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**"ASSESSING THE CIRCULARITY OF THE FASHION GLOBAL
VALUE CHAIN WITHIN POST-CONSUMER ACTIVITIES"**

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INTRODUCTION

The fashion industry is one of the leading industries in the global trade and one of the most resource-intensive industries that generates a large amount of waste throughout its life cycle. Considering the environmental concerns that arise from this, the circular economy seems to be a very effective option to cope with the challenges. Therefore, the focus is on circular Global Value Chains that aim to extend the product's life cycle while reducing the use of resources and waste. Such an approach primarily focuses on post-consumer activities in the form of strategies such as recycling and resale. This thesis discusses how the incorporation of Circular Economy principles can better shape established global fashion value chains, with a particular focus on post-consumer activities. This study investigates the value retention patterns and post-consumer activities in global fashion value chains to assess the potential contribution of circularity to environmental impact reduction and sustainable consumption. Through an exploratory study of circular strategies such as take-back programs and recycling systems, this thesis demonstrates how fashion brands can ensure value chain resilience and greater sustainability. The Jeans Redesign Project case study investigates the contribution of these circular concepts in the fashion industry practices.

1. The Comprehensive Overview of The Circular Economy

1.1. The Concept of Circular Economy

The search for efficiency in resource use has led to an increase in academic articles and methods to investigate the concept of circular economy. In the circular economy, material flow is mentioned with a closed-loop approach, creating an ecosystem to effectively use resources (Goyal et al., 2018). In this ecosystem, there is an approach that goes beyond a classical linear approach, and it performs re-creating resources from waste after the resources are transformed into products.

The most fundamental defining component of the circular economy is the restorative use of resources. It is aiming to maintain products, components, and materials at their highest utility and value including the distinguishment of the technical and biological cycles (Ellen MacArthur Foundation et al., 2016). So, circular economy is defined as a “closed-loop economy” that does not create excess waste and converts all waste into resources.

Another significant way of describing circular economy comes from the EU Circular Economy Action Plan by saying the value of products and their materials is preserved as long as possible and at the same time use of resources and waste generation is reduced. After a product reaches the end of its life cycle the materials will be used repeatedly, to create a value loop in the same economy. Circular economy focuses on the maximum use of many important points in the life cycle of a product, starting from the supply chain, including consumption and the transformation of unused parts into a new resource by gaining a new purpose (Esposito et al., 2018). It has changed the mindset of many researchers with the idea that it has the potential for disruptive business models. In establishing this concept correctly, it is important to explain the circular economy concept well and not to confuse it with its enablers to avoid confusion. Along with the circular economic concept, it is also seen that the 3R, that is, reduce, reuse and recycling, has gained interest and the importance of 3R is also discussed (Cochet, 2020)

Global warming and scarcity in natural resources caused a decrease in biodiversity and paved the way for the formation of systems thinking. This urgency, which emerged in the early 2000s, was supported by the rapid information sharing provided by digitalization (Alvarez-Risco et al., 2022).

The use and resizing of materials occurred with the increase in product diversity with the rapidly growing global economy increased production by increasing the demand for new products. This rapid increase has been directly proportional to the amount of waste. This situation has caused waste management to gradually become a problem and an obligation that needs to be regulated (Wilts, 2017)

When it comes to waste management, it is seen that a systematic working method is essential in terms of ensuring an orderly storage method and incineration processes. However, there is no established order on this waste management yet. The priority of waste management is to reduce waste generation and improve the quality of materials for reuse, including organic waste for composting (Pires et al., 2011). In this way, it controls the production of waste by separating potentially recyclable materials at their source. It is important to reuse materials that cannot be reduced. These methods have become the most effective solution for waste disposal so far. The policy that includes reducing, reusing and recycling waste is called zero waste. Reducing the waste at the source is a primary method in waste management. Thus, it offers a solution to prevent waste generation as much as possible, also known as avoidance of waste (Benjamin, 2003).

It is seen that significant amounts of waste are dumped in less developed countries. As can be understood through the global media, waste management practices, which seem to be a solution in the short term, are not only local problems of that country but are linked to global problems. In other words, it is obvious that short-term solutions will eventually affect developed countries and produce economic results. It turns out that the concepts of clean production and industrial ecology gain importance at these stages and contribute to thinking in systems (Lewis & Gertsakis, 