

Cotton Development Authority. (2006). Government of Kenya. Retrieved from http://www.cottondevelopment.co.ke

De Win, G. et al, reCure, Een roadmap naar slimme herbruikbare kwaliteitszorg. https://indd.adobe.com/view/800511cc-c325-437b-a225-de7f9bd44723

Co-funded by the European Union

Delilah, P. (2022). Textile industries polluting Lake Victoria - report. *Monitor*. Retrieved from https://www.monitor.co.ug/uganda/news/national/textile-industries-polluting-lake-victoria-report-3824138?utm_source=chatgpt.com

DH Geda. (2023). *Sustainable textile production at DH Geda.*

Drew, J., Christie, S. D., Rainham, D., & Rizan, C. (2022). HealthcareLCA: an open-access living database of health-care environmental impact assessments. Lancet Planet Health, 6, 1000–1012. www.thelancet.com

Ernst & Young Global Ltd. (2023). Kenya publishes draft National Green Fiscal Incentives Policy Framework. Retrieved from https://www.ey.com/en_gl/technical/tax-alerts/kenya-publishes-draft-national-green-fiscal-incentives-policy-fr

Ethiopian Investment Commission. (2023). *Green industrial development strategies in Ethiopia.*

Ethiopian Ministry of Environment. (2023). *Waste management policies for sustainable industries.*

Ethiopian Textile Industry Development Institute. (2022). *Sustainable sourcing practices in Ethiopian textiles.*

Ettner, H., & Haosi, Y. (2020). Political partners of the project are: Ministry of Trade and Industry of the Federal Democratic Republic of Ethiopia Ministry of Commerce of the People's Republic of China Responsible Authors/Publishers: Design and Layout. www.cntac.org.cn/www.giz.de/en/worldwide/336.html

European Centre for Development Policy Management (ECDPM). (2022). Kenya's potential for sustainable textiles. Retreaved from https://ecdpm.org/work/kenyas-potential-sustainable-textiles

European Commission. (2022). EU Strategy for Sustainable and Circular Textiles Retreaved from https://environment.ec.europa.eu/document/download/74126c90-5cbf-46d0-ab6b-60878644b395_en?filename=COM_2022_141_1_EN_ACT_part1_v8.pdf

European Centre for Development Policy Management (ECDPM). (2023). Kenya's potential for sustainable textiles. Retrieved from https://ecdpm.org/work/kenyas-potential-sustainable-textiles#

European Commission (2021) Cotton value chain analysis in Ethiopia. Retrieved from https://knowledge4policy.ec.europa.eu/publication/cotton-value-chain-analysis-ethiopia_en

European Green Deal, 2020. Accessed on 10 January 2025. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

European Commission, 2020. Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions - The European Green Deal. P.2

European Chemicals Agency (ECHA): https://echa.europa.eu/home

Fetting, C. (2020). "The European Green Deal", ESDN Report, December 2020, ESDN Office, Vienna

Co-funded by the European Union

Food and Agricultural Organization. (2024). Monitoring African Food and Monitoring Policies: Analysis of Incentives and Disincentives for Cotton in Kenya. Retrivied from https://www.fao.org/fileadmin/templates/mafap/documents/technical_notes/KENYA/KENYA_Technical_Note_COTTON_EN_Nov2012.pdf

Führ M. and Bizer K. (2007). REACh as a paradigm shift in chemical policy – responsive regulation and behavioural models. Journal of Cleaner Production, 15, 4, 327-334

Georgiou S., Postle M. and Rheinberger C.M. (2019). Valuation of Health Impacts Under the EU's REACH Chemicals Regulation. Encyclopedia of Environmental Health (Second Edition), 314-318

Geraldine J. (2023). Sustainable Fashion Ecosystem in Kenya. Retrieved from https://fashion-declares.org/sustanable-fashion-ecosystem-in-kenya/

Guzzo, D., Carvalho, M. M., Balkenende, R., & Mascarenhas, J. (2020). Circular business models in the medical device industry: paths towards sustainable healthcare. Resources, Conservation and Recycling, 160, 104904. https://doi.org/10.1016/J.RESCONREC.2020.104904

Harsanto, B., Primiana, I., & Sarasi, V. (2023). Sustainability Innovation in the Textile Industry : A Systematic Review.

