

Textile Waste Management in Kenya: An Investigation into the Current Practices and Opportunities for Improvement

A Master's Thesis submitted for the degree of
“Master of Science”

supervised by
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Affidavit

I, **GEORGINE CALLAR ODERO**, hereby declare

1. that I am the sole author of the present Master's Thesis, "TEXTILE WASTE MANAGEMENT IN KENYA: AN INVESTIGATION INTO THE CURRENT PRACTICES AND OPPORTUNITIES FOR IMPROVEMENT", 68 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted the topic of this Master's Thesis or parts of it in any form for assessment as an examination paper, either in Austria or abroad.

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Abstract

Production and consumption have contributed highly to the global economy and damaged the planet's ecosystem and resources. The textile industry, for instance, contributes to economic growth at the individual and international levels through revenues gained through employment creation. Over three hundred million individuals rely on this sector for their incomes, and in return, governments benefit from the taxes throughout the textile value chain. Despite being an important industry sector for developing and developed nations, the textile industry has contributed to environmental pollution. Worldwide clothing consumption has increased because of the accessibility of quickly evolving fashions and lower apparel prices. The change in fashion trends has led to a rise in the consumption of used clothing in developed nations. Consequently, developing nations witness a surge in second-hand garments that often end up in landfills or water bodies due to inadequate waste management infrastructure.

This thesis analysed the state of textile waste from second-hand clothes imported into the Republic of Kenya based on desk-based research and evaluation of the country's policies and regulations on textile waste management. Kenya's economy benefits from the trade of second-hand clothes. However, due to a lack of waste regulations, the environment suffers the repercussions of poorly managed textile waste. Textile waste has not been given much focus in the country, and consumers lack awareness of the impact of improper disposal of clothes in open dumps. Although regional legislations are developed, and brands promote sustainability, they rarely are tailored to the specific needs of developing countries. This thesis recommends that international brands provide market access for waste textile recyclers as an essential means to aid these countries. Opportunities for recycling and reusing clothes exist, but proper measures for collecting textile waste must be implemented through legislation. As a low-middle-income country, this study recommends that Kenya's primary focus on textile waste management should be on the proper collection methods to facilitate the recycling of waste from textiles.

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List of abbreviations

AGOA- African Growth and Opportunity Act

CAGR- Compound Annual Growth Rate

CO2- Carbon dioxide

COMESA- Common Market for Eastern and Southern Africa

COVID-19- coronavirus disease 2019

EAC- East African Community

EPZ- Export Processing Zone

EU- European Union

GDP- Gross Domestic Product

KEBS- Kenya Bureau of Standards

LDC- Least Developed Countries

NGOs- Non-governmental Organisations

SDGs- Sustainable Development Goals

SMEs- Small and Medium Enterprises

SSA- Sub-Saharan Africa

UN- United Nations

USD- United States Dollar

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I would like to appreciate the effort that I put into this work despite the limited time. I would also like to extend my appreciation to my supervisor, Assoc.Prof.Dipl.-Ing.Dr.techn. Johann Fellner for his patience and insight despite the back and forth on the topic. I would also like to show my appreciation to Ao.Univ.-Prof.i.R. Dipl.-Ing. Dr.techn. Hans Puxbaum for his dedication towards the ETIA program. I am also grateful to the entire group of ETIA 15 for their support in one way or the other during the two years that I got to interact with them. Finally, my appreciation goes to my family for their unwavering support during my study period. To my sister Lovina Akinyi, I am indebted to you for making me who I am today.

1 Introduction

“Unsustainable patterns of consumption and production are root cause of triple planetary crisis: Climate change, Biodiversity loss and Pollution.” (UN, 2022). Global production and consumption have not only contributed highly to the global economy, but also damaged the planet’s ecosystem and resources (Kufeoglu, 2022). Like all other industries, the fashion and textile industry has faced economic challenges related to the pandemic. However, it has also seen remarkable growth due to a rise in consumer behaviour, leading to increased textile production to quickly and efficiently meet consumer demands (McKinsey & Company, 2021). The growing demand for textile goods is a major factor in the expansion that the textile industry experienced over the past couple of decades globally. This growth has been attributed to the adoption of e-markets, such as the use of digital communication outlets for marketing and online shops. It ought to be noted that the global textile sector has continued to expand since the beginning of 2022, even though there have been persistent economic challenges, such as rising commodity prices as a result of the conflict between Russia and Ukraine (The Business Research Company, 2023). The industry contributes to economic growth both at the individual level and international level through revenues gained through the creation of employment. Over 300 million individuals rely on this sector for their income, and in return, governments benefit from the taxes throughout the textile value chain (Ellen MacArthur Foundation, 2017). Despite being an essential industry sector for development in developing and developed nations, the textile industry comes with its fair share of flaws, such as human rights violations and environmental pollution, and has an impact on climate change at some point in its value chain. Regarding human rights violations, the industry has been known for its nature of outsourcing cheap labour in developing countries where wages are significantly low and working conditions are poor due to a lack of relevant and strict policies to regulate these conditions, and even if there are, they are not seriously taken into consideration (European Parliament, 2014). In addition, the issue of child labour and women being the most affected by these poor working conditions has also been a major concern in this industry (Bureau of International Labor Affairs, 2022). The reason behind this issue is that a significant number of women are employed in the textile industry, making them the largest population in this workforce. The poor working conditions, such as lack of adequate protection gear while handling some of the chemicals used in the dyeing of apparel,

expose women to health risks who, in turn, pass the risks to their unborn kids, who are then born with abnormal health conditions (Islam, 2022).

For quite a while, the waste management issue globally has focused more on plastics, and some significant steps are being taken to deal with this, resulting in outstanding results, such as the end of plastic pollution resolutions by the United Nations (UN) (UN, 2022). While this is just a single area of environmental pollution, areas like textiles waste management have not been given the same attention despite it also having negative impacts on the environment if not responsibly managed. The industry is estimated to emit 8% of global greenhouse gases (Quantis,2018). It is, therefore, similarly essential to investigate the area of textile waste to find measures that could be put in place, especially in countries that lack adequate and stringent policies on how waste from textiles should be handled. Despite the challenges that the world continues to face from the pandemic, war, and climate change, the world population continues to rise. In a way, people have continued to find alternate lifestyles. This population growth has increased consumption in all industries, including textiles, posing a threat to nature's resources (Rashid *et al.*, 2023). The fashion industry, to be precise, has seen an increase in sales, also known as '*fast fashion*' where the contemporary trends come and go so fast even before the dust settles on the recent scramble to get new clothes and designs in the industry (Tummino *et al.*, 2023). Every season means a new fashion trend in shops across countries, and consumers rush to ensure they get the best of the designs as new arrivals and sales come in. The high consumption forces manufacturers to increase their pace of production to keep up with the demand, especially in the wake of social media, where news about new trends spread fast among users (Sumanti *et al.*, 2022). While this trend continues, there is the issue of disposing of the already worn clothes that some owners may feel are no longer in trend or the need to create space for the new ones or some that were bought out of impulse and peer pressure from social media and the owner no longer feels like wearing them.

Over the past years, the issue of waste management has been focused on plastic, and some significant steps are being taken to deal with this, resulting in great results, such as the end of plastic pollution resolutions by the United Nations (UN) (UN, 2022). While this is just a single area of environmental pollution, areas like textile waste management have not been given the same attention despite negative impacts on the environment if not responsibly managed. The industry is estimated to emit 8% of global greenhouse

gases (Quantis,2018). It is, therefore, similarly essential to investigate the area of textile waste to find measures that could be put in place, especially in countries that lack adequate and stringent policies on how waste from textiles should be handled. Despite the challenges that the world continues to face from the pandemic, wars, and climate change, the world population continues to rise. In a way, people have continued to find alternate lifestyles. This increase in population and lifestyle change has resulted in an increase in consumption in all industries, including textiles, posing a threat to nature's resources (Rashid *et al.*, 2023). Every season in the fashion industry means a new fashion trend in shops across countries, and consumers rush to ensure they get the best of the designs as new arrivals and sales come in. This forces manufacturers to increase their pace of production to keep up with the demand, especially in the wake of social media, where news about new trends spread fast among users (Sumanti *et al.*, 2022). While this trend continues, there is the issue of disposing of the already worn clothes that some owners may feel are no longer in trend or the need to create space for the new ones or some that were bought out of impulse and peer pressure from social media and the owner no longer feels like wearing them. These used clothes often are given as charity or sold in developing countries. The system may seem like an action to promote sustainability for developed countries but, it results in an environmental concerns in developing countries.

1.1 Aim of Study

This thesis will put its focus on second-hand clothes in the Republic of Kenya, referred to as Kenya in the text. The reason for choosing Kenya is because of the country's high rate of annual importation of clothes, both new and used from, the European Union(EU), China, the United Kingdom, and many others. The country will only serve as an example for the sake of data estimates and policies on textile waste management put in place. But in general, other countries' profiles will be used in other examples during the discussions on second-hand clothes import in African countries.

The research will investigate the impact of second-hand clothes or thrift clothes, as may be known by many, in African countries' environments by looking into current practices and opportunities for improvement, such as alternative ways to manage waste from textiles that will ensure the waste does not end up in the environment and that the value of the garment is also not lost and to promote sustainable development. Additionally, this thesis also analyses the new EU regulations on the quality of exported textiles. For

instance, with the new EU textile regulation, there will be a change in the collection system in the EU countries. As of now, the collection system in the cities just focus on clothes which can be reused again while with the new regulation, it will also focus on clothes that are not reusable. Therefore, the impact that this additionally added textile will have on importing countries will be analyzed.

1.2 Statement of Research Questions

The increased environmental pollution from the textile industry is due to an increase in clothing and apparel product consumption globally because of the ‘*fast fashion*’ era. The amount of second-hand clothes being traded among countries has also increased over time. The trend of used clothes ending up in developing countries like Kenya has therefore raised concerns due to their increase in landfills or open dumpsites. This thesis will conduct its research to identify solutions for the questions that follow, which will help in providing suggestions for decision-makers and governments in the proper management of waste from second-hand clothes.

1. What is the state of affairs on textile waste management in the Republic of Kenya?

This thesis wants to get an adequate understanding of the state of textile waste management in Kenya and the trends and drivers of textile waste generation in it. It will also analyze the existing regulations and policies in place, and if they can meet the textile waste management needs to answer this question. In addition to that, the thesis will also look if these policies in place for waste management have been executed and are operational at large.

2. Is textile waste a major concern in Kenya, and what are the possible measures to increase recycling, upcycling, and reuse?

Once the existing waste management conditions in the Republic of Kenya have been examined, the research will then shift its focus on the potential course of action on the proper management of waste from textiles to ensure the waste does not end up in the environment and that the value of the garment is also not lost. An evaluation of the impact of second-hand clothes on the economy, society, environment, and generally textiles in African countries will enable the thesis to answer the question.

1.3 Thesis Outline

To efficiently investigate and analyse the topic as introduced above, this thesis will be approached in the following structure: The methodology will be discussed, followed by the analysis of relevant literature on the state of the art of the textile industry, including production, consumption, wastes generated, followed by recycling and reuse of textile wastes. It will then be followed by research chapters that will include an analysis of available literature to answer the research questions. Finally, the findings followed by recommendations will be given, and the conclusion from the research will come after. The findings will function as a guide to aid in providing recommendations Kenya could use and the relevant stakeholders or individuals in the textile and waste management sector to ensure that the environment is well protected and future generations can enjoy the decisions made today regarding our consumption and disposal.

2 Methodology

This section gives more details on the procedures used to conduct this thesis. This research opted for desk-based qualitative research by conducting a comprehensive literature review to answer the research questions, establish gaps, and propose alternatives for the managing textile waste in developing countries.

2.1 Research Strategy

Comprehensive research on different academic databases such as Google Scholar, ScienceDirect, Research Gate, connected papers, library catalogues, and many others was done. Using key terms such as textile waste, waste management in developing countries, Kenya waste, textile valorization, textile production and demand, fashion and environment, textile and circular economy, sustainable textile, textile recycling, second-hand clothes, and many others, the thesis was able to find relevant literature. The search was confined to articles and papers between 2011 and 2023, making it comprising recent studies and findings. However, to understand the respective policies and regulations of the country and legal documents were referred to despite not being within the period range of the other kinds of literature used.

Information and data from the peer-reviewed articles were retrieved based on their relevance to the topic in discussion. A thematic approach was applied in the evaluation to enable identify key concepts. By confining the research to pertinent and current materials different experts in the field have investigated, the strategy above sought to ensure the accuracy and legitimacy of the results obtained, and items of irrelevance were discarded from the search. The research also limited itself to articles, book sections, publications, reports, and documents in the English language.

The primary focus was on journal articles, technical and scientific papers, working papers, legislative databases for Kenya, UN reports and publications, institutions like the World Bank, and other Non-governmental Organisations (NGOs) like the Ellen MacArthur Foundation reports. In the analysis, existing and already published research studies were considered. The environmental policies and regulations that Kenya has in place regarding waste management, journal articles on waste management, and textile waste management were referred to. Data from databases such as The Observatory of Economic Complexity (OEC) and Our World in Data were also analyzed and compared with those of other institutions. The research also used scientific papers that provided

alternative ways of managing textile waste from a scientific point of view. This research also tackled and analyzed a variety of aspects of the topic of waste management in Kenya. Together with the second-hand clothes trade, regulations, and future changes to the EU collection system of used clothes, it addresses the existing modes for managing waste from second-hand clothes. In addition to that, the challenges and possibilities for enhancing textile waste management techniques are reviewed in this research. This thesis additionally looks at the impact that textile waste in Kenya has on the social and economic sectors, as well as the environmental impact of second-hand clothing on air, water, soil quality, biodiversity, and natural ecosystems.

In the previous reports and findings on the issue of textile waste management in African countries, researchers have used various methods in their work, including qualitative through the analysis of literature and reports on the issue and quantitative through surveys followed by reports on the data collected. Other articles and reports used individual field observations and surveys from stakeholders involved in the textile industry, ranging from cotton farmers and textile experts to final consumers. This study will have a sectional summary based on the author's view on the area of discussion in the discussion chapter.

3 State of the Art

Over the past years, the issue of waste management has been focused on plastic, and some significant steps are being taken to deal with this, resulting in impressive results of plastic pollution ban resolutions by the United Nations. While this is just a single area of environmental pollution, areas like textiles waste management have not been given the same attention despite it also having negative impacts on the environment if not effectively managed. This chapter will review the literature on the current situation of textile production and consumption by looking into overall global and Kenya textile production and consumption. Further to that, the issue of distinct types of textiles will be discussed, followed by the impact of textile waste on humans and the environment. In addition, recycling and reuse of textiles as a way of promoting a circular economy and environmental sustainability will also be analyzed based on previous reports.

3.1 Global Textile Production

In their report, Maxwell and Ryan define Textiles as an extensive range of objects or items comprising clothing worn by consumers, uniforms worn in commercial settings (either by the public sector or by corporations), and upholstery items such as curtains and bed linens, with a particular emphasis on fibres, yarns, and fabrics (Maxwell and L. Ryan, 2015). McCarthy, on the other hand, defines textiles as woven fibres, filaments, and yarns, natural and artificial, and other products which are primarily made from them, as opposed to the primary definition that only identified textiles as fabrics that are woven (McCarthy, 2016) Raw materials including cotton, wool, silk, and synthetics start the textile value chain. After that, yarns are spun and weaved or knitted into fabrics; After dyeing, printing, and finishing, the fabrics look and function better and next, fabrics are cut, sewn, and combined into clothes, which then retailers and distributors sell the finished products to end-users (MITDGA, 2021). The production of textiles entails the transformation of fibres and yarn into garments, finished goods, and technical textiles via procedures such as preparation, weaving, knitting, dyeing, printing, finishing, and stitching (MITDGA, 2021). The textile and apparel production goes through the stages of production of fibre, followed by yarn production, fabric production which involves weaving, knitting, and non-woven fabric, and then followed by pre-treatment before dyeing and printing, which is then followed by finishing treatment and finally, the manufacturing of the finished product and selling to the consumer as seen in **Figure 3.1** below. The value chain of textile and garment

production can also be summarized as shown in the figure below (Fernandez-Stark, Bamber and Couto, 2022). This shows the processes, components, individuals, and coordination that are involved, from the input of raw material to the final consumption of textiles at the end of the chain.

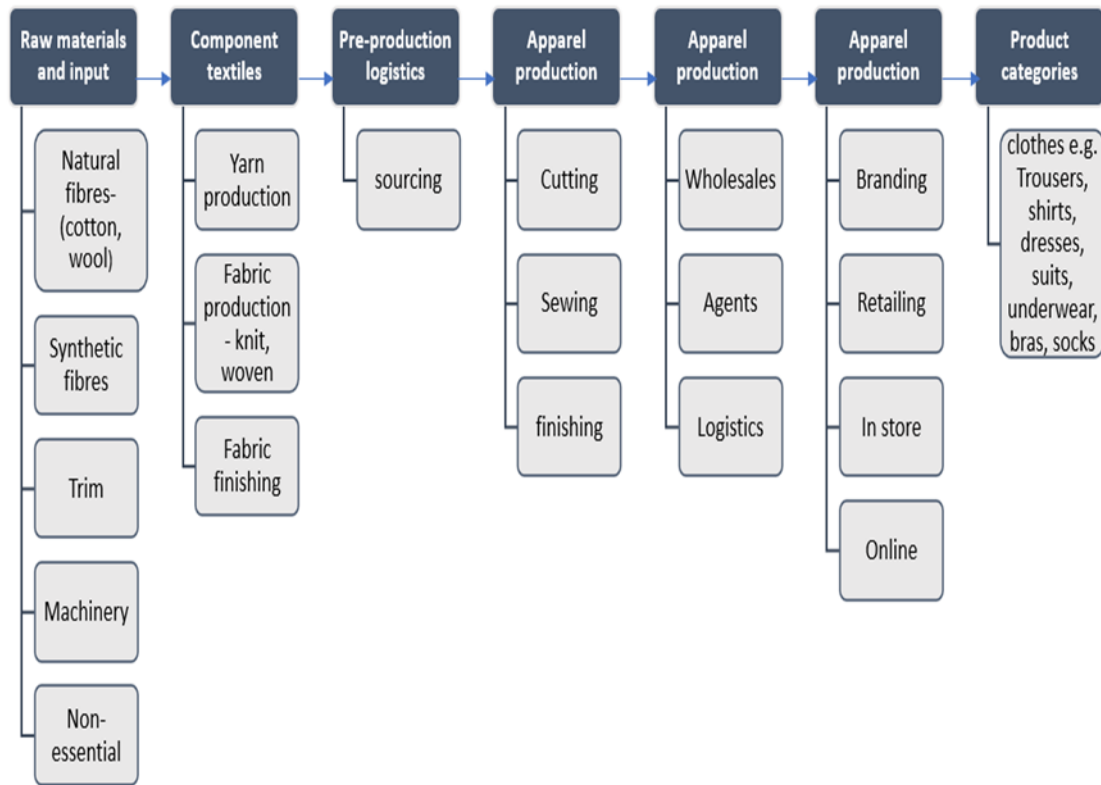


Figure 3.1 Diagram showing the textile Value Chain summary from the production to final consumption as depicted by Fernandez-Stark et al. (2022).

In the global market, household, fashion, and technical textiles make up the majority of the textile industry's market share with fashion textiles having the highest composition, with technical textiles following closely behind. (Uddin, 2019). Consisting of twelve separate categories, the technical textiles market is significant for both industrialized and emerging economies where they offer a broad range of use in the manufacture and production of different goods such as erosion-prevention nets, bandages, athletic footwear, crop protection nets, and many other products (Uddin, 2019). The distinct categories consist of agricultural, medical, construction, transportations, protective, industrial, household, apparel, athletic, packaging, sustainable, and geo textiles (Uddin, 2019). The textile industry, over the years, has experienced growth due to the increase in demand for clothes globally, and recently this has been attributed to the adoption of e-markets, such as the utilization of various social media channels, for advertising

purposes and online shops (Guru and Kumar, 2023). Despite the economic problems that have continued to be felt, such as the increase in commodity prices and political shifts that came with the war between Russia and Ukraine since the beginning of 2022, the global textile industry has experienced growth with a 6% of the compound annual growth rate (CAGR) in 2022 (The Business Research Company, 2023). Due to its high export share, added value, and ease of accessibility for new entrepreneurs with low investment, the textile industry has played a significant role in the economic development of developing countries (MITDGA, 2021).

The growth rate for exports of textiles was the lowest compared to other manufactured goods, coming in at only 7% for the year 2021, and this slower growth can be attributed to the fact that despite the effects of the pandemic, the textiles industry already had high values in the year 2020 (WTO, 2021). As shown in **Figure 3.2** below, the textile industry came seventh in the annual percentage change of the world exports of manufactured goods in the year 2021. In 2021 and 2022, the world value of textiles trade went down by 1% and 2%, respectively, but despite these drops, the amount of trade in 2021 was still 14% higher than in 2019, and this is attributed to the high demand for medical face masks in 2020, which are part of the textiles (WTO, 2023)

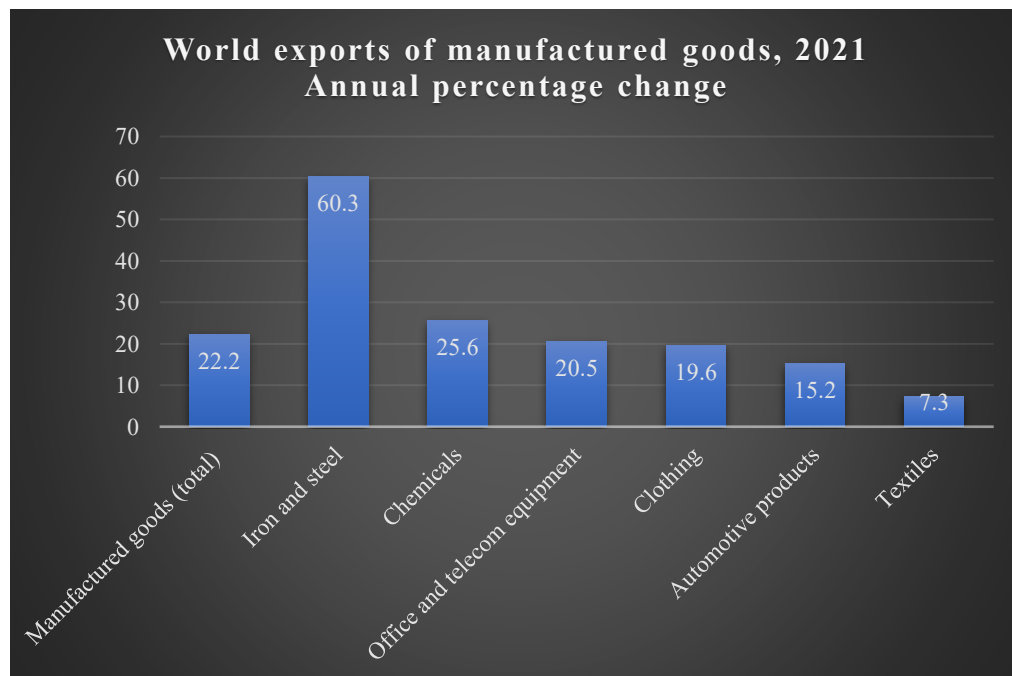


Figure 3.2 Annual percentage change of manufactured goods exported in 2021, showing textiles at 7.3% as adapted after WTO (2022).

Reports from 2021 indicate that the United States led in the importation of textiles, followed by Germany and Japan, respectively, as shown in **Figure 3.3**. The report also indicates that the leading exporters were China, Bangladesh, and Vietnam, respectively, (OEC, 2021), as shown in **Figure 3.4**. The production of textiles has seen its shift in Asian countries over the past decades, as they offer cheap labour to manufacturers compared to developed countries like the United States and EU countries (East African Community, 2019). As a result, the overall leading exporters of textiles were the Asian countries globally. China, for example, has set up several policies and guidelines, and technological developments that aim at boosting the industry and enhancing its competitiveness at the global level (Pepermans, 2019).

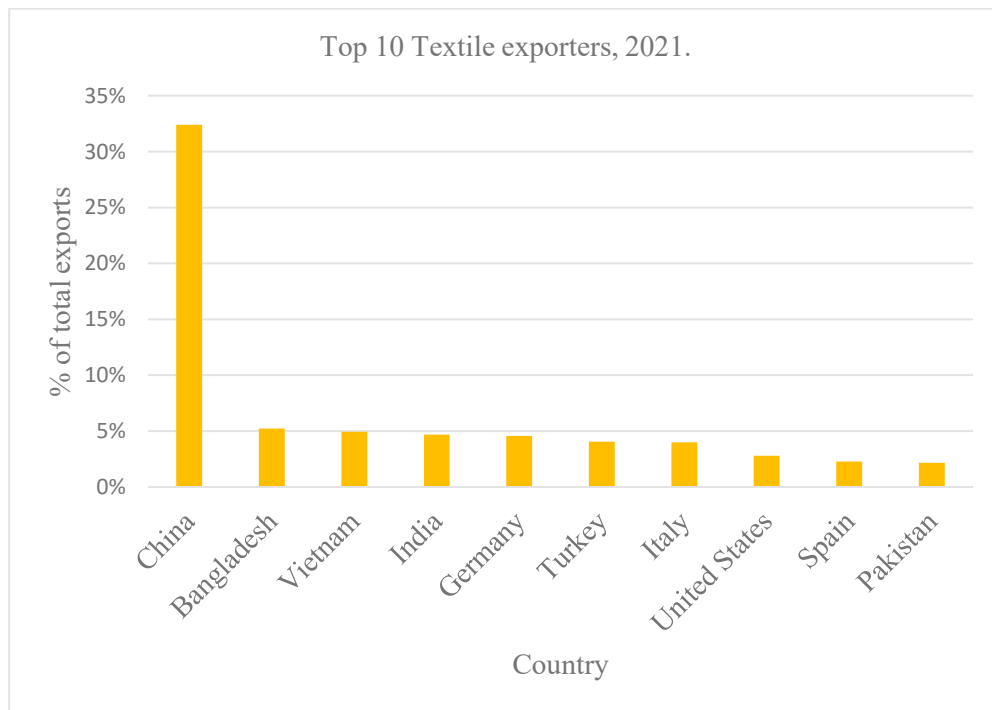


Figure 3.3. Leading textile exporters in 2021 as adapted from OEC (2021). The areas of production fall in most Asian countries where labour is cheap and environmental regulations from textile waste are less strict as compared to countries of consumption.

3.2 Global Consumption of Textiles

Global textile consumption has increased overall, and this can be attributed to the increase in the global population and the fast change in fashion trends among consumers. As an observation, it can also be mentioned that the issue of fashion trends is tied to international celebrities who deem themselves as pacesetters in the fashion industry and social media influencers. The increased use of technology has enabled the spread of fashion trends among consumers and enhanced the ease of delivery of products for individuals globally (EURATEX, 2022). In the EU, the share of textile and apparel sales made online has increased dramatically, with clothing being the most frequently purchased item online and, this trend seems to be significant among young internet users (EURATEX, 2022).

Fast fashion is a business method that is often used in the retail fashion industry whose main goal is to make sure that there are always new clothes on the market that are in line with the latest fashion trends and that people want to buy (Choi et al., 2014). Worldwide clothing consumption has increased as a result of the accessibility of quickly evolving fashions and lower-quality apparel, and as a result, people are disposing of their outgrown, outdated, or worn clothing in a variety of ways, such as through donations, recycling, or waste disposal (Odinga et al., 2022). The tremendous increase in the consumption of technical textiles can also be attributed to the increase in global industrialization leading to the demand for different categories of technical textiles (McCarthy, 2016). In the recent case of Covid 19 pandemic, there was an increase in the use of medical textiles used in the manufacture of personal protective equipment such as masks across the globe (Ivanoska-Dacicj et al., 2023).

Industrialization and structural change relied heavily on the production of clothing and footwear. Hence these sectors have aided in boosting economies, opening doors to international supply networks, and providing women in developing nations with formal employment options (de Mattos et al., 2022). The paper also adds that despite being a lifeline to economic and social independence for many young women in low-income countries (LIC), many workers nevertheless experience informal, precarious, and unprotected work conditions (de Mattos et al., 2022). For marginalized women in Africa, the textile and clothing industry holds great promise for empowerment and social change because it is the second largest employer in the developing world (after

agriculture) and provides labour-intensive employment opportunities, especially for youth and women (Fashionomics, 2016)

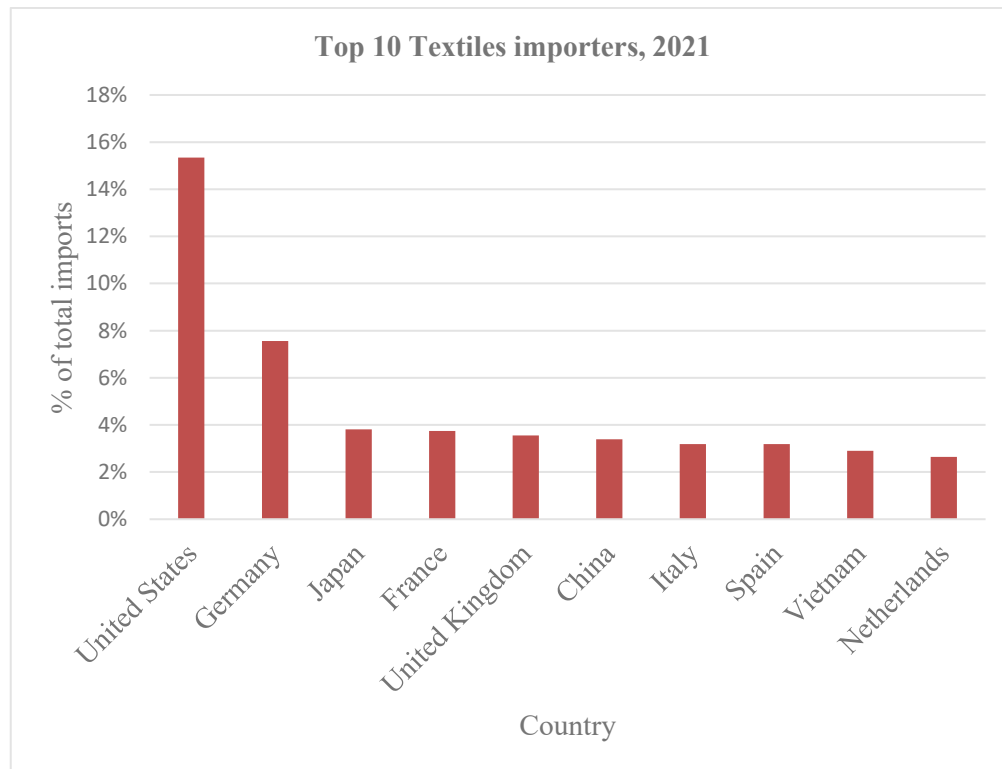


Figure 3.4. The top ten leading textile importers in 2021, showing the global percentage share of the countries as adapted from OEC (2021). These countries represent regions of high consumption of textile products, including clothes and footwear.

3.2.1 Textile Production and Consumption in the Republic of Kenya

In Kenya, the textile sector is a significant manufacturing activity, creating jobs for over 2.5 million individuals and playing a part in 14% of employment in the country (UNEP, 2020b). In 2019, the sector had a total turnover of USD 564 million, with 84% of employees in this sector in the micro small and medium enterprises (SMEs), while 8% are in support services (UNEP, 2020b). The significance of the sector to the country's industrialisation is also supported by its link to other sectors, such as agriculture. While 80% of the land is suitable for cotton cultivation in Kenya, most of the textiles currently used in Africa are imported (Alkaya and Demirer, 2014). In 2020, the country imported textiles and clothing with an approximate value of USD 750,000, with East Asia and Pacific regions leading in the regions of importation followed by the EU (World Bank, 2023). As for individual countries, Kenya majorly imported textiles and clothing from China (World Bank, 2023). The Kenyan government recognizes the textile apparel sector as an essential player in the country's path toward industrialisation in achieving its 2030 vision. Kenya has preferential market access to the US and Europe and a Free

Trade Agreement with Common Market for Eastern and Southern Africa (COMESA) and the East African Community (EAC), leading to the boost of the apparel sector over the textile sector (Naumann, 2020; UNCTAD, 2023).

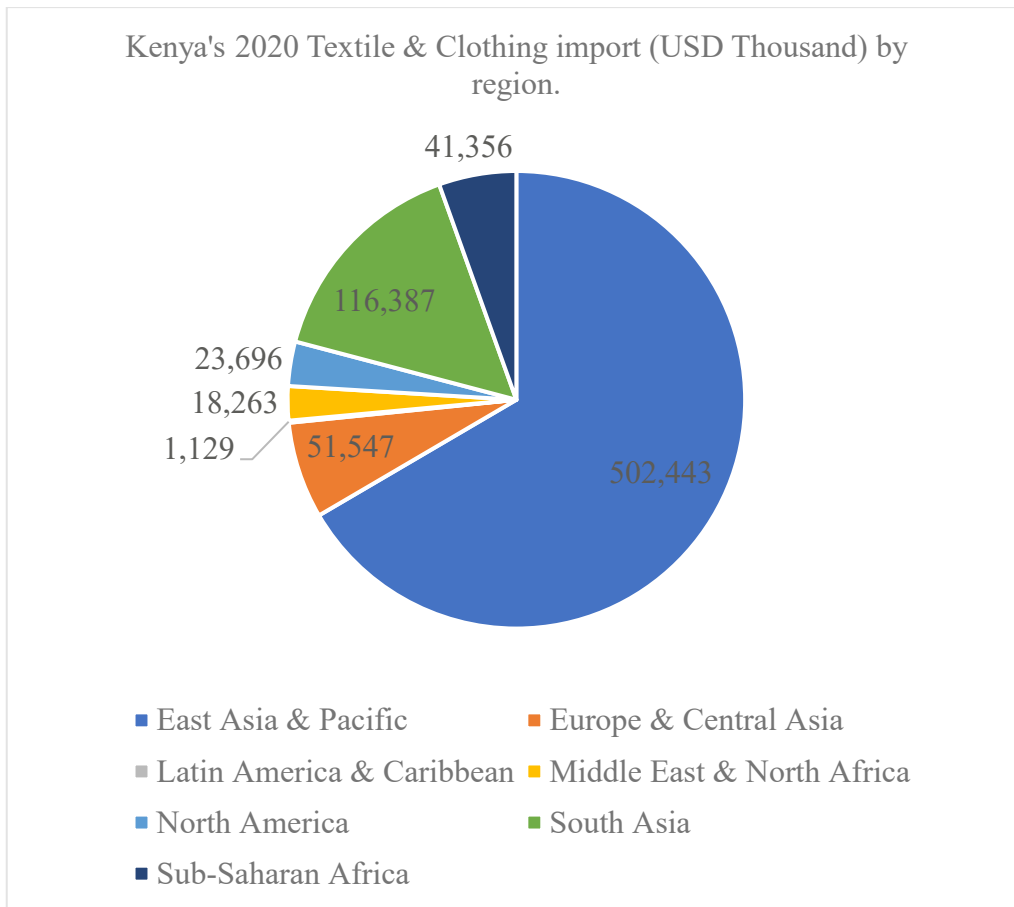


Figure 3.5. Import value in USD thousands of textiles and clothing in Kenya by regions for the year 2020 as adapted from the World Bank data (2023). The values indicate East Asia and the Pacific as the major contributor to the textile and clothing industry in Kenya.