Ian de Cruz (2022). Closing the loop in Kenya's fashion industry. Retrieved from https://trellis.net/article/closing-loop-kenyas-fashion-industry/

International Trade Administration. (2024). Kenya Country Commercial Guide, Energy-Electrical Power Systems. Retrieved from https://www.trade.gov/country-commercial-guides/kenya-energy-electrical-power-systems

International Trade Administration. (2024). Trade Agreements. Retrieved from https://www.trade.gov/country-commercial-guides/kenya-trade-agreements

International Labour Organization (ILO). (2021). *Fair labor standards in textile manufacturing.*

Institute of Economic Affair. (2019). The State of Second-Hand Clothes and Footwear Trade in Kenya. Retrieved from https://ieakenya.or.ke/download/the-state-of-second-hand-clothes-and-footwear-trade-in-kenya/

Institute of Economic Affairs. (2021). The state of the secondhand clothes and footwear trade in Kenya. Retrieved from. https://ieakenya.or.ke/download/the-state-of-second-hand-clothes-and-footwear-trade-in-kenya/

International trade administration. (2024). Energy-Electrical Power Systems. Retrieved from https://www.trade.gov/country-commercial-guides/kenya-energy-electrical-power-systems#:~:text=The%20Energy%20

Islam, T., Jahan, R., Jahan, M., Howlader, S., & Islam, R. (2022). *Sustainable Textile Industry : An Overview*. *04*(02), 15–32.

Co-funded by the European Union

Jones, P., & Van Ael, K. (2022). Design Journeys though Complex Systems: Practice Tools for Systemic Design. BIS Publishers. https://www.systemicdesigntoolkit.org/book

Karliner, J., Slotterback, S., Boyd, R., Ashby, B., & Steele, K. (2019). De klimaatvoetafdruk van de gezondheidszorg: hoe de gezondheidssector bijdraagt aan de wereldwijde klimaatcrisis en mogelijkheden voor acties.

Kemmlein S., Herzke D. and Law R.J. (2009). Brominated flame retardants in the European chemicals policy of REACH-Regulation and determination in materials. Journal of Chromatography A, 1216, 3, 320-333

Kenya Institute for Public Policy Research and Analysis (KIPPRA). (2020). Assessing the cotton, textile and apparel sector employment potential in Kenya. Government of Kenya. Retrieved from https://kippra.or.ke

Kenya Institute for Public Policy Research and Analysis (KIPPRA). (2023), Rejuvenating Local Manufacturing in the Context of Secondhand Economy. Retrieved from https://kippra.or.ke/rejuvenating-local-manufacturing-in-the-context-of-secondhand-economy/#:~:text=The%20continued%20increase%20of%20cheap,not%20spared%20the%20leather%20industry.

Kohan Textile Report. (2022). Middle, East and African Textile Portal. Retrieved from https://kohantextilejournal.com/

Law reform commission of Uganda, (1973). National Textiles Board Act. Retrieved from https://ulii.org/akn/ug/act/1974/22/eng%402000-12-31

Lugojja, F. (2017). *Cotton and its by products*. Retrieved from https://unctad.org/system/files/official-document/ditc_com_inf_2018_2_en.pdf

Maqbool A, Abbas W, Rao AQ, Irfan M, Zahur M, Bakhsh A, Riazuddin S, Husnain T (2010) Gossypium arboreum GHSP26 enhances drought tolerance in Gossypium hirsutum. Biotechnol Prog 26:21–25

Ma Z et al (2018) Resequencing a core collection of upland cotton identifies genomic variationand loci influencing fibre quality and yield. Nat Genet 50:803–813. https://doi.org/10.1038/s41588-018-0119-7.