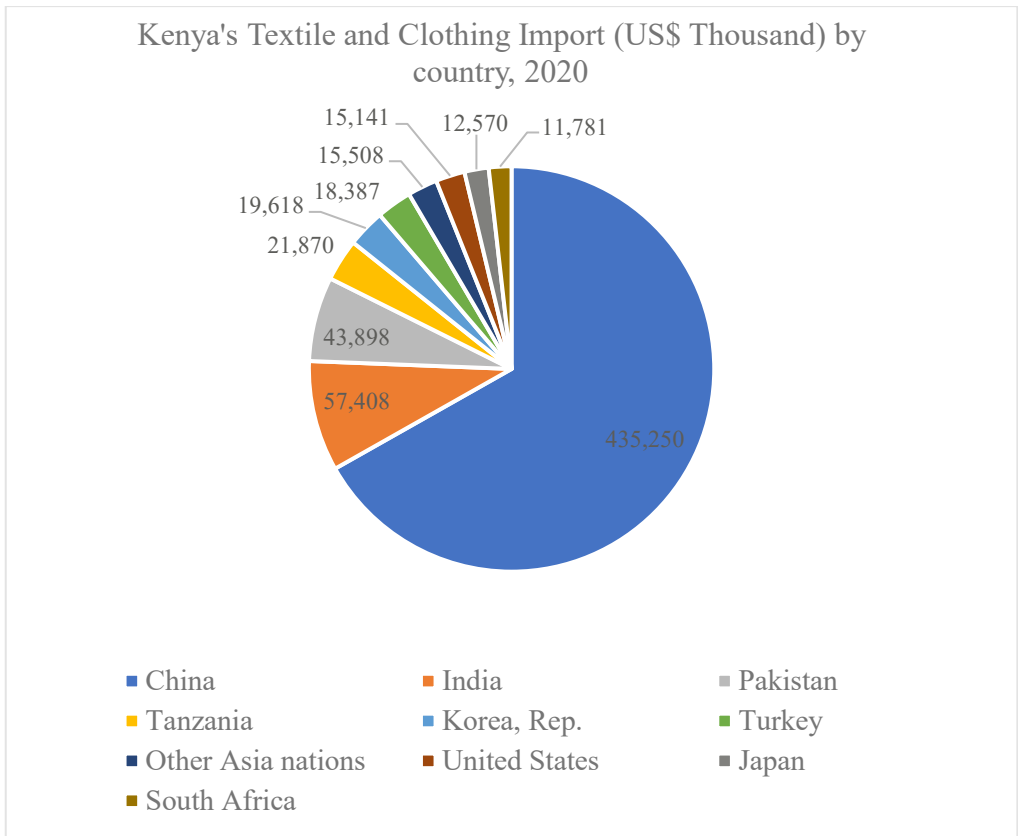


Figure 3.6. Import value in USD thousands of textiles and clothing in Kenya by countries for the year 2020 as adapted from the World Bank (2023). The values show that China was the main textile and clothing exporter to Kenya. This indicates the demand for new textiles and clothes from abroad due to their low prices.

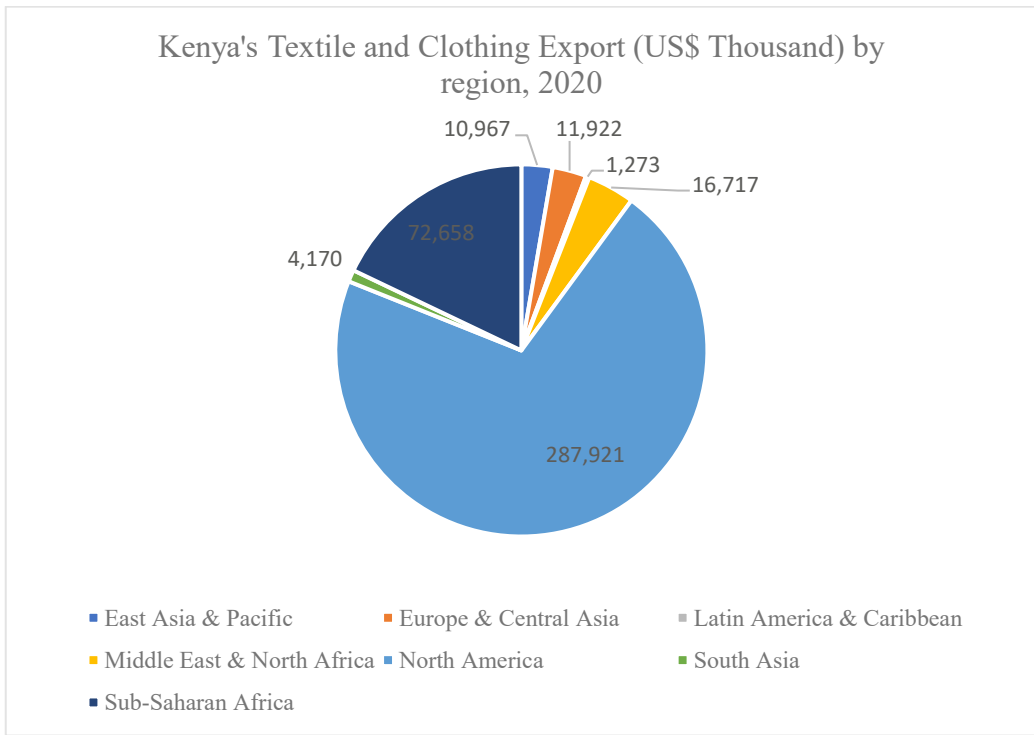


Figure 3.7. This diagram presents the export data of the textile and clothing industries in the region as adapted from the World Bank's report (2023). Due to the existing trade agreements such as the African Growth and Opportunity Act (AGO), Kenya's textile and clothing exports are majorly consumed in North America.

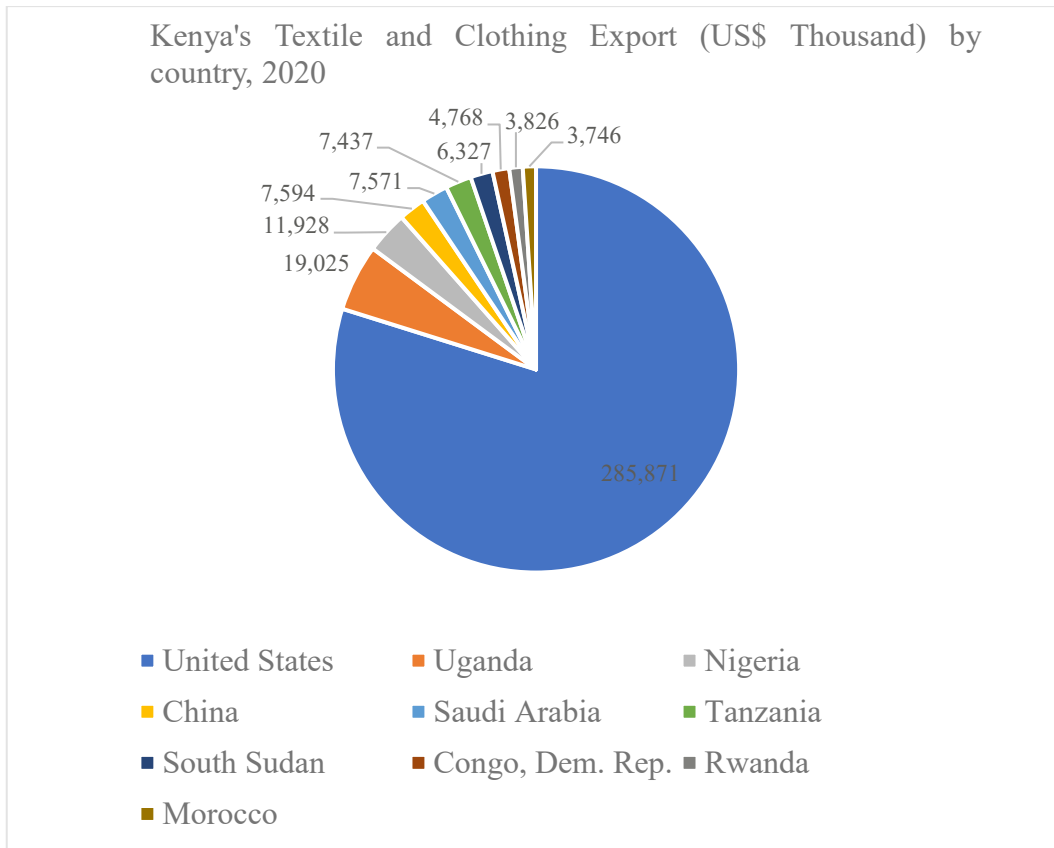


Figure 3.8. A visual representation of Kenya's export partners in regard to specific countries as adapted from World Bank (2023). Because of the trade privileges provided by AGOA, Kenyan clothing and textile products have enhanced opportunities to be exported to the United States. The United States has emerged as Kenya's most important commercial partner in this industry.

3.3 Wastes from Textiles Value Chain

Waste is detrimental to both the environment and humankind, and although an anthropocentric perspective of waste management should be avoided, the Anthropocene concept helps comprehend the effects of human activities on the earth (Reno, 2015). Waste is not merely a by-product of human activity; it is also a vital component of the ecological equilibrium for non-human animals (Reno, 2015). The definition of waste and management as given by the Basel Convention is as follows; “Wastes” are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law; 2. “Management” means the collection, transport and disposal of hazardous wastes or other wastes, including after-care of disposal sites;” (UNEP, 2011). Population growth has promoted urbanization, industrialization, and the pursuit of consumer goods, increasing the generation of solid waste (Ezeudu *et al.*, 2021). The lack of incorporation of environmental costs in the production of virgin textiles is a hindrance to the sustainable management of textile waste (Palm, 2011).

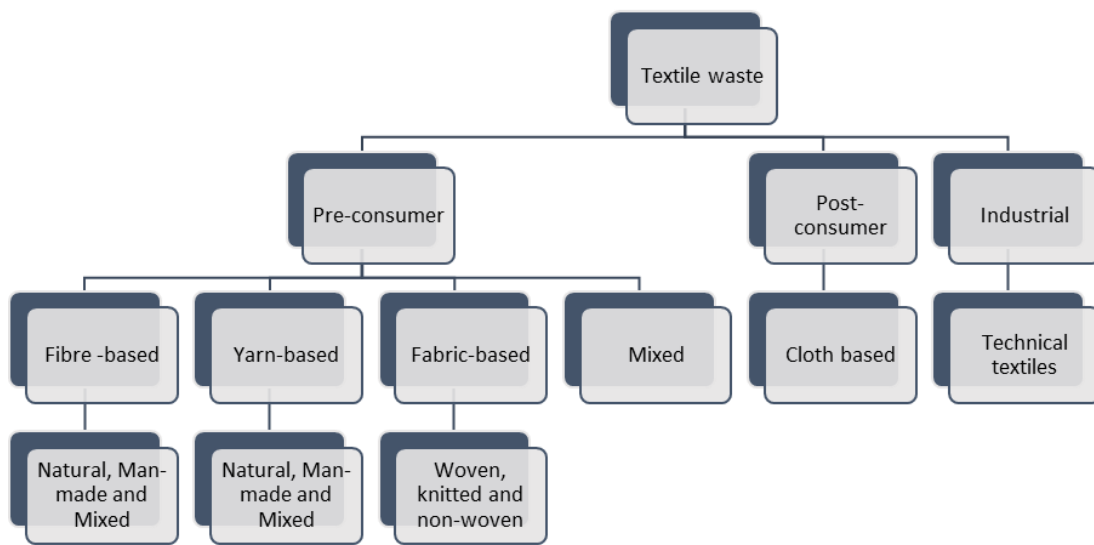


Figure 3.9. An overview of waste from textiles as adapted from Mishra *et al.* (2022).

Waste from textiles can be categorized into pre-consumer textile waste, post-consumer textile waste, and industrial textile waste (Chavan, 2014; Mishra *et al.*, 2022). Pre-consumer textile waste comprises wastes produced during the manufacturing and production of textiles and while post-consumer textile waste refers to the used household apparel whose value can still be recovered or reused or otherwise discarded if the value is lost, and industrial textile waste is the waste that comes from industrial and commercial use and is considered as “dirty waste” (Chavan 2014). The physical characteristics of textile waste determine whether it is classified as solid waste or wastewater (Mandal, 2022). Solid textile waste includes the fibre, yarn, fabric, and clothing that are discarded during the production, pre-consumer, and post-consumer stages of the textile industry, while wastewater refers to the effluent released during the production process (Mandal, 2022). The quantity of waste generated, along with the nature of that waste, varies depending on a wide range of factors, such as the type of fabric that is being processed, the chemicals that are used, and the technology and operating methods that are utilized (Tiwari and Babel, 2013). Waste from textiles is generated through several channels, such as fibre, textile, and clothing manufacturing industries, consumers, and the commercial and service industries (Ütebay, Çelik and Çay, 2020). Synthetic fibres release more waste per kilogram of fibre during the dyeing and finishing process than natural fibres (Boston Consulting Group, 2020).

In summary: There are three primary textile waste categories are: pre-consumer, post-consumer, and industrial textile waste. They are generated at different processes in the manufacture of textiles or clothing. The volume of waste produced, as well as the nature of that waste, can be quite variable depending on the many different causes; the sort of material that is being processed, the chemicals that are involved, as well as the technology and methods that are used throughout operations.

3.3.1 Environmental Impact of Textile Waste from Production and Consumption

Concerns regarding sustainability, such as energy and water consumption, pollution, and greenhouse gas emissions, present the textile industry with significant environmental and resource challenges (Shirvanimoghaddam *et al.*, 2020). All around its supply chain, the textile and apparel industry has a significant impact on water consumption and pollution, with the cultivation of cotton, textile manufacturing, and consumer laundering being the most water-intensive processes (Maxwell and L. Ryan, 2015). The authors also add that the global average water footprint per kilogram of cotton cultivation ranges between 10,000 and 20,000 litres, whereas textile manufacturing uses over 5 trillion litres of water yearly (Maxwell and L. Ryan, 2015). Cotton fabric is known for its superior physical and chemical qualities, such as its durability, softness, absorbency, and dyeability (Fang *et al.*, 2015). Another report estimate that around 378 billion litres of water are consumed by the textile industry every year and that the process of dyeing and finishing one kilogram of textiles can take up to 200 litres of water (World Wildlife Fund, 2013). In addition, cotton farming is responsible for eight to ten per cent of the world's total use of pesticides and as much as fifty per cent of the total use of pesticides in developing nations (World Wildlife Fund, 2013). The use of synthetic fibres has continued to prevail in the fibre market, with polyester leading with 52%, followed by cotton at 23% of global fibre production volume in 2019 (Textile Exchange, 2020). This changed in 2021, with polyester having a 54% market share of the total global fibre production, while cotton's market share in global fibre production decreased to 22% (Textile Exchange, 2022b). The report also indicates that more than half of the fibre production globally is bad for the environment, yet there are no alternate fibres available to match the demand for apparel production at present (Textile Exchange, 2022a). Further studies indicate that the textile sector is a significant contributor to the overall high levels of energy consumption and carbon

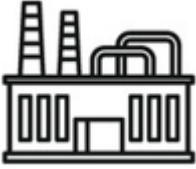



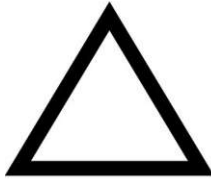
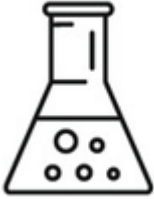
dioxide (CO₂) emissions (Alkaya and Demirer, 2014). The process of cutting and sewing textiles is approximated to generate 15% of the fabrics, which are disposed of in landfills although fit for reuse (Rapsikevičienė, Gurauskienė and Jučienė, 2019). When waste is dumped in landfills, it leads to the emission of greenhouse gases, such as methane and CO₂, as well as the potential release of leachate into bodies of water (Juanga-Labayen, Labayen and Yuan, 2022). The industry is responsible for an approximated 10% of the emission of Carbon dioxide globally, as 75% of the waste from textile are disposed of in landfills (Juanga-Labayen, Labayen and Yuan, 2022). The CO₂ emissions, water, and energy consumption differ in the type of fibre used in garment production across the value chain, as shown in **Table 3.1** below.

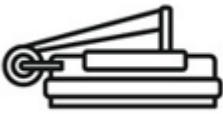

Table 3.1. Niinimäki et al. (2020) depicts the several types of fibres utilized in textile manufacturing, their corresponding levels of water and energy consumption, as well as their CO₂ emissions. While polyester is the highest in production, water is consumed most by cotton, and wool production emits the most CO₂ among the fibres. The bold texts indicate areas with high consumption of resources or emissions. Source: Niinimäki et al., (2020).

Fibre Type	Fibre production (million tonnes)	Energy consumption (KWh/kg Fibre)	Consumption of water (litres/kg fibre)	CO₂ emissions (Kg/kg fibre)
Cotton	27	48	1559	2.2
Polyester	54	108	21	3.3
Non-cotton cellulosic	7.0	85	92	3.3
Polyamide	6.1	160	40	8.3
Wool	1.2	120	530	17.0
Hemp	0.09	22	89	3.1

It is estimated that textile finishing treatment and dyeing contribute to approximately 20% of industrial water pollution and that 72 harmful chemicals have been detected in water exclusively from the dyeing of textiles (Kant, 2012). The textile industry is among the primary cause of the increase in global air pollution (Tiwari and Babel, 2013). The table below shows the different air pollutants released during different processes in the manufacturing of textiles (Tiwari and Babel, 2013).

Table 3.2. Different air pollutants released during different processes and stages of textile manufacturing as adapted from Tiwari & Babel (2013)

Stage/ process	Pollutant released
 <p>Energy production</p>	Particulates, Nitrous Oxides (NO _x), Sulphur dioxides (SO ₂)
 <p>Coating, drying, and curing</p>	Volatile Organic Compounds (VOCs)
 <p>Cotton handling</p>	Particulates
 <p>Sizing</p>	Nitrogen Oxides, Sulphur Oxides, Carbon monoxide
 <p>Bleaching</p>	Chlorine, Chlorine dioxide
 <p>Dyeing</p>	Hydrogen sulfide (H ₂ S)

 <p>Printing</p>	<p>Hydrocarbons, ammonia</p>
 <p>Finishing</p>	<p>Formaldehyde, polymers</p>

Synthetic textiles contribute to microplastics by chaffing the textiles during the laundry process. Developing countries consume a majority of these synthetic fibres. It is reported that one load of laundry of clothes made out of polyester are can discharge approximately 700 000 microplastic fibres that are toxic to the environment and can end up in human and animal food chain (Boucher and Friot, 2017).

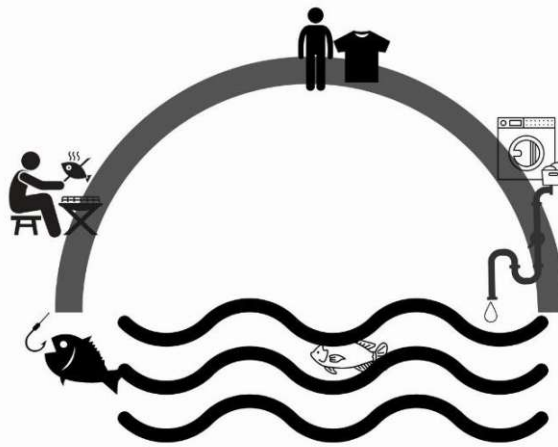


Figure 3.10. Visual representation of microfibres from textiles being released into water bodies during laundry and ending up in the human and animal food chain as adapted from Ellen MacArthur (2017).

The textile industry is responsible for a significant amount of pollution, yet despite efforts to reduce this pollution, the repercussions continue to surpass the methods that are now in place (Binti Norarmi *et al.*, 2022). This can be because laws aren't being followed or enforced as strictly as they should.

3.3.2 Social and Health Impact of Textile Production and Consumption

12.6% of the world's population is employed in the textile, garment, and fashion industries (Solidarity Center, 2023). This number indicates that many people depend on this sector for their daily income and their family's well-being. With the increase in production and consumption, the number will continue to rise and, hence this sector is of immense value to economic development and industrialization. However, the textile industry does not only harm the environment but also the social and health of human beings. This impact is evident in areas where production and manufacturing take place, and most workers do not have labour law protections hence resulting in unstable working hours, and a lack of proper employment agreements (Solidarity Center, 2023). 18% of factories in Vietnam were reported to be defiant of the employment regulations for employees under the age of eighteen in hazardous work, while in Bangladesh, 11% of those working in the garment sector consist of school-aged children who are not in school (UNICEF 2020). Female workers in the apparel and footwear industry often are uninformed of their rights on taking maternities, and in some cases, there is inconsistency in the regulations regarding maternity (UNICEF 2020). Cotton and garments were listed to be among goods made with forced or child labour, where out of the 77 countries, 15 and 24 were reported to have used forced and child labour, respectively, in their production of cotton and garments (ILAB 2022). There are cases of forced and child labour in the textile and garment industries of Bangladesh, Vietnam, Cambodia, Argentina, Thailand, China, Brazil, Nepal, India, Jordan, Ethiopia, Malaysia, and Nepal. In addition to that, cases of sexual harassment and exploitation, together with gender-based violence, are also rampant in the industry (Solidarity Centre, 2019). It is therefore worth noting that the leading textile exporters are also the ones leading with cases of poor working conditions, child and forced labour during production and manufacturing. **Table 3.3** summarizes the occupational hazards that workers in textile factories face and the impact on their health (Parvin et al., 2020). The authors also go ahead and give some specific chemicals and their impact on human health, as indicated in **Table 3.4**.

Table 3.3. Table showing occupational hazards and their impact on textile workers as adapted from Parvin *et al.*, (2020).

Occupational hazard	Effect on workers
Noise from textile industries	Hearing loss, sleep problems
Chemicals and dyes	Cancer of the skin, brain cancer, or leukaemia due to prolonged exposure, respiratory problems, and other skin diseases.
Cotton dust	Byssinosis- occupational lung disease among textile workers.
Inadequate lighting, long working hours	Eyesight problem

Table 3.4. Table showing pollutants and their effect on human health as adapted from Parvin *et al.*, (2020).

Pollutant	Effect on human beings
Sulfur dioxide (SO ₂)	Respiratory system irritation, Bronchitis
Aldehydes	Respiratory system irritation
Chlorine	Lung and eye irritation
CO ₂	Unconsciousness when it binds with haemoglobin

3.4 Recycling of Textiles

The previous articles and reports have indicated an increase in the production and consumption of textiles globally. Hence, stakeholders in the textile industry continue to find means of tackling waste to reduce its impact on the environment. Global organizations and fashion labels have also increased their focus on the problem of fashion waste (Nayak *et al.*, 2020). Recycling and reusing textiles can provide a sustainable solution by reducing the amount of textile waste sent to landfills, and decreasing the demand for new materials, energy consumption, and the industry's overall environmental footprint (Shirvanimoghaddam *et al.*, 2020). The recycling of wastes from textiles is advantageous both economically and environmentally as it results in less demand for energy, water, and chemicals used in textile production and less landfill space (Rani and Jamal, 2017). The authors define *textile recycling* as the repurposing of already-used apparel and clothing from manufacturing process (Rani and

Jamal, 2017). This technique can be carried out using either mechanical, chemical, or thermal processes (Milam-Guerrero *et al.*, 2023). Physical recycling involves the repurposing and reclamation of waste into new products. It is much cheaper and more environment friendly. Chemical recycling, on the other hand, involves the conversion of larger-size polymer molecules into those of smaller size, which are then used in the raw production of other chemicals and polymers (Rani and Jamal, 2017). Chemical recycling is also described as the depolymerization of synthetic polymer fibres, such as polyesters or the dissolving of natural or synthetic fibres after which they are repolymerised and, polymers are then spun back into new fibres (Sandin and Peters, 2018). Recycling reduces the use of dyes in producing new materials since the recycled products already contain dye, hence less water pollution (Aishwariya, 2018). Despite being environmentally friendly, recycling clothes is difficult because most garments are composed of numerous types of fabric, that require a great deal of energy and labour to separate (Milam-Guerrero *et al.*, 2023). The use of multiple poses a challenge to recycling textile waste due to their distinctive attributes making the process difficult as various methods and techniques need to be applied in the process (Rashid *et al.*, 2023). Various scientific studies have demonstrated innovative and practical alternatives for the management of textile waste, such as the use of chemical recycling for the production of microcrystalline cellulose (MCC) (Singhal, Agarwal and Singhal, 2023). Companies are now recycling or repurposing this waste to generate money-making items to become more sustainable and reduce the amount that goes into landfills (Patnaik and Tshifularo, 2021). The use of recycled materials from fibres is also becoming popular in the transport sector, including aircraft and motorcars industries such as Toyota and BMW (Rashid *et al.*, 2023). Companies like H&M use eco-materials and support sustainable manufacturing to reduce carbon dioxide emissions and energy use through its Conscious Action program. Through programs like these, fashion firms can create an environmentally friendly supply chain and educate consumers about sustainability and its impact (Patnaik and Tshifularo, 2021). Other brands like Patagonia and Nike are adapting to the sustainability trend by using recycled Polyethylene terephthalate (PET) bottles in their production (Aishwariya, 2018). Although the move is helping curb the plastic pollution problem, the challenge of what becomes of the waste that comes from these produced from recycled products remains. Synthetic textiles can be recycled mechanically by shredding the fabric and melting the polymers to make new fibres, such as polyester. Recycled polyester, however, is often

not made from old polyester clothes but rather from PET bottles (Manshoven *et al.*, 2021). This is because PET bottles, which are composed entirely of PET and are, therefore, relatively clean, have access to preexisting collection networks and recycling infrastructure (Manshoven *et al.*, 2021). This facilitates their shredding into flakes for subsequent melting into fresh PET fibres. Shortening fibre lengths, distinguishing fibre kinds, and dealing with persistent contaminants are technical challenges when recycling textiles from fibre to fibre (Koszewska, 2018). The recent trend where brands using recycled plastic bottles, fishing nets or ocean plastic to make their clothes may raise awareness of the volume of recyclable material that is lost or winds up in the ocean, but it will not effectively address the plastic crisis (Changing Markets Foundation, 2021a). This statement advocates for a closed-loop cycle in textile recycling. Additionally, collecting and sorting enough recycled textiles while maintaining environmentally beneficial reuse paths is difficult (Koszewska, 2018). Furthermore, creating a standardized method for fractionating and separating cotton and polyester textile blends is a difficult process since the different structures and percentages of these textiles that can be found in different products make the task more complicated than it should (Kahoush and Kadi, 2022). It can be noted that sorting techniques are costly and labour-intensive, and the usage of different fibre blends in textiles makes it difficult to sort and recycle (Bukhari, Carrasco-Gallego and Ponce-Cueto, 2018).

3.5 Reuse of Textiles

Various life cycle assessment studies suggest that expanding the lifespan and recycling clothing can greatly minimize the environmental effect of garment manufacture, saving virgin material, energy, water, and greenhouse gas emissions from textile manufacture (Laitala and Klepp, 2017). Just like recycling, the reuse of textiles has proven to be the most efficient way to reduce the impact of textiles on the environment in contrast to incineration and disposal in landfills (Sandin and Peters, 2018). Getting people to reuse things is one of the most important things you can do to reduce waste. The production of long-lasting things ought to be prioritized in the textile industry, and individuals must be adequately educated on the importance of reducing waste (Dahlbo *et al.*, 2016). By reusing, repairing, improving, and remanufacturing items that would otherwise be discarded, the value of these items can be enhanced through a process known as *upcycling* (Singh *et al.*, 2019). Upcycling is considered to be environmentally friendly since it combines circular material flows with slower product and material output, as

well as reduced cycles of consumption in order to aid in minimizing the negative effects on the environment (Singh *et al.*, 2019). Compared to recycling, direct reuse retains the quality of materials higher while consuming less energy (Rapsikevičienė, Gurauskienė and Jučienė, 2019). When it comes to reusing, the transportation of second-hand clothes globally may result in environmental pollution that surpasses the one that it meant to avoid in the first place (Sandin and Peters, 2018). It is therefore, worth, analyzing the waste environmental pollution that could be generated from shipping clothes for reuse. New textiles should be made suitable for reuse or recycling, and traditional materials to be restored with more sustainable ones (Palm, 2011). Reusing also involves selling clothes online, giving them as a charity, or passing them on to family members (Boston Consulting Group, 2020). This method benefits the seller economically and helps reduce environmental pollution while conserving resources and promoting a circular economy. Reports have also indicated that consumers want fashion businesses and governments to prioritize openness and responsibility to ensure supply chain human rights and environmental standards (Fashion Revolution, 2021). They emphasize ethical practices that prioritize human and environmental well-being. Because textiles exhibit remarkably low rates of degradation in landfills, their impact on climate at the end of the value chain remains low compared to other stages (UNEP, 2020a). However, increasing their reuse, repair/repurposing, and closed-loop recycling will reduce climate emissions at all phases of the textile value chain (UNEP, 2020a).

In summary: Significant environmental and resource challenges related to sustainability arise the textile industry, particularly in the areas of energy and water consumption, pollution, and greenhouse gas emissions. Cotton and other natural fibres demand a substantial quantity of water resources during the production process; however, the production of textiles using artificial fibres typically consumes more energy than natural fibres, as shown by the statistics presented by Niinimaki et al. (2020). The production process has varying effects on the environment and the resources available due to the different types of fibres that are employed. Over 50 percent of the world's fiber production is harmful to the environment yet, there is a lack of alternative fibres that are commercially feasible and capable of meeting the demand for the production of clothing. Although landfilling of textiles has a lesser adverse impact on the environment compared to other production stages, recycling and reusing textiles can further minimize the impact of all stages on the environment.(UNEP, 2020a).

4 Results and Discussions

This section aims to discuss in detail the key underlying factors behind the generation of textile waste in Kenya. It will therefore begin by highlighting circular economy and sustainability measures in the textile industry at the globally. In addition, the general state of the second-hand clothes industry in the continent will be analyzed. The waste management practices in Kenya will be examined including, the available policies and regulations available. Challenges of managing waste in the country and opportunities for recycling will also be highlighted. By understanding the main contributors to textile waste in different countries on the continent, this thesis will be able to identify areas that need improvement and provide further recommendations.

4.1 Circular Economy and Sustainability Approach in Fashion and Textile Waste Management

A *circular economy* is to move toward a sustainable environment along side economic prosperity obtained through the utilization of various technologies and systems of recycling and valorization (Mishra et al., 2022). Through the "cradle-to-cradle" idea, a circular economy is a plan to reduce the environmental impact of the whole economy (Pino et al., 2017). It disagrees that a healthy economy must either shrink or stay the same size. It encourages growth by taking a broad view of product, service, and infrastructure decisions and tries to keep the value from being lost along the value chain by putting it back into the business (Pino et al., 2017). By improving product design and processes to encourage maximum resource reuse, and waste prevention, the circular economy aims to be restorative and regenerative (Bukhari, Carrasco-Gallego and Ponce-Cueto, 2018). To beneficially influence a company's value creation cycle and realize benefits like cost reduction, risk management, and increase in revenue, sustainability is becoming more significant for managers (Resta and Dotti, 2015). Cellulose, sugar, adsorbent for heavy metal, biogas, ethanol, bricks, chipboards, composites, hydrogen, and thermal insulation are just some of the many products that may be made from textile waste (Mishra et al., 2022). Giving these wastes a new life in the value chain can be done sustainably by recycling cloth materials and turning them into high-tech materials for green processes (Tummino et al., 2023). The advancement of adaptable scientific industrial-level technologies for fabric waste will play a role in reducing the volume that ends in landfills while also contributing to the production of significant products in the industry. The advancement of adaptable scientific industrial

level technologies for fabric waste will play a role in reducing the volume that ends in landfills while also contributing to the production of significant products in the industry (Singhal, Agarwal and Singhal, 2023). Radio Frequency Identification (RFID) tags may be applied to categorize garments according to the fabric (Chen *et al.*, 2021). During the manufacture of the garment, these tags are sewn into the hems of the fabric, and they can continue to function normally throughout the whole lifecycle. Solvent technologies provide workable options to sort fibres and yarns (Chen *et al.*, 2021). The first technique involves dissolving soluble fibres while leaving the insoluble fibres unaltered (Chen *et al.*, 2021). The second technique involves heating one type of fiber at a high temperature while leaving the other unaltered (Chen *et al.*, 2021). Utilizing these technologies is essential for transitioning towards a circular economy.

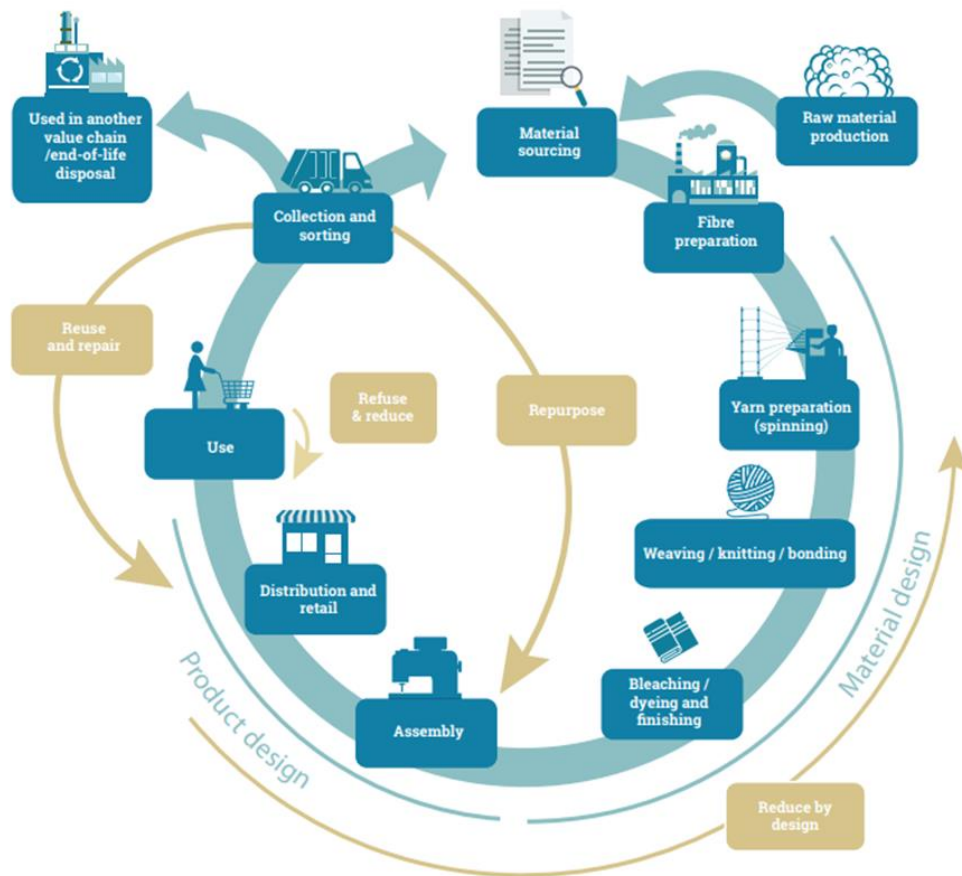


Figure 4.1. Diagram showing the circular economy model in the textile sector as presented by UNEP (2020) illustrating that the circular economy aims at transforming the conventional “take-make-dispose” presented by linear economy into a circular model that ensures that resources are not discarded after use but instead they remain in the loop as long as possible at the highest value possible.

Efforts are being made globally to help curb the fast fashion menace. The approach requires all textile and fashion industry stakeholders to support and ensure sustainable

production and consumption. Such efforts have led to the development of the Fashion Industry Charter for Climate Action. It is a global mission statement where fashion companies and textile industries commit to attaining net-zero emissions by 2050 while addressing their role in climate change and keeping the global warming level below 1.5°C per the Paris Agreement goal (UN Climate Change, 2021). This action will involve eliminating use of coal at all owned and supplier locations as quickly as feasible and no later than 2030. By January 2023, at the very least, no new coal power plants should be built (UN Climate Change, 2021). The charter had ninety-nine signatories out of which sixty-eight were brands and retailers, and thirty-one were manufacturers in 2022 (Hohmann, Xhaferi-Salih and Oliveras, 2023). Forty-five per cent of the active signatories complied with establishing public climate target required to maintain global warming below 1.5°C (Hohmann, Xhaferi-Salih and Oliveras, 2023). However, due to their failure to report, 31 signatories' lost their accreditation with the Charter (Hohmann, Xhaferi-Salih and Oliveras, 2023). Financial incentives are essential for shifting from the wasteful fast fashion paradigm to a circular textile economy (Goezet and Wilts, 2022). The costs of collecting and recycling are the responsibility of firms and should be set per the circularity of their products and business strategies. Companies that produce high-quality, easily recyclable apparel should be compensated at a far higher rate than those that do not (Goezet and Wilts, 2022). This method would guarantee a stable and equitable market for all participants.



Figure 4.2. A picture of a recycling container at a H&M store in Vienna. The words on the container encourage members to earn shopping points while recycling. The company collects reused clothes in any condition. The picture was taken by the author in Vienna (2023).