MAA Garment - Home. (n.d.). Retrieved March 4, 2025, from https://www.maatextiles.com/background

MAA Garment - Social Compliance. (n.d.). Retrieved March 4, 2025, from https://www.maatextiles.com/social-compliance

MAA Garment - Technical Compliance. (n.d.). Retrieved March 4, 2025, from https://www.maatextiles.com/technical-compliance

MAA Garment & Textiles (Kebire Enterprises PLC.)Latest Profile Video - YouTube. (n.d.). Retrieved March 4, 2025, from https://www.youtube.com/watch?v=bqOmrxmwINA

Co-funded by the European Union

Martin Luther Oketch. (2023, September). 90% of Uganda's cotton is exported, says UMA. *The Monitor*. Retrieved from https://www.monitor.co.ug/uganda/business/markets/90-of-uganda-s-cotton-is-exported-says-uma--4379358

MTIC. (2018). *National Textile policy - Uganda*. Retrieved from https://www.mtic.go.ug/download/national-textile-policy-2/

Ministry for Investments, Trade and Industry b. (2024). Strategic Plan 2023-2027, Government of Kenya. Retrieved from https://www.industrialization.go.ke/sites/default/files/2024-09/STARTEGIC%20PLAN%202023-2027.pdf

Ministry for Investments, Trade and Industry a. (2024). Draft Cotton, Textile and Apparel (CTA) Policy, 2024: National Cotton Textile and Apparel Policy. Government of Kenya. Retrieved from https://www.industrialization.go.ke/sites/default/files/2024-11/Draft%20Cotton%2C%20Textile%20and%20Apparel%20%28CTA%29%20Policy%2C%2024.pdf

Ministry of Industrialization and Enterprise Development. (2015). Kenya Apparel and Textile Industry: Diagnosis, Strategy and Action Plan. World Bank Group. Retreaved from https://documents1.worldbank.org/curated/pt/441761468000939834/pdf/99480-REVISED-Kenya-Apparel-and-Textile-Industry.pdf

Ministry of Industry, Trade and Cooperatives. (2017). Buy Kenya Build Kenya: Government of Kenya. Retrieved from https://www.industrialization.go.ke/sites/default/files/2023-08/Buy%20Kenya%20Build%20Kenya%20Strategy%20June%202017.pdf

Ministry of Industrialization, Trade and Enterprise Development. (2021). Investing In Kenya's Fibre, Textiles And Apparel Industry, Keninvest, Government of Kenya. Retrieved from https://www.invest.go.ke/wp-content/uploads/2023/12/KenInvest-Fibre-Text-App-IP-PDF-version.pdf

Ministry for Investments, Trade and Industry. (2024). National Cotton Textile and Apparel Policy. Retreaved from https://www.industrialization.go.ke/sites/default/files/2024-11/Draft%20Cotton%2C%20Textile%20and%20Apparel%20%28CTA%29%20Policy%2C%2024.pdf

Ministry of Environment and Forestry. (2021). National Sustainable Waste Management Policy. Retrieved from https://faolex.fao.org/docs/pdf/ken205137.pdf

Ministry of Environment and natural resources. (2016). Green Economy Strategy and Implementation Plan 2016 – 2030: A low carbon, resource efficient, equitable and inclusive socio-economic transformation, Retrieved from https://www.greenpolicyplatform.org/sites/default/files/downloads/policy-database/KENYA)%20Improving%20Efficiency%20in%20Forestry%20Operations%20and%20Forest%20Product%20Processing%20in%20Keyna_0.pdf

Ministry of Industrialization, Trade and Enterprise Development. (2020). Protocols for the Importation of used textiles and shoes. Retrieved from

Co-funded by the European Union

https://infotradekenya.go.ke/media/PROTOCOLS_ON_IMPORTATION_OF_SECOND_HAND_CLOTHES_IN_KENYA_-_PUBLIC.pdf

Ministry of Investments, Trade, and Industry. (2024). Research, Manufacturing & Industrialization Policy. Retreaved from https://www.industrialization.go.ke/research-manufacturing-industrialization-policy

Ministry of Information, Communication and Digital Economy, (2022). Retrieved from https://www.ict.go.ke/

Moses M Ikiara & Lydia K Ndirangu. (2003). Developing a Revival Strategy for Kenya's Cotton-Textile Industry: A Value Chain Approach. Retrieved from

https://idl-bnc-idrc.dspacedirect.org/items/0768f99b-c11b-4730-9f7e-6ed468d0030c

MwasiagiJ. I. M., Deivani H., Kefar C., Charles N. (2023). Circularity and Eco-Innovation in the Kenyan Textile and Apparel Sector. Retrieved from https://www.studocu.com/row/document/moi-university/legal-drafting/kenya-policy-quick-scan-sept-2023/108089953