In the EU, various regulations have been set on the same to promote circular fashion and, at the same time enhance sustainable production. After years of pushing for environmentally friendly and sustainable utilization of raw materials, reuse and recycling, the EU finally adopted a circular economy to ensure a separate collection of textiles in all member states by latest 2025 (Nikolina, 2019). The EU has developed a strategy for sustainable and Circular Textiles that seeks to establish a comprehensible framework and a vision for change in the textile sector, which states: “By 2030 textile products placed on the EU market are long-lived and recyclable, to a great extent made of recycled fibres, free of hazardous substances and produced in respect of social rights and the environment. Consumers benefit longer from high quality affordable textiles, fast fashion is out of fashion, and economically profitable re-use and repair services are widely available. In a competitive, resilient and innovative textiles sector, producers take responsibility for their products along the value chain, including when they become

waste. *The circular textiles ecosystem is thriving, driven by sufficient capacities for innovative fibre-to-fibre recycling, while the incineration and landfilling of textiles is reduced to the minimum.*” (European Commission, 2022). The regulation aims to establish specific EU-level specifications to differentiate waste and second-hand products from textiles to avoid waste from being falsely classified as second-hand clothes during importation from the EU. The Commission will also consider requiring that separately collected textile waste from households and similar waste is prepared for reuse as a necessary first step, which will boost preparing for reuse, reuse and repair activities and reduce the volumes for types of waste treatment that are lower in the waste hierarchy (European Commission, 2022). Although producing countries are accountable for the depletion of natural resources, pollution, and other negative effects of production, industrialized countries also face significant responsibilities in this regard and bear significant practical and legal responsibilities due to their prominent levels of consumption (Kufeoglu, 2022). The EU regulation on textiles aims to ensure that the products sold within the EU are safe for consumption and are of desirable quality. The regulation requires accurate labelling of textile products, provision of fibre content information, the product’s origin, and directions on the maintenance and further limit the use of potentially harmful substances in producing textile products (EU Regulation, 2011). With these regulations, the EU aims to ensure that apart from sustainable production and consumption, human rights are also looked after during the value chain of textile production. However, the absence of proper waste disposal methods, inadequate measures of sorting wastes, and lack of adequate waste collection policies hinder the adoption of circular economy in developing countries (Ezeudu *et al.*, 2021). A study on Extended Producer Responsibility (EPR) in the EU market shows that EPR can serve as an asset and resource in the textile waste stream, especially for post-consumer waste (Gerstmann, 2020). *OECD defines extended producer responsibility (EPR) as “an environmental policy approach in which a producer’s responsibility for a product is extended to the post-consumer stage of a product’s life cycle have become common.”* (Monier *et al.*, 2014). It intends to hold manufacturers and producers accountable for the environmental impacts caused by their products at every stage of the product life cycle, from the initial design phase to the phase after consumers have used it. Post-consumer waste fall under municipal waste, which the EPR was principally intended for (OECD, 2016). The study advises the EU on determining which instrument to use, but the quality of products and enhancement with respect to

durability and recyclability are confirmed (Gerstmann, 2020). Progress in technology is required to match the oncoming recycling goals. Through technology and digitalisation, there will be an increase in traceability and openness in the value chain that might make room for tailored policy approaches soon (Gerstmann, 2020). These sustainability actions will enable the achievement of Sustainable Development Goal (SDG) twelve on ensuring sustainable production and consumption through waste reduction. The SDG 12 target 6 states, “*Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle.*” (UN, 2015). Together with SDG 12, target C states, “*Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities.*” (UN, 2015). Textile industries will effectively contribute to the global goals, enhance resource conservation, and reduce the impact of climate change in the long run.

Review: As already indicated, consumer demand is the cause of the increase in clothing production globally. With countries in the EU adopting measures to increase textile collection, this will also encourage consumers to buy more as it is easy to dispose of used clothing in the collection systems put in place. As a result, second-hand clothes export to developing countries like Kenya increases. This statement is supported by the reports that the demand for second-hand clothes in developed countries is low in compared to developing countries. Although the regulation aims to restrict the export of SHC to countries with proper waste management, it does not guarantee that the said countries will not export to the countries lacking waste management facilities. It also does not guarantee EPR in developing countries. Hence, the need for global regulation of fast fashion. In addition to that, it is evident that sustainability is becoming a trend among fashion brands in developed countries. However, these acts of sustainability only function across the borderline of these industrialised countries. More action is needed to ensure that actions like the Fashion Industry Charter for Climate Action are mandatory for all brands.

On the other hand, the regulation could ensure that clothes imported to countries like

Kenya contain less harmful substances to the environment. The importing countries will therefore have to lay down regulations to ensure that the clothes received are in a good state and labelling is done accordingly. This process may be labour-intensive due to the sorting process involved, but it will also create opportunities for employment in the sector. In addition, the receiving countries need to have better means of post-consumer textile waste management systems in place.

4.2 Second-hand Clothes in Africa

Due to the emergence of large-scale production and worldwide retail companies that make it easy and fast to disseminate trendy fashion products at the international level, the subject of what becomes of clothing when it reaches the end of its useful life has continued to be more challenging (Lewis 2015). This trendy sector of the economy often leads to a disparity between demand and disposal, pushing excess apparel from developed countries onto the markets of developing ones (Lewis, 2015). The author also adds that developed nations frequently use this technique of disposal, which entails shipping used clothing to developing nations, as a result, it is entirely upon the recipient nation to determine whether to reuse or discard the apparel (Lewis, 2015). Differences in disposal costs and environmental regulations continue to be the significant reason for the shipment of second-hand goods from developed countries to Least Developed Countries (LDC) (Bernard, 2011). Disposal costs in LDC are low, and regulations are less stringent compared to developing countries (Bernard, 2011). Producers who own recycling centres might consider legal and illegal shipment of goods to reduce the extended producer responsibility complying cost. This will enable them to reduce the costs of waste disposal (Bernard, 2011). Used items are exempt from international waste restrictions and open trade opportunities, hence the need to falsely classify wastes as second-hand goods to escape the financial responsibilities of safely disposing of them as required by the country's regulations (Bernard, 2011). The second-hand market for apparel, personal accessories, and footwear is advancing globally, indicating a 15%–20% CAGR in the next five years (Boston Consulting Group, 2020). Low prices, choice variability, distinctiveness, and environmental concerns are the key drivers toward second-hand consumption (Boston Consulting Group, 2020). When purchasing products, quality and durability are of greater importance to customers (Odinga, Ombaba and Joseph Mwanza, 2022). Several African countries have sizable second-

hand clothes markets where donated apparel is sold. While this method keeps clothes out of landfills and lowers prices, it does have some drawbacks (Patnaik and Tshifularo, 2021). Although it is hard to prove, global North apparel overconsumption harms the ecology and society while ignoring people's basic requirements. Capitalism creates spatial inequality, and the present structure, which gains from others' labour, contributes to disparities in society and wages, resulting in uneven nutritional and clothing access (Brooks, 2015). Sub-Saharan Africa's (SSA) garment industry suffers from shared issues. These challenges include a lack of textile production facilities, a difficulty for small-scale producers and designers to access industrial production, a shortage of industry-specific training facilities and skilled labour, limited financing, limited local and regional input suppliers and export companies, and changing end-market requirements (Fashionomics, 2016).

Regulatory concerns, weak infrastructure, and limited information availability are further challenges for the business. Africa currently accounts only for 1.9% of global manufacturing (Alkaya and Demirer, 2014). Africa's top 10 apparel exporting countries are all located in East and Southern Africa and only have a 0.56% share of the global volume of clothing exports, amounting to US\$ 2.6 billion (Alkaya and Demirer, 2014). However, the import of second-hand clothes and footwear in African countries has been linked to causing environmental pollution and suppressing the domestic textiles industry leading to some countries' ban on imports (Fibre2Fashion, 2022). East African countries consisting of Kenya, Rwanda, South Sudan, Uganda, and Burundi attempted to phase out the import of second-hand clothes and footwear in 2016 to build their local textile industries (Friedman, 2017). Rwanda's import of apparel to AGOA was, however, suspended following the country's ban on second-hand clothes and footwear and the rise of tariffs on the same, which contradicted the eligibility criteria for AGOA (USTR, 2018). The findings of a study on the socioeconomic benefits of the second-hand industry and the expansion of the market in Liberia suggest that a ban on the sale of used clothing in Liberia would have a negative impact on the people with lower incomes (Sumo, 2022). The author also suggests the development of measures to assist young entrepreneurs in gaining jobs and access to financial resources (Sumo, 2022). The regulation of the value chain for second-hand garments will be beneficial to both projects aimed at empowering women and those serving those in need. An example of the second-hand market in Maputo, Mozambique, and the way it impacts the livelihoods

of the vendors by Brooks argues that it is important to balance a vendor's particular chances in the market with the broader effects on national commodity circulation spheres and modes into global economic integration (Brooks, 2012).

4.3 Waste Management Practices in the Republic of Kenya

Lying in an area of 582,646 Km², natural resources and the environment continue to be the cornerstone of the economic system of Kenya by contributing substantially to its Gross Domestic Product (GDP) (Government of Kenya, 2021). The contribution of the Environment and natural resources sector to the GDP for the period under review stood at 3.6 per cent, compared to a contribution of 3.5 per cent in 2020 (KNBS, 2022a). However, due to population growth and urbanisation, informal settlements are becoming prevalent, resulting in the degradation of the environment attributed to a surge in solid waste, effluents, and changes that impact the environment (Government of Kenya, 2021). Kenyan Act defines waste as follows, “*Waste means— (a) any substance, material or object that is intended or required to be discarded or disposed of by its holder, whether or not it can be reused, recycled or recovered and include municipal waste, domestic waste, waste from agriculture, construction waste, commercial waste, waste from horticulture, aquaculture and forestry, medical waste, chemical waste, hazardous waste, toxic waste, industrial waste, pesticides, e-waste and toxic substances but does not include radioactive waste;*” (GOK 2022) The Kenyan Act on sustainable waste management does not exclusively mention textile waste in its definition. However, under the environmental laws of the Republic of Kenya, human health and the environment are protected. The Environmental Management and Co-ordination Act, 1999, chapter 387, part vii, section 87 reads as follows; “(1) *No person shall discharge or dispose of any wastes, whether generated within or outside Kenya, in such manner as to cause pollution to the environment or ill health to any person. (2) No person shall transport any waste other than— (a) in accordance with a valid licence to transport wastes issued by the Authority; and (b) to a wastes disposal site established in accordance with a licence issued by the Authority.*” (Environmental Management and Co-Ordination Act., 1999). The government of Kenya, under the Environmental Management and co-ordination (waste management) Regulations, 2006, stipulates that “*No person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle.*” (Environmental Management and Co-Ordination (Waste Management) Regulations, 2006). Despite the

already existing regulations on waste management, the amount of waste disposed continues to surpass the amount collected. This statement also includes the waste generated from used clothes in the country.

Table 4.1. Summary of waste generation, collection and recovery status in selected towns in Kenya as adapted from NEMA (2015). Source: National Environmental Act (NEMA), Kenya, (2015)

Town	Estimated Waste generated (tons/day)	Waste Collected (%)	Uncollected Waste (%)	Waste Recovery (%)	Unrecovered (%)
Nairobi	2400	80	20	45	55
Nakuru	250	45	55	18	82
Kisumu	400	20	Value unknown	Value unknown	Value unknown
Thika	140	60	40	30	70
Mombasa	2200	65	35	40	60
Eldoret	600	55	45	15	85
	Total= 5990				

The unavailability of up-to-date data on the waste generated from the cities hinders the study, planning and budgetary allocations towards waste management in the country. On the waste classification and separation, the sustainable waste management ACT states, “(1) All public and private sector entities shall segregate non-hazardous waste into organic and non-organic fractions. (2) The segregated waste shall be placed in properly labelled and colour coded receptacles, bins, containers and bags. (3) All waste service providers shall collect, handle and transport segregated waste as provided for under this Act.” (GOK 2022). Despite having regulations on waste collection, regulation and EPR, there is still a challenge to waste disposal and management. Since the measures in place are not followed strictly by the relevant authorities, the public lack awareness of their existence. It is uncommon to find well-labelled and colour-coded collection bins in the areas set for waste collection in most parts of the country.

Therefore, the relevant authorities must create awareness by incorporating waste and waste management into the educational curriculum and allocate adequate resources for waste collection. Kenya faces the challenge of proper waste disposal due to inadequate sanitary landfills and incineration facilities (IUCN-EA-QUANTIS, 2020).

4.3.1 Second-hand Cloth Trade in Kenya

Second-hand clothes were introduced into the Kenyan market in the 1980s, during which the domestic textile industry flourished, providing 30% employment in the labour force (Chemengich *et al.*, 2013). However, economic liberalisation entailed importing second-hand clothes, which resulted in the near crumble of this domestic industry in the 1990s (Chemengich *et al.*, 2013). The signing of the AGOA only resuscitated the textile industry for a short while, focusing on the export rather than the local market (Chemengich *et al.*, 2013). The apparel sector, however, saw growth due to Export Processing Zone (EPZ) enterprises having spurred clothing export growth following the commencement of AGOA. One hundred eighty-five thousand tonnes of second-hand clothes, comparable to 8,000 containers, were imported into Kenya in 2019 (IEA, 2021). Second-hand import quantity decreased slightly to 183,830 tonnes in 2021 (KNBS 2022a). As reported by Africa Collect Textiles, a start-up in Kenya that upcycles waste from textiles, 30 to 40 per cent of second-hand clothes are of poor quality that is not suited for reuse and amounts to an estimated 150 to 200 tonnes of textile waste each day (Fibre2Fashion, 2022). Businesses are subject to regional and national trade rules, as well as the importation protocols published by KEBS (EIA, 2021). Since it did back down from the ban on second-hand clothes, Kenya remains to benefit from textiles and apparel in AGOA until 2025, when the legislation period will end (USTR, 2018). In 2021, the government of Kenya reported having imported 183.830 tonnes of second-hand clothing compared to 135.868 tonnes in 2017, as shown in the **Figure 4.3** (KNBS 2022b). This quantity shows a significant increase in the sector. The objective behind phasing out second-hand clothing is to uplift the cotton, apparel, textiles, and leather industries struggling to compete with the high influx of second-hand clothes in the region (Wetengere, 2018). Although second-hand clothes had some positive contributions, they ultimately negatively impacted on the textiles and leather industries, consumer health, human dignity, and African culture (Wetengere, 2018). While the ban is commendable, it is important to note that some evidence, as provided by Wetengere 2018 shows that the second-hand clothes trade was not the

primary cause of the industry collapse in the region. The author cites poor leadership, lack of investment capital, infrastructure, and competition from new imported clothes (Wetengere, 2018).

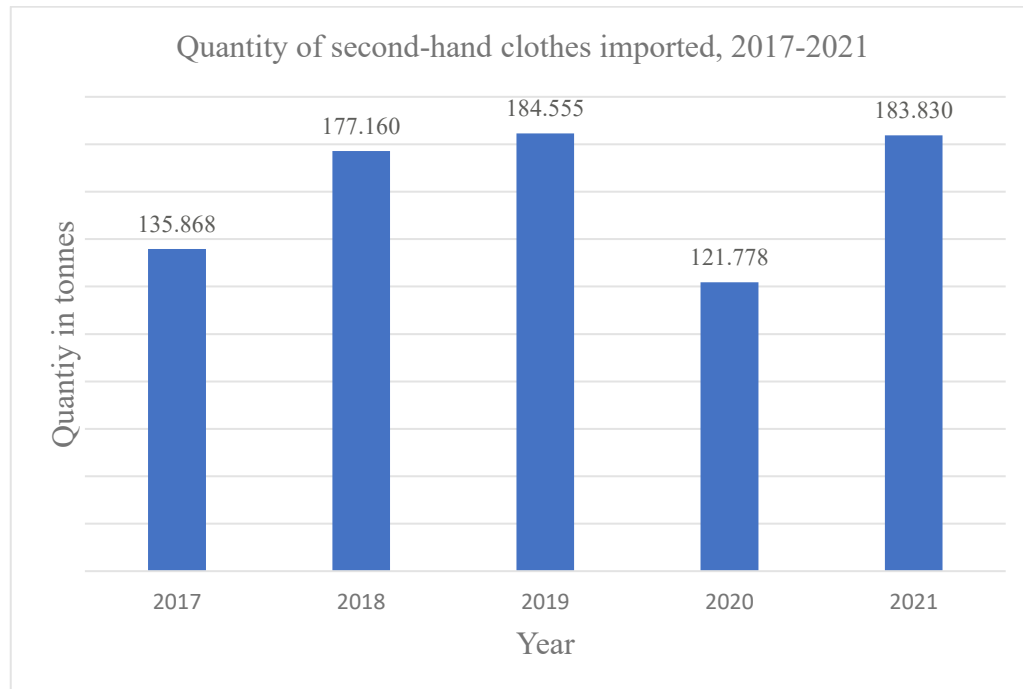


Figure 4.3. Quantity of second-hand clothes imported in Kenya from 2017-2021 as reported in the economic survey by Kenya National Bureau of Standards (KNBS), 2022b. Source: KNBS, (2022b)

The second-hand clothes market is a complicated chain since many stakeholders are involved, from their exportation and arrival at the Port of Mombasa to the final consumption, as shown in **Figure 4.5**. This flow shows the complexity that arises when it comes to tracing the source of clothes disposed of in the open areas. The different stakeholders play a crucial role in the circulation of the clothes, as indicated, and they also contribute to their impact on the environment. The exporting countries also play a crucial role in the life cycle of second-hand clothes. In addition, producers, as shown initially, bear the huge responsibility of ensuring sustainable production for goods to be exported. Therefore, the measures put in place to tackle textile waste, like the Fashion Industry Charter for Climate Action, should be compulsory for all stakeholders involved to achieve the desired goals. **Figure 4.4** below shows the cycle of second-hand cloth after it has been discarded by the consumer in the global North and finally ending in a dumpsite in Kenya. The first part shows how consumers discard their clothes through donations or recycling centres, and 10-30% of the collected clothes are sold back into

the domestic market while the rest is either downcycled, disposed of as waste or exported to countries like Kenya (Cobbing *et al.*, 2022).

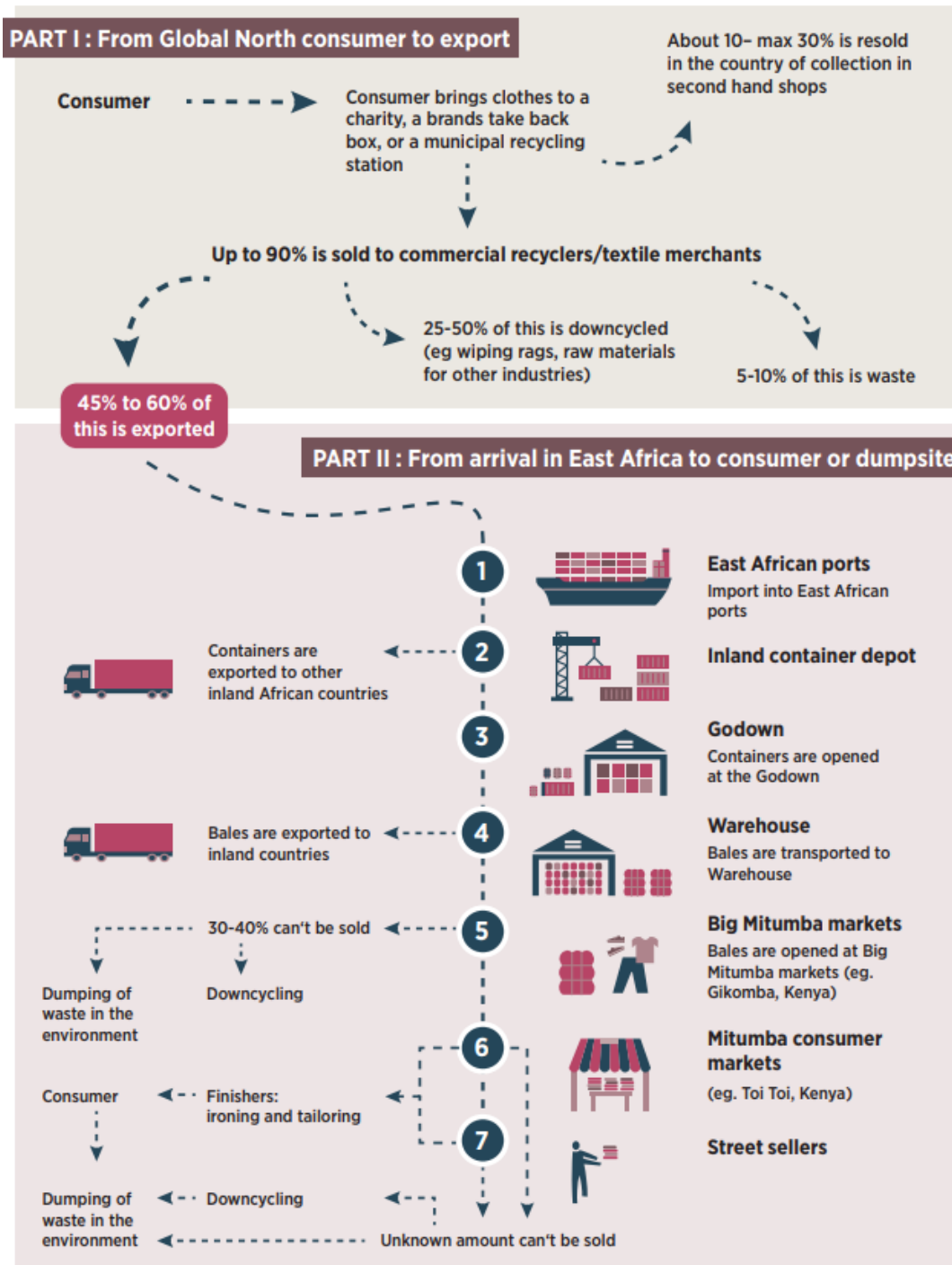


Figure 4.4. Graphic illustration as presented by Greenpeace (2022) indicating the movement of used cloth "mitumba" from the country of origin to importing country.

Upon arrival at the Mombasa port in Kenya, the second-hand clothes, also known as 'mitumba' by the locals, are cleared by the customs authorities before being transported to the godowns or warehouses where goods are then sent to the market for wholesalers, retailers, exporters and consumers as shown in figure 4.1 below. 'Mitumba' is a Swahili

word for bales which symbolises how second-hand clothes are most often packaged upon arrival at the port.

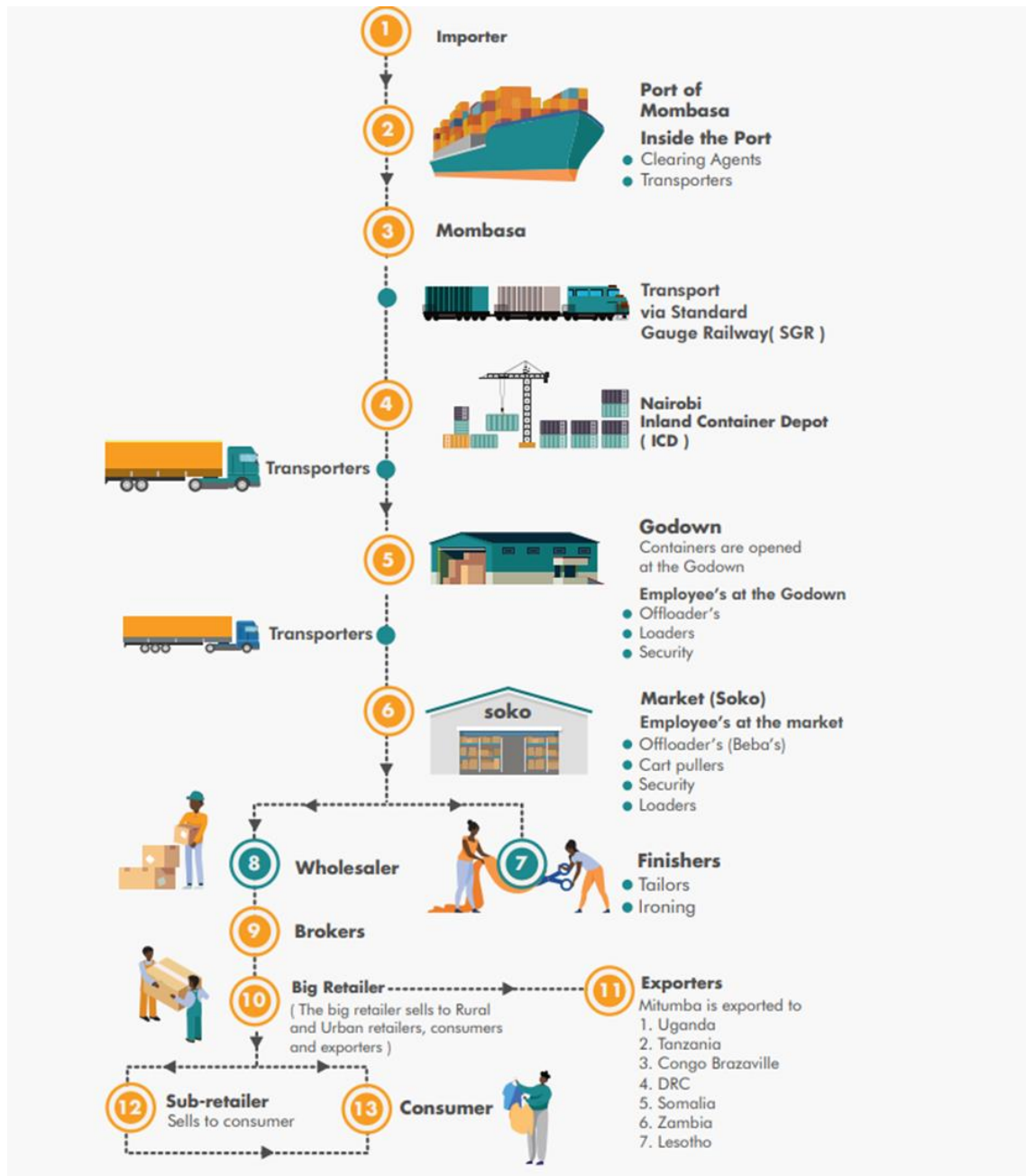


Figure 4.5. A further illustration by IEA Kenya (2019) of the journey through which second-hand clothes undergo from importation to final consumption, including all the stakeholders involved. As indicated, Kenya further exports the clothes to neighbouring countries such as Uganda, the Republic of Tanzania and others, as shown in the figure above.

Several countries, as well as continents, are frequently involved in the manufacturing of a single article of apparel. For instance, Greece could grow a shirt's cotton, and the fibres spun in Turkey, fabric woven in India, sewed together in Bangladesh, and ultimately sold by a retailer in Germany (Köhler *et al.*, 2021). The final consumption of

the cotton shirt may happen in Kenya, where it ends up as second-hand cloth, as shown in the figures above.

4.3.2 Waste from Second-hand Clothes in Kenya

Second-hand clothing is sold to a commercial sorter or recycler before exportation. Economically, only around 50% of these clothes can be reused for apparel, and the rest are downcycled (such as for rags, insulation, or other industries) in the domestic market (Cobbing *et al.*, 2022). If they have no market value, garments exported for "reuse" may become waste in importing countries, worsening textile waste accumulation (Cobbing *et al.*, 2022). Due to a lack of facilities to adequately manage waste in the country, most waste from second-hand clothes often finds its way into open-air burning or open dumpsites (Cobbing *et al.*, 2022). This disposal method poses a health risk to the public and the environment. Decomposing clothing releases methane, a harmful greenhouse gas contributing to climate change (Juanga-Labayen, Labayen and Yuan, 2022). Significant quantities of non-renewable resources, particularly synthetic fibres, are used in the production of apparel, which is frequently worn for a short period before being discarded and ultimately ending up in landfills or burned (Changing Markets Foundation, 2021b). This synthetic fibre waste from clothes also contributes to plastic leakage into water bodies in the country (IUCN-EA-QUANTIS, 2020), as shown below.

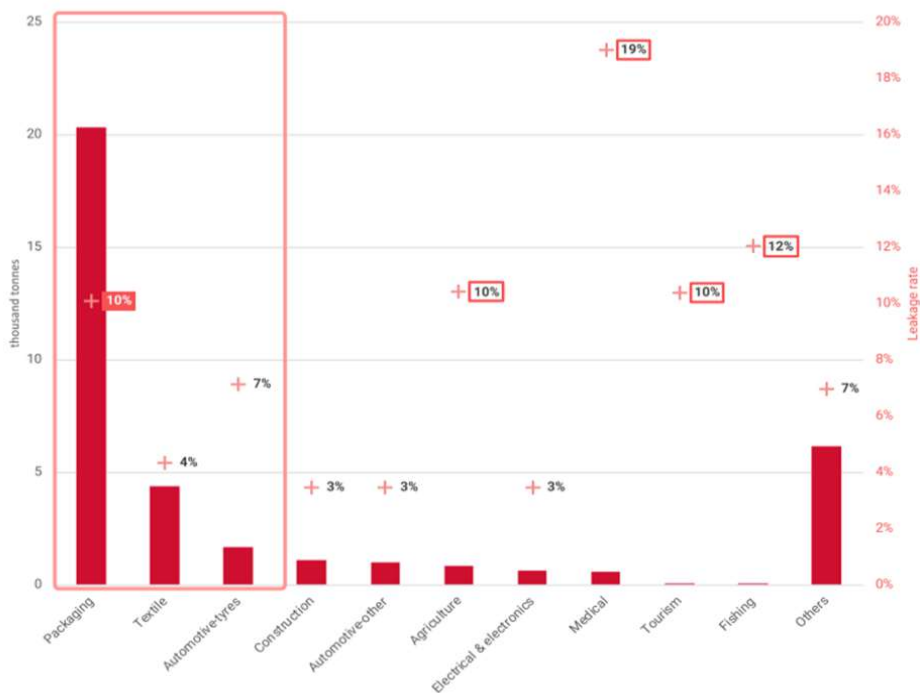


Figure 4.6. The diagram presented by IUCN-EA-QUANTIS (2020) shows plastic leakage rates from different sectors in Kenya. The data from the diagram indicate that plastic from the textiles sector comes second after packaging regarding plastic leakage into oceans and rivers.

Significant quantities of second-hand apparel are frequently discarded in Kenya's ever-expanding landfills, contributing to the pollution of the Nairobi River and, ultimately, the ocean (Changing Markets Foundation, 2023). A documentary by Changing Markets Foundation on second-hand clothing exports to Kenya found that traders complained of receiving low-quality, torn, and out-of-place apparel that is hard to sell resulting in their disposal (Trashion, 2023). It was also observed that individuals who roast peanuts on the street purchase clothing designated unfit for sale and then utilise these garments as fuel (Trashion, 2023). In addition, a substantial amount of waste in landfills consists of non-biodegradable fibres such as polyester (Trashion, 2023). Due to the prevalence of synthetic materials in discarded clothing, microplastic leaching and the subsequent contamination of water and soil are significant concerns (Changing Markets Foundation, 2023). This report suggests that, although often disregarded, synthetic clothing waste is a significant contributor to global plastic pollution. Climate change has increased the frequency of flooding in many places in the Global South (Lundberg and DeVoy, 2022). Water has difficulty draining when gutters become clogged with old, discarded clothes (Lundberg and DeVoy, 2022). This problem can make floods worse and raise the danger of illnesses related to water.

4.3.3 Challenges of Textile Waste Management in Kenya

Second-hand clothes have been a source of revenue for the government of Kenya, and the people have also benefitted through employment opportunities offered by the sector. However, the problem of waste from second-hand clothes cannot fail to be felt by the same consumers. As already stated earlier, the waste management practice in Kenya is wanting and waste from textiles have not been given the much-needed attention as it ought to. This practice hinders data collection, and for studies to find adequate information on waste from textiles. Therefore, this study identified the challenges facing waste management in general since textile waste is not separately categorized in the country's waste management system. The present condition of waste management in the country is inefficient due to challenges such as haphazard dumping and the absence of proper waste segregation (NEMA, 2014). As a result, mixed wastes are disposed of collectively in dumpsites, hindering material recovery, reuse, and recycling and even in cases where sorting is done, there is a lack of sectionalised vehicles for transportation of

the sorted waste, resulting in remixing (NEMA, 2014). Residents of informal and low-income settlements face challenges paying for waste management services, resulting in a lack of proper waste collection. Consequently, illegal waste dumping has become common in undesignated areas such as streams, rivers, and highways (NEMA, 2014). Fast fashion, a lack of education about the need of sustainability, lax laws, the use of materials of low quality, and improper care for textiles are the primary contributors to textile waste (Aishwariya and Jaisri, 2020). The impact of fast fashion is felt in LIC. Companies specializing in mass-manufacturing clothing and conventional washing techniques also contribute to this problem (Aishwariya and Jaisri, 2020). Even though laws and policies exist to guide waste management, their weak implementation and poor practices have caused towns and cities to become overloaded with waste. The lack of government regulations on the quality of clothes getting into the country has also contributed to an increase of low-quality synthetic clothes entering the market and posing a threat to the environment due to their non-biodegradable nature, as shown in the documentary (Trashion, 2023). Corruption, a lack of political will, political meddling, and a lack of public collaboration are the primary factors contributing to Kenya's difficulties in efficiently executing and enforcing legislation (Amugsi et al., 2022). Waste management technologies are available, but adoption is slow due to insufficient resources, incentives, awareness, and enforcement. The sector's slow development pace is mainly due to a lack of appropriate national policy direction, low stakeholder participation and limited financial investment. As for recycling, the process is managed primarily by scavengers who combine different waste types, resulting in a considerable contamination level of waste (Soezer, 2017). As a result, recycling businesses incur substantial cleaning expenses, rendering the recycling of most materials economically unfeasible. There are enterprises dedicated to recycling waste plastic, paper, and metal, which has led to an increased demand for commodities that can be recycled (Soezer, 2017). However, businesses have a hard time locating sources of clean inputs to match the demand (Soezer, 2017). It is challenging to remove recyclable elements from domestic waste, according to organizations specializing in waste recycling, because household waste is frequently not separated and contains a substantial proportion of organic waste (about 60%) (MEF, 2021). These businesses also face difficulties as a result of ambiguous regulations, an excessive number of licenses and fees, an inadequate differentiation in licensing between waste collection companies and recycling companies, and insufficient controls at recycling sites, which

frequently results in their misuse as dump sites rather than as materials recovery centers (MEF, 2021). Franchising waste collection to private companies in several areas in Kenya has been challenging as companies tend to ignore less developed areas and instead compete for more developed areas, which can lead to inefficiency and corruption (MEF, 2021).

4.4 Opportunities for Recycling and Reuse of Textile Waste

The main goals of waste management, as provided by the Waste Framework Directive, are protecting human beings, conserving natural resources, and minimizing GHG emissions (Waste Directive 2008/98, 2008). The directive also sets out means through which the goals are to be reached through waste prevention, recycling and disposal (Waste Directive 2008/98, 2008). The means of reaching these goals vary across countries depending on the economic development of a country and the type of waste produced in the given country.

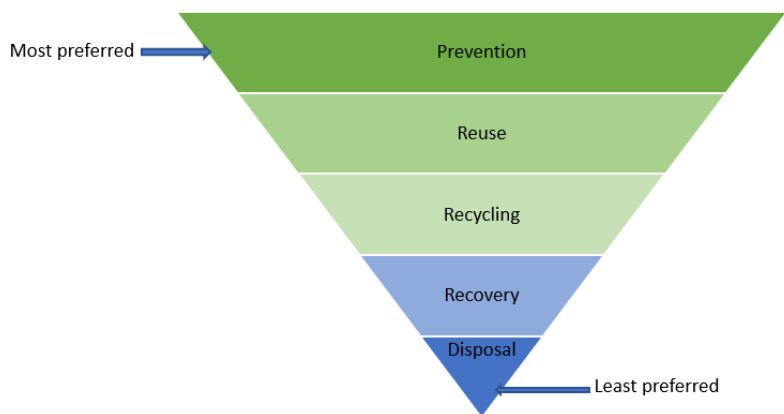


Figure 4.7. Waste hierarchy as elaborated in the Waste Framework Directive (2008). It outlines the sequence in which waste should be managed according to preference. The Framework illustrates waste prevention as the most preferred method and disposal being the least preferred method. Only when the higher step seems impossible should one consider stepping down this ladder (Yacout and Hassouna, 2016).