Mwasiagi, J. I., Mpofu, N. S., Kariuki, E., & Chepkwony, K. (2023). Eco-innovation: A Case Study of the Kenyan Textile and Apparel Industry. In Circularity in Textiles (pp. 19-38). Cham: Springer Nature Switzerland. Retrieved from https://www.springerprofessional.de/en/eco-innovation-a-case-study-of-the-kenyan-textile-and-apparel-in/26566744

Nakaweesi, D. (2024, November 11). Govt has no plan to support free-falling cotton exports. *The Monitor*. Retrieved from https://www.monitor.co.ug/uganda/business/commodities/govt-has-no-plan-to-support-free-falling-cotton-exports-4819064

National Treasury and Economic Planning. (2022). Draft national green fiscal incentives policy framework. Retreaved from https://www.treasury.go.ke/wp-content/uploads/2023/01/Draft-Green-Fiscal-Incentives-Policy-Framework.pdf

National Environmental Management Authority. (2024), compliance assistance program. Retrieved from https://nema.go.ke/index.php?option=com_content&view=article&id=272&catid=2&Itemid=423

Ngui, D., Chege, J., & Kimuyu, P. (2016). Kenya's industrial development. Manufacturing transformation, 72. Retrieved from cholar.google.com/scholar?q=Ngui,+D.,+Chege,+J.,+%26+Kimuyu,+P.+(2016).+Kenya's+industrial+development.+Manufacturing+transformation&hl=en&as_sdt=0&as_vis=1&oi=scholart

Oko-Institut e.V (2018) The cotton supply chain in Ethiopia: A country-focused commodity analysis in the context of the Bio-Macht project final report, Freiburg, Germany.

Olweny-CODA, H., & Karuiki, F. G. (2013). Policy Research on the Kenyan Textile Industry, https://agoa.info/images/documents/5264/ACTIF%20Report%20on%20Policy%20Research%20on%20the%20Kenyan%20Textile%20Industry_Margaret%20Chemengich_2013.pdf

Organisation for Economic Co-operation and Development (OECD). (2022). *Eco-friendly chemical usage in textile production.*

PAN UK (2016) Mind the gap: Towards a more sustainable cotton market. Available at https://www.solidaridadnetwork.org/wp-content/uploads/migrated-

Co-funded by the European Union

files/publications/Mind%20the%20Gap%20-%20Towards%20a%20more%20Sustainable%20Cotton%20Market.pdf.

Penman M., Banton M., Erler S., Moore N. and Semmler K. (2015). Olefins and chemical regulation in Europe: REACH. Chemico-Biological Interactions, 241, 59-65

Raut, R., Gardas, B. B., & Narkhede, B. (2019). Ranking the barriers of sustainable textile and apparel supply chains An interpretive structural. 26(2), 371–394. https://doi.org/10.1108/BIJ-12-2017-0340

Report, D. (2018). Policy Recommendations : Realizing New Productive Capacity in Ethiopia ' s Textiles and Apparel Sector. 1–156.

Revolve Magazine. (2022). Kenya's Potential for Sustainable Textiles. Retrieved from https://revolve.media/features/kenyas-potential-for-sustainable-textiles

Riley, K. (2013). Overview of the modelH Business Model Canvas. https://imaginego.com/overview-modelh-business-model-canvas-healthcare/

Rupiny, D. (2021). UIA, CDO team up to boost import substitution in the cotton sector. Retrieved December 24, 2024, from Uganda Investments Authority website: https://www.ugandainvest.go.ug/uia-cdo-team-up-to-boost-import-substitution-in-cotton-sector/

Sardar, S., Mohsin, M., Memon, M. S., Ramzan, B., & Sharif, R. (2022). *An empirical study regarding the environmental sustainability practices*. *73*(4), 384–396. https://doi.org/10.35530/IT.073.04.202152

SOFRECO (2016) Scoping study report. National Cotton Development Strategy (2015–2030).Federal Democratic Republic of Ethiopia and Private Enterprise Programme Ethiopia

SCR (2020) Sustainable cotton ranking report for the year 2020 by PAN UK, Solidaridad and WWF. Available at https://www.tescoplc.com/media/756546/cotton-score-ranking-2020.pdf.

SCR (2020) Sustainable cotton ranking report for the year 2020 by PAN UK, Solidaridad and WWF. Available at https://www.tescoplc.com/media/756546/cotton-score-ranking-2020.pdf

SOFRECO (2017) National cotton development strategy (2018–2032) and road map. Federal Democratic Republic of Ethiopia and Private Enterprise Programme Ethiopia.

Stewart R. (2012). 2 - EU legislation relating to electronic waste: the WEEE and RoHS Directives and the REACH regulations. Waste Electrical and Electronic Equipment (WEEE) Handbook, 17-52

Strategyzer. (2023). Business Model Canvas. https://www.strategyzer.com/library/the-business-model-canvas

Sumo, P. D., Arhin, I., Danquah, R., Nelson, S. K., Achaa, L. O., Nweze, C. N., … Ji, X. (2023). An assessment of Africa's second-hand clothing value chain: a systematic review and research opportunities. *Textile Research Journal*, *93*(19–20), 4701–4719. https://doi.org/10.1177/00405175231175057

Co-funded by the European Union

The Norwegian Investment Fund for Developing Countries. (2023). Investing in textile industry to create thousands of jobs in Kenya. Retrieved from https://www.norfund.no/investing-in-textile-industry-to-create-thousands-of-jobs-in-kenya/

The Kenyan Vision 2030. (2007). Government of Kenya. https://vision2030.go.ke/

The politics of industrial policy in a context of competitive clientelism: The case of Kenya's garment export sector. African Affairs, 118(472), 553-579.

UNEP. (2023). Policy Scan and Recommendations for the Kenyan Textile and Apparel Sector. Retrieved from https://www.studocu.com/row/document/moi-university/legal-drafting/kenya-policy-quick-scan-sept-2023/108089953

United Nations Environment Programme (UNEP). (2023). *Sustainable textile production and its global impact.*

United Nations Industrial Development Organization (UNIDO). (2021). *Energy-efficient manufacturing technologies.*

Utexbel, Dr. Green, Retrieved from https://utexbel.com/ December 2024

UPRC Uganda. (2024). Uganda implored to assess impact of proposed ban on second-hand clothes. Retrieved from https://eprcug.org/press-releases/uganda-implored-to-assess-impact-of-proposed-ban-on-second-hand-clothes/?utm_source=chatgpt.com

Uganda Revenue Authority. (n.d.). What is Textile Processing? Retrieved from https://ura.go.ug/en/textile-processing-industry/

Valarie N. (2022). Sustainable Fashion in a Kenyan, Context (Opportunities for Growth) https://www.linkedin.com/pulse/sustainable-fashion-kenyan-contextopportunities-growth-nyamwaya

Wandera, S. (2021, January 2). Nytil is moving up the textile ladder after a turbulent past. *The Monitor*. Retrieved from https://www.monitor.co.ug/uganda/business/finance/nytil-is-moving-up-the-textile-ladder-after-a-turbulent-past-1646960

Warhurst A.M. (2006). Assessing and managing the hazards and risks of chemicals in the real world—the role of the EU's REACH proposal in future regulation of chemicals. Environment International, 32, 8, 1033-1042

Wario, M., & Njoroge, L. (2020). Assessing the cotton, textile and apparel sector employment potential in Kenya. KIPPRA Discussion Paper. Retrieved from https://kippra.or.ke/wp-content/uploads/2021/02/Assessing-the-Cotton-Textile-and-Apparel-Sector-Employment-Potential-in-Kenya.pdf

Woldeyohannes, B., & Alebachew, T. (2020). Assessment Practices and Challenges of Training and Development at the Ethiopian Textile Industry Development Institute(ETIDI). *International Journal of African and Asian Studies*. https://doi.org/10.7176/jaas/68-02

Co-funded by the European Union

World Bank. (2023). *Renewable energy adoption in industrial sectors.*

World Bank. (2023). *Sustainable textile production at Adama Spinning Factory.*

Wu, S., & Cerceo, E. (2021). Sustainability Initiatives in the Operating Room. The Joint Commission Journal on Quality and Patient Safety, 47(10), 663–672. https://doi.org/10.1016/J.JCJQ.2021.06.010

Zachary M., Gebhart A.M. and Whittaker M. (2014). GreenScreen for Safer Chemicals, as a support tool for the EU reach regulation: Identifying chemicals of very high concern (SVHC) and safer alternatives. Toxicology Letters, 229 (Supplement), S124-S125

Co-funded by the European Union