The textile industry in Kenya does not provide enough secondary resources for recycling due to its size. However, start-ups are beginning to sprawl in the private sector, aiming to help mitigate the textile waste problem. There exist initiatives like TakaTaka (waste) Solutions which launched TakaTaka Textile Recycling, a subsidiary focused on converting textile waste into new raw materials for manufacturing industries. Household and commercial waste is collected and then transported to a

sorting facility. Recyclable textiles are sold to third-party recyclers who use them for other industrial purposes. This initiative creates employment opportunities while promoting sustainable practices (Bestseller, 2023).

Similarly, Closing the Loop on Textile Waste in Kenya is a partnership in East Africa reducing textile waste by regenerating material to produce fibre of pristine quality for the textile industry. This model imitates India's effective strategy and addresses the lack of recycling options in Kenya's expanding textile industry (Cruz and McGuckin, 2021). The partnership's technique reduces water demand by 99%, emission of greenhouse gases by 40-90%, and energy use by 90% compared to conventional methods. PurFi, Upset Sourcing East Africa, and non-profit Enviu spearhead the collaboration. They want to boost recycling with Kenya's Export Processing Zone Authority (Cruz and McGuckin, 2021).

Another start up in Kenya is Africa Collect Textiles. They collect used textiles in Kenya and Nigeria to reuse and recycle them, contributing to the development of a circular economy for these textiles (ACT, 2021). They aim to reduce the damage from the fashion industry to the environment while at the same time creating job opportunities in the industry (ACT, 2021). They accomplish this through the use of creative and inventive design. In addition, they give away clothing for free or at a reduced cost to underprivileged areas and create brand-new items from recycled materials. Unlike other wastes, such as scrap metals, textile waste recycling has not gained popularity in the country. Waste scavengers have stated that they do not acquire discarded clothing due to its low monetary value compared to scrap metals (Changing Markets Foundation, 2023). Regarding reusing, Kenyans have always practised the reuse of clothes through donation drives in orphanages and churches and the repairing of clothes due to the availability of cheap tailors. Since the quality of second-hand clothes is reducing due to the cheap materials used in production, it is challenging for the consumers of second-hand clothes to use them for a long time. The fibres used in the production of cheap clothes make it difficult to recycle. PET bottles can be recycled efficiently in closed-loop bottle-to-bottle recycling. However, diverting these bottles from a closed-loop system to produce polyester for garments can result in landfill or incineration, thereby promoting downcycling (Changing Markets Foundation, 2021a)



Figure 4.8. A picture of a ranger from the Sheldrick Wildlife Trust carrying a bag made of upcycled ranger trousers by Africa Collect Textiles. The picture is courtesy of Africa Collect Textiles (2023)



Figure 4.9. A carpet made of used textiles by the Africa Collect Textiles. The picture is courtesy of Africa Collect Textiles (2023)

4.5 Recommendations

In response to the challenges posed by textile waste, these recommendations promote sustainable and efficient production and consumption practices. The second-hand clothes are consumer-oriented, and hence there is a need for consumers to be aware of the impact that their consumption has on the environment. Manufacturers should use recycled materials and have a recycling plan for their products (Muthu, 2017). They should also use resource-efficient processes and have a transparent supply chain for traceability in recycling procedures. Additionally, they should submit end-of-life management plans when obtaining a business license (Muthu, 2017). The government should promote recycling through subsidies and tax reductions, enforce strict actions against polluting industries, establish recycling centres, showcase recycling statistics, conduct evaluations, and invest in research and updated regulations. At the international level, this thesis agrees with the recommendation for developing stringent global laws to ensure ethical manufacturing, set standards for manufacturing in developing nations, monitor recycling activities and share knowledge through international conferences.

There should be an awareness created of the health impact of second-hand clothes. Experts recommend washing second-hand underwear, clothing, and shoes at least 70 degrees to prevent the spreading of parasitic and fungal diseases (Wetengere, 2018). These temperatures are impossible for communities that do not have access to washing machines; hence an alternative would be the regulation of the types of clothes to be imported. Effective waste management can reduce waste and enhance environmental conditions, but there is limited data on waste management practices for textiles in developing countries and their environmental impact (Yacout and Hassouna, 2016).

Review: This thesis acknowledges the significance of the SHCs market in Kenya. It has provided two basic needs, clothing and food, through income generated from the sale of SHCs. It is also worth noting that the population's health is essential. Hence, many considerations must be taken in this area before making decisions. Therefore, after analyzing the challenges and opportunities that arise from managing waste from textiles in Kenya, this study came up with the following recommendations.

First, suppose Kenya continues to allow the entry of cheap new clothing from countries like China while limiting the import of second-hand clothing (SHC). In that case, the country will not be able to solve the textile waste environmental problem. This is because both use similar materials and production methods. The environment will,

therefore, still be negatively impacted.

Second, the textile industry in the EU may have been regulated to some extent, but it is crucial to note that the EPR measures often do not extend to developing countries. The consequence of this is that the responsibility of managing waste is unfairly placed on the shoulders of others. Assuming that EPR could be implemented in LICs. In such a scenario, the study suggests that brands collaborate with recycling companies to provide financing and infrastructure to encourage recyclers to focus on textile waste and increase recycling. Regarding the collection of used clothing, textile waste recyclers could consider implementing the "mali mali" approach already in use in most urban areas of Kenya. "Mali" in Swahili means "wealth." It signifies the act of exchanging your wealth in return for wealth. It creates a win-win situation for both parties involved. Using this strategy, door-to-door vendors offer plastic household items such as cups, plates, mugs, laundry baskets, and buckets in exchange for used household items such as shoes, bags, and cutlery. This form of barter trade could facilitate the collection of used clothing for recycling purposes, as opposed to the current practice of many vendors who resell used clothing they collect. However, an alternative for plastic households will be explored to prevent environmental harm. Since SHCs are frequently collected as a form of donation in developed nations, charitable organizations could use this as a drop-and-collect. Those in need could return their outworn clothing and receive new ones. They could then sell them to textile recyclers.

Furthermore, collection centres could be established in public locations such as institutions with adequate security or shopping malls to facilitate collection. Religious institutions could also serve as a collection centre, as most clothing donations are made in churches. Initiatives like Africa Collect Textiles reuse collected clothes by giving to charity homes. These charity homes could also serve as collection centres for worn-out clothes.

The limitations to the recommendations are that most start-ups face the challenge of a lack of starting capital and existing corporate tax. The government should have a tax reduction on recycling firms as it did for plastic recyclers, whose corporate tax was reduced by half from 30% to 15%. By procuring funding and investments, it is possible to expand the workforce and gain financial benefits. With a larger workforce, it becomes possible to take advantage of reductions in taxes and seek opportunities in

carbon credits. With these initiatives, Kenya can become an exporter of upcycled products to the international market.

In addition, Kenya should identify how to negotiate its way into AGOA to deal with the waste from SHC. The legislation focuses on the economic benefits and leaves out the environmental impact of this trade. SHCs have contributed to the waste problem in Kenya, but there are opportunities for improvement. In order to establish a circular economy for textiles, it is necessary to implement systemic changes that demand commitment, collaboration, and creativity. (Rouch, 2021).

4.6 Study Limitations

This study faced the challenge of finding data on the amount of waste generated from textile waste in Kenya. It also applied to the amount of general waste generated in recent years. This challenge was also due to a lack of feedback from those whom the author reached out to. The lack of data on the end of life garments in the country inhibits adequate planning and investment. It might be challenging for investors interested in recycling projects since they could not quantify the generated waste. Hence, improvement in data availability is crucial for development in the textile waste management sector. As most studies used estimates, more research should also be done on the amount of waste generated from importing SHC. The government and relevant stakeholders should invest in improving up-to-date data.

5 Conclusion

This thesis began by analyzing literature on global textile production and consumption and found that production and consumption have increased globally, driven by increased population and industrialization. Consumption is also driven by technological advances that make it easier to influence fashion on users and ease of product delivery across the globe. Further, the valorization of textile waste through recycling and reuse was also highlighted, as presented by other literature. The studies show advancements in the valorization of waste from textiles and the need for adaptation and implementation by producers and manufacturers. Concerning SHC, this thesis found that second-hand clothes consumption in African countries is also increasing due to the emergence of fast fashion in developed countries. As a result of fast fashion, textiles from SHC continue to increase. In Kenya, there are inadequate measures for managing waste in general. Despite the country having waste regulations and policies in place, it has not been able to implement them fully.

Regarding textile waste, there are challenges, including the absence of proper sorting at the source, lack of awareness of existing regulations on textile waste management, and slow adoption of waste management technologies due to factors like lack of resources, unfavourable government regulations for textile recyclers, incentives, awareness, and enforcement. Despite the challenges, initiatives like Takataka Solution, which collects and sells textile waste to third-party recyclers, and start-ups like Closing the Loop on Textile Waste in Kenya and Africa Collect Textiles. This study recommends that brands collaborate with recycling firms in developing countries like Kenya to provide finance and infrastructure to encourage recyclers to concentrate on textile waste and increase recycling. They could also provide international market access to products made out of recycled items like carpets from Africa Collect Textiles. A collection strategy would be to implement the already existing 'mali mali' approach, a form of barter trade to facilitate the collection of used clothing for recycling purposes, as opposed to the current practice of many vendors who resell used clothing they collect.

This research contributes to Kenya's endeavours to upcycle and reuse textile waste. In addition, it provides sustainable consumption and production solutions. In Kenya and other developing countries, additional research can be conducted in this area to uncover additional methods for preventing textile waste from ending up in landfills.

References

- Africa Collect Textiles (2021) *Africa Textile Collect – | Home, Africa Collect Textiles*. Available at: <https://africacollecttextiles.com/> (Accessed: 30 May 2023).
- Aishwariya, S. (2018) ‘Waste Management Technologies in Textile Industry’, *Innovative Energy & Research*, 07(03). Available at: <https://doi.org/10.4172/2576-1463.1000211>.
- Aishwariya, S. and Jaisri, M.J. (2020) ‘HARMFUL EFFECTS OF TEXTILE WASTES’, *Fibre2Fashion*, p. 8. Available at: <https://www.fibre2fashion.com/industry-article/8696/harmful-effects-of-textile-waste>.
- Alkaya, E. and Demirer, G.N. (2014) ‘Sustainable textile production: a case study from a woven fabric manufacturing mill in Turkey’, *Journal of Cleaner Production*, 65, pp. 595–603. Available at: <https://doi.org/10.1016/j.jclepro.2013.07.008>.
- Bernard, S. (2011) ‘Transboundary movement of waste: second-hand markets and illegal shipments’, *CIRANO-Scientific Publications 2011s-77* [Preprint]. Available at: <https://doi.org/10.2139/ssrn.1999005>.
- Bestseller (2023) *TakaTaka Textile Recycling, BESTSELLER Foundation*. Available at: <https://bestseller.org/takataka-textile> (Accessed: 23 May 2023).
- Binti Norarmi, N.F. *et al.* (2022) ‘A Review on Textile and Clothing Industry Impacts on The Environment’, *International Journal of Academic Research in Business and Social Sciences*, 12(10), p. Pages 2137-2146. Available at: <https://doi.org/10.6007/IJARBSS/v12-i10/11090>.
- Boston Consulting Group (2020) *The Consumers Behind Fashion’s Growing Secondhand Market, Boston Consulting Group*. Available at: <https://www.bcg.com/publications/2020/consumer-segments-behind-growing-secondhand-fashion-market> (Accessed: 15 May 2023).
- Boucher, J. and Friot, D. (2017) *Primary microplastics in the oceans: a global evaluation of sources*. Gland, Switzerland: IUCN. Available at: <https://doi.org/10.2305/IUCN.CH.2017.01.en>.
- Brooks, A. (2015) *Clothing Poverty: The Hidden World of Fast Fashion and Second-hand Clothes*. London. Available at: <https://doi.org/10.13140/RG.2.1.3268.0161>.
- Bukhari, M.A., Carrasco-Gallego, R. and Ponce-Cueto, E. (2018) ‘Developing a national programme for textiles and clothing recovery’, *Waste Management & Research: The Journal for a Sustainable Circular Economy*, 36(4), pp. 321–331. Available at: <https://doi.org/10.1177/0734242X18759190>.
- Changing Markets Foundation (2021a) *Fossil Fashion: The hidden reliance of fast fashion on fossil fuels*. Changing Markets Foundation. Available at: https://changingmarkets.org/wp-content/uploads/2021/01/FOSSIL-FASHION_Web-compressed.pdf.

Changing Markets Foundation (2021b) *Synthetics Anonymous*. Changing Markets Foundation. Available at: https://changingmarkets.org/wp-content/uploads/2021/07/SyntheticsAnonymous_FinalWeb.pdf.

Changing Markets Foundation (2023) *Trashion: The stealth export of waste plastic clothes to Kenya*. Available at: <https://changingmarkets.org/portfolio/fossil-fashion/>.

Chavan, R. (2014) 'Environmental Sustainability through Textile Recycling', *Journal of Textile Science & Engineering*, s2(01). Available at: <https://doi.org/10.4172/2165-8064.S2-007>.

Chemengich, M. *et al.* (2013) *Policy Research on the Kenyan Textile Industry: Findings and Recommendations*. Nairobi, Kenya: African Cotton & Textile Industries Federation, p. 106. Available at: https://agoa.info/images/documents/5264/ACTIF%20Report%20on%20Policy%20Research%20on%20the%20Kenyan%20Textile%20Industry_Margaret%20Chemengich_2013.pdf.

Chen, X. *et al.* (2021) 'Circular Economy and Sustainability of the Clothing and Textile Industry', *Materials Circular Economy*, 3(1), p. 12. Available at: <https://doi.org/10.1007/s42824-021-00026-2>.

Cobbing, M. *et al.* (2022) *Poisoned Gifts: From donations to the dumpsite: textiles waste disguised as second-hand clothes exported to East Africa*. A Greenpeace Germany Report. Available at: <https://www.greenpeace.org/static/planet4-international-stateless/2022/04/9f50d3de-greenpeace-germany-poisoned-fast-fashion-briefing-factsheet-april-2022.pdf>.

Cruz, I. de and McGuckin, R. (2021) 'How a Partnership in Kenya Recycled 100,000 Kilograms of Fashion Waste'. Available at: <https://www.wri.org/insights/closing-loop-textile-waste-recycling-kenya> (Accessed: 22 May 2023).

Dahlbo, H. *et al.* (2016) 'Increasing textile circulation—Consequences and requirements', *Sustainable Production and Consumption*, 9, pp. 44–57. Available at: <https://doi.org/10.1016/j.spc.2016.06.005>.

East African Community (2019) 'The East African Community Cotton Textiles Apparels Strategy and implementation Roadmap 2020-2030'. East African Community (EAC) Secretariat. Available at: <http://repository.eac.int/bitstream/handle/11671/24345/CTA%20Strategy%20to%20be%20published.pdf?sequence=1&isAllowed=y> (Accessed: 28 April 2023).

European Commission (2022) 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS: EU Strategy for Sustainable and Circular Textiles'. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:9d2e47d1-b0f3-11ec-83e1-01aa75ed71a1.0001.02/DOC_1&format=PDF.

European Parliament and Council of the European Union (2011) 'Regulation (EU) No 1007/2011 of The European Parliament and of The Council of 27 September 2011 on textile fibre names and related labelling and marking of the fibre composition of textile

products and repealing Council Directive 73/44/EEC and Directives 96/73/EC and 2008/121/EC of the European Parliament and of the Council'. European Union. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02011R1007-20180215>.

European Union (2008) 'DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives'. European Union. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098>.

Ezeudu, O.B. *et al.* (2021) 'Enablers and barriers to implementation of circular economy in solid waste valorization: The case of urban markets in Anambra, Southeast Nigeria', *Environmental and Sustainability Indicators*, 12. Available at: <https://doi.org/10.1016/j.indic.2021.100150>.

Fang, L. *et al.* (2015) 'Eco-friendly cationic modification of cotton fabrics for improving utilization of reactive dyes', *RSC Advances*, 5(57), pp. 45654–45661. Available at: <https://doi.org/10.1039/C5RA05887B>.

Fashion Revolution (2021) *CONSUMER SURVEY KEY FINDINGS: A survey of EU consumer attitudes to sustainability and supply chain transparency in the fashion industry*. Available at: https://issuu.com/fashionrevolution/docs/fashrev_consumerurvey_2020_keyfindings (Accessed: 22 April 2023).

Fashionomics (2016) *Report on the Feasibility Study for the Development of the online FASHIONOMICS PLATFORM*. External report. African Development Bank Group. Available at: <https://fashionomicsafrica.org/documents/reportfeasibility.pdf> (Accessed: 22 April 2023).

Fernandez-Stark, K., Bamber, P. and Couto, V. (2022) *Analysis of the Textile and Clothing Industry Global Value Chains*. Inter-American Development Bank. Available at: <https://doi.org/10.18235/0004638>.

Fibre2Fashion (2022) 'Second-hand clothing in Africa: Opportunities and challenges'. Fibre2Fashion. Available at: <https://www.fibre2fashion.com/industry-article/9422/second-hand-clothing-in-africa-opportunities-and-challenges>.

Friedman, A. (2017) *Used-clothing trade causes contention between US and East African Nations*, *AGOA info*. Available at: <https://agoa.info/news/article/15277-used-clothing-trade-causes-contention-between-us-and-east-african-nations.html>.

Gerstmann, B.S., Brigitte Simone (2020) *Towards circular resource use: the potential of extended producer responsibility for textile circularity in the EU*, *Towards circular resource*. TU Wien. Available at: <https://doi.org/10.34726/hss.2020.80650>.

Goezet, B. and Wilts, H. (2022) 'The Circular Economy as a New Narrative for the Textile Industry. An analysis of the textile value chain with a focus on Germany's transformation to a circular economy', *Wuppertal Institute* [Preprint]. Available at: <https://doi.org/10.13140/RG.2.2.23092.12160>.

Government of Kenya (2021) *Kenya State of Environment Report 2019 -2021*. Nairobi, Kenya: National Environment Management Authority. Available at: https://www.nema.go.ke/images/Docs/EIA_1920-1929/SoE%202019-2021%20SUMMARY%20FOR%20POLICY%20MAKERS%20.pdf.

Government of Kenya (2022) *Sustainable Waste Management Act*. Available at: <http://kenyalaw.org:8181/exist/kenyalex/actview.xql?actid=No.%2031%20of%202022>.

Hohmann, L., Xhaferi-Salihi, L. and Oliveras, R. (2023) *Fashion Industry Charter for Climate Action: Progress Report 2023*. UNFCCC. Available at: <https://unfccc.int/sites/default/files/resource/230329%20BLS23055%20UCC%20Climate%20Action%202023%20v06.pdf>.

Institute of Economic Affairs Kenya (2021) *The State of Second-Hand Clothes and Footwear Trade in Kenya*. Nairobi, Kenya: Institute of Economic Affairs. Available at: <https://ieakenya.or.ke/download/the-state-of-second-hand-clothes-and-footwear-trade-in-kenya/> (Accessed: 16 May 2023).

Islam, T. (2022) ‘Health Concerns of Textile Workers and Associated Community’, *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 59, p. 004695802210886. Available at: <https://doi.org/10.1177/00469580221088626>.

IUCN-EA-QUANTIS (2020) *National Guidance for plastic pollution hotspotting and shaping action, Country report Kenya*. Available at: https://plastichotspotting.lifecycleinitiative.org/wp-content/uploads/2020/12/kenya_final_report_2020.pdf.

Juanga-Labayen, J.P., Labayen, I.V. and Yuan, Q. (2022) ‘A Review on Textile Recycling Practices and Challenges’, *Textiles*, 2(1), pp. 174–188. Available at: <https://doi.org/10.3390/textiles2010010>.

Kahoush, M. and Kadi, N. (2022) ‘Towards sustainable textile sector: Fractionation and separation of cotton/ polyester fibers from blended textile waste’, *Sustainable Materials and Technologies*, 34, p. e00513. Available at: <https://doi.org/10.1016/j.susmat.2022.e00513>.

Kenya National Bureau of Statistics (2022a) *Economic Survey 2022*. Nairobi, Kenya: Kenya National Bureau of Statistics. Available at: <https://www.knbs.or.ke/wp-content/uploads/2022/05/2022-Economic-Survey1.pdf>.

Kenya National Bureau of Statistics (2022b) *Statistical Release BOP/3/2022- Quarterly Balance of Payments*. Third Quarter, 2022. Nairobi, Kenya: Kenya National Bureau of Statistics. Available at: <https://www.knbs.or.ke/download/q3-2022-bop-and-international-trade-report/> (Accessed: 17 May 2023).

Köhler, A. *et al.* (2021) *Circular economy perspectives in the EU textile sector : final report*. Luxembourg: Publications Office of the European Union. Available at: <https://doi.org/10.2760/858144>.

Koszewska, M. (2018) ‘Circular Economy — Challenges for the Textile and Clothing Industry’, *Autex Research Journal*, 18(4), pp. 337–347. Available at: <https://doi.org/10.1515/aut-2018-0023>.

Kufeoglu, S. (2022) 'SDG-12: Responsible Consumption and Production', in, pp. 409–428. Available at: https://doi.org/10.1007/978-3-031-07127-0_14.

Laitala, K. and Klepp, I.G. (2017) 'Clothing reuse: The potential in informal exchange', *Clothing Cultures*, 4(1), pp. 61–77. Available at: https://doi.org/10.1386/cc.4.1.61_1.

Lewis, T. (2015) '10 - Apparel disposal and reuse', in R. Blackburn (ed.) *Sustainable Apparel*. Woodhead Publishing, pp. 233–250. Available at: <https://doi.org/10.1016/B978-1-78242-339-3.00010-8>.

Lundberg, D. and DeVoy, J. (2022) *The Aftermath of Fast Fashion: How Discarded Clothes Impact Public Health and the Environment | SPH, Boston University School of Public Health*. Available at: <https://www.bu.edu/sph/news/articles/2022/the-aftermath-of-fast-fashion-how-discarded-clothes-impact-public-health-and-the-environment/> (Accessed: 29 May 2023).

Mandal, S. (2022) 'Perspectives of Textile Waste Management in the U.S. – A Review', *Journal of Textile Science & Fashion Technology*, 9(4). Available at: <https://doi.org/10.33552/JTSFT.2022.09.000716>.

Manshoven, S. *et al.* (2021) *Plastic in textiles: potentials for circularity and reduced environmental and climate impacts*. Belgium: European Topic Centre Waste and Materials in a Green Economy. Available at: <https://www.eionet.europa.eu/etcw/wmge/products/etc-wmge-reports/plastic-in-textiles-potentials-for-circularity-and-reduced-environmental-and-climate-impacts>.

Maxwell, D.M. and L. Ryan, J. (2015) *The State of the Apparel Sector 2015 special Report - Water*. a report for the global leadership award in sustainable apparel. The sustainable business group. Available at: https://www.thesustainablebusinessgroup.com/source/filemanager/files/GLASA_report_v6_14_10_15_final.pdf (Accessed: 19 April 2023).

McCarthy, B.J. (2016) 'An overview of the technical textiles sector', in *Handbook of Technical Textiles*. Elsevier, pp. 1–20. Available at: <https://doi.org/10.1016/B978-1-78242-458-1.00001-7>.

Milam-Guerrero, J. *et al.* (2023) 'From waste to wearable: an alternative waste stream for unusable textiles turned into piezoelectric textiles', *RSC Sustainability*, 1(2), pp. 326–334. Available at: <https://doi.org/10.1039/D2SU00068G>.

Ministry of Industry and Technology General Directorate of Development Agencies (2021) *Textile Sector Analysis Report and Guide TR62 Region (Adana, Mersin)*. COVID-19 Resilience and Response Project. Ankara: Ministry of Industry and Technology General Directorate of Development Agencies. Available at: https://www.undp.org/sites/g/files/zskgke326/files/migration/tr/tekstil-tr62_eng.pdf (Accessed: 28 April 2021).

Ministry of Environment and Forestry (2021) 'National Sustainable Waste Management Policy'. MINISTRY OF ENVIRONMENT AND FORESTRY, Kenya. Available at: https://www.environment.go.ke/wp-content/uploads/2023/03/SWM_Policy_2021_final_copy.pdf.

Mishra, P.K. *et al.* (2022) ‘A comprehensive review on textile waste valorization techniques and their applications’, *Environmental Science and Pollution Research*, 29(44), pp. 65962–65977. Available at: <https://doi.org/10.1007/s11356-022-22222-6>.

Monier, V. *et al.* (2014) *Development of Guidance on Extended Producer Responsibility (EPR)*. Final Report. European Commission – DG Environment. Available at: https://ec.europa.eu/environment/pdf/waste/target_review/Guidance%20on%20EPR%20-%20Final%20Report.pdf.

Muthu, S.S. (ed.) (2017) *Textiles and Clothing Sustainability*. Singapore: Springer Singapore (Textile Science and Clothing Technology). Available at: <https://doi.org/10.1007/978-981-10-2146-6>.

National Environment Management Authority (2014) *The National Solid Waste Management Strategy*. Nairobi, Kenya: National Environment Management Authority, Kenya (NEMA). Available at: <https://www.nema.go.ke/images/Docs/Media%20centre/Publication/National%20Solid%20Waste%20Management%20Strategy%20.pdf>.

Naumann, E. (2020) ‘AGOA performance and country profile of Kenya [Updated 2021]’. Trade Law Centre (tralac). Available at: <https://agoa.info/images/documents/15557/kenya-agoa-brochure-2021.pdf>.

Nayak, R. *et al.* (2020) ‘Sustainable reuse of fashion waste as flame-retardant mattress filling with ecofriendly chemicals’, *Journal of Cleaner Production*, 251, p. 119620. Available at: <https://doi.org/10.1016/j.jclepro.2019.119620>.

Nikolina, S. (2019) ‘Environmental impact of textile and clothes industry’. European Parliamentary Research Service. Available at: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/633143/EPRS_BRI\(2019\)633143_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/633143/EPRS_BRI(2019)633143_EN.pdf).

Observatory of Economic Complexity (2021) *Textiles | OEC, OEC - The Observatory of Economic Complexity*. Available at: <https://oec.world/en/profile/hs/textiles> (Accessed: 17 May 2023).

Odinga, M., Ombaba, K.Dr. and Joseph Mwanza, Mr. (2022) ‘EFFECT OF AGGRESSIVE APPROACH ON GROWTH OF SECOND-HAND CLOTHES BUSINESSES IN KISUMU CENTRAL SUB COUNTY, KENYA’, *International Journal of Research Publications*, 109(1). Available at: <https://doi.org/10.47119/IJRP1001091920223889>.

Organisation for Economic Co-operation and Development (2016) ‘Extended Producer Responsibility Guidance for efficient waste management’. Organisation for Economic Co-operation and Development. Available at: <https://www.oecd.org/environment/waste/Extended-producer-responsibility-Policy-Highlights-2016-web.pdf>.

Palm, D. (2011) ‘Improved waste management of textiles’, *IVL Swedish Environmental Research Institute Ltd.* [Preprint]. Available at: <https://www.ivl.se/download/18.34244ba71728fcb3f3f7b9/1591704633006/B1976.pdf>.

Patnaik, S. and Tshifularo, C.A. (2021) 'Fashion brands approach toward waste management', in *Waste Management in the Fashion and Textile Industries*. Elsevier, pp. 295–309. Available at: <https://doi.org/10.1016/B978-0-12-818758-6.00016-8>.

Pepermans, A. (2019) 'China as a Textile Giant Preserving its Leading Position in the World, and What it Means for the EU *', pp. 63–108. Available at: [https://doi.org/10.6166/TJPS.201906_\(80\).0004](https://doi.org/10.6166/TJPS.201906_(80).0004).

Rani, S. and Jamal, Z. (2017) 'Recycling of textiles waste for environmental protection', *International Journal of Home Science* [Preprint]. Available at: https://www.academia.edu/68743171/Recycling_of_textiles_waste_for_environmental_protection.

Rapsikevičienė, J., Gurauskienė, I. and Jučienė, A. (2019) 'Model of Industrial Textile Waste Management', *Environmental Research, Engineering and Management*, 75(1), pp. 43–55. Available at: <https://doi.org/10.5755/j01.arem.75.1.21703>.

Rashid, Md.E. *et al.* (2023) 'Challenges of textile waste composite products and its prospects of recycling', *Journal of Material Cycles and Waste Management* [Preprint]. Available at: <https://doi.org/10.1007/s10163-023-01614-x>.

Reno, J. (2015) 'Waste and Waste Management', *Annual Review of Anthropology*, 44, pp. 557–572. Available at: <https://doi.org/10.1146/annurev-anthro-102214-014146>.

Republic of Kenya (2006) *Environmental Management and Co-ordination (Waste Management) Regulations, 2006*. Available at: <https://www.nema.go.ke/images/Docs/Regulations/Waste%20Management%20Regulations-1.pdf>.

Sandin, G. and Peters, G. (2018) 'Environmental impact of textile reuse and recycling – A review', *Journal of Cleaner Production*, 184. Available at: <https://doi.org/10.1016/j.jclepro.2018.02.266>.

Shirvanimoghaddam, K. *et al.* (2020) 'Death by waste: Fashion and textile circular economy case', *Science of The Total Environment*, 718, p. 137317. Available at: <https://doi.org/10.1016/j.scitotenv.2020.137317>.

Singh, J. *et al.* (2019) 'Challenges and opportunities for scaling up upcycling businesses – The case of textile and wood upcycling businesses in the UK', *Resources, Conservation and Recycling*, 150, p. 104439. Available at: <https://doi.org/10.1016/j.resconrec.2019.104439>.

Singhal, S., Agarwal, S. and Singhal, N. (2023) 'Chemical recycling of waste clothes: a smarter approach to sustainable development', *Environmental Science and Pollution Research* [Preprint]. Available at: <https://doi.org/10.1007/s11356-023-26438-y>.

Soezer, Dr.A. (2017) *Nationally Appropriate Mitigation Action on Circular Economy Solid Waste Management Approach for Urban Areas in Kenya*. Nairobi, Kenya: United Nations Development Programme (UNDP), Ministry of Environment and Natural Resources. Available at: <https://www.ndcs.undp.org/content/dam/LECB/docs/pubs-namas/undp-lecb-Kenya-Waste-NAMA-2016.pdf?download> (Accessed: 27 May 2023).

Sumanti, S. *et al.* (2022) ‘The Influence of Influencers TikTok on Online Shopping Interests in Communication Studies Students’, *Proceedings Of International Conference On Communication Science*, 2, pp. 234–242. Available at: <https://doi.org/10.29303/iccsproceeding.v2i1.109>.

Sumo, P. (2022) ‘The Retail Second-hand Clothing Sector in Developing Economy: Case study of Liberia’, 3, pp. 138–160. Available at: <https://doi.org/10.2478/crdj-2022-0013>.

Textile Exchange (2020) *Preferred Fiber & Materials Market Report 2020*. Available at: https://textileexchange.org/app/uploads/2021/03/Textile-Exchange_PREFERRED-Fiber-Material-Market-Report_2020.pdf (Accessed: 8 May 2023).

Textile Exchange (2022a) *2025 Recycled Polyester Challenge First Annual Report*. Available at: https://textileexchange.org/app/uploads/2022/07/2025-Recycled-Polyester-Challenge_2022.pdf.

Textile Exchange (2022b) *Preferred Fiber & Materials Market Report*. Available at: https://textileexchange.org/app/uploads/2022/10/Textile-Exchange_PFMR_2022.pdf.

The Business Research Company (2023) *Textile Market Size, Trends and Global Forecast To 2032*, The Business Research Company. Available at: <https://www.thebusinessresearchcompany.com/report/textile-global-market-report> (Accessed: 8 April 2023).

The National Council for Law (1999) *Environmental Management and Co-ordination Act, 1999.*, 387. Available at: https://eregulations.invest.go.ke/media/emca_1.pdf.

Tiwari, M. and Babel, S. (2013) ‘Air pollution in textile industry’, *Asian Journal of Environmental Science*, 8(1), pp. 64–66.

Trashion: The stealth export of waste plastic clothes to Kenya (2023). Available at: <https://www.youtube.com/watch?v=ISM0wyBdggs>.

Tummino, M.L. *et al.* (2023) ‘A Glance at Novel Materials, from the Textile World to Environmental Remediation’, *Journal of Polymers and the Environment* [Preprint]. Available at: <https://doi.org/10.1007/s10924-023-02810-4>.

Uddin, F. (2019) ‘Introductory Chapter: Textile Manufacturing Processes’, in F. Uddin (ed.) *Textile Manufacturing Processes*. IntechOpen. Available at: <https://doi.org/10.5772/intechopen.87968>.

UN Climate Change (2021) ‘Fashion Industry Charter for Climate Action’, in. *COP26, United Nations Framework Convention on Climate Change*. Available at: https://unfccc.int/sites/default/files/resource/Fashion%20Industry%20Carter%20for%20Climate%20Action_2021.pdf.

United Nations (2015) *Transforming our World: The 2030 Agenda for Sustainable Development*. United Nations. Available at: <https://sustainabledevelopment.un.org/post2015/transformingourworld/publication>.

United Nations (2022) *The Sustainable Development Goals Report 2022*. Available at: <https://unstats.un.org/sdgs/report/2022/> (Accessed: 22 May 2023).

United Nations Environment Programme (2011) *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal: Protocol on Liability and Compensation For Damage Resulting From Transboundary Movements of Hazardous Wastes and Their Disposal*. Geneva: United Nations Environment Programme. Available at: <https://wedocs.unep.org/bitstream/handle/20.500.11822/8385/-Basel%20Convention%20on%20the%20Control%20of%20Transboundary%20Movements%20of%20Hazardous%20Wastes%20-20113644.pdf?sequence=2&isAllowed=>.

United Nations Environment Programme (2020) *Sustainability and Circularity in the Textile Value Chain- Global Stocktaking*. Nairobi, Kenya. Available at: https://www.oneplanetnetwork.org/sites/default/files/unep_sustainability_and_circularity_textile_value_chain_1.pdf.

United Nations (UNCTAD), COMESA. (2023) *The Utilization of Trade Preferences by COMESA Member States Intra-regional Trade and North South Trade*. UNCTAD/ALDC/2022/1. United Nations. Available at: https://unctad.org/system/files/official-document/aldc2022d1_en.pdf.

United Nations United Nations Environment Programme (2022) 'END PLASTIC POLLUTION - TOWARDS AN INTERNATIONAL LEGALLY BINDING INSTRUMENT'. United Nations United Nations Environment Programme. Available at: <https://wedocs.unep.org/xmlui/bitstream/handle/20.500.11822/39764/END%20PLASTIC%20POLLUTION%20-%20TOWARDS%20AN%20INTERNATIONAL%20LEGALLY%20BINDING%20INSTRUMENT%20-%20English.pdf?sequence=1&isAllowed=y> (Accessed: 24 April 2023).

United States Trade Representative (2018) *President Trump Determines Trade Preference Program Eligibility For Rwanda, Tanzania, And Uganda, United States Trade Representative*. Available at: <http://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2018/march/title> (Accessed: 16 May 2023).

Ütebay, B., Çelik, P. and Çay, A. (2020) 'Textile Wastes: Status and Perspectives', in A. Körlü (ed.) *Waste in Textile and Leather Sectors*. IntechOpen. Available at: <https://doi.org/10.5772/intechopen.92234>.

Wetengere, K.K. (2018) 'Is the banning of importation of second-hand clothes and shoes a panacea to industrialization in east Africa?', in. AFRICAN JOURNAL OF ECONOMIC REVIEW (1). Available at: <https://www.ajol.info/index.php/ajer/article/view/166029> (Accessed: 20 May 2023).

World Bank (2023) *Kenya Textiles and Clothing Imports by country & region 2020 | WITS Data, World Integrated Trade Solution (WITS)*. Available at: https://wits.worldbank.org/CountryProfile/en/Country/KEN/Year/2020/TradeFlow/Import/Partner/all/Product/50-63_TextCloth (Accessed: 18 May 2023).

World Wildlife Fund (2013) *Cleaner, greener cotton Impacts and better management practices*, p. 28. Available at: <https://www.worldwildlife.org/publications/cleaner-greener-cotton-impacts-and-better-management-practices> (Accessed: 19 April 2023).

Yacout, D.M.M. and Hassouna, M.S. (2016) 'Identifying potential environmental impacts of waste handling strategies in textile industry', *Environmental Monitoring and Assessment*, 188(8), p. 445. Available at: <https://doi.org/10.1007/s10661-016-5443-8>.

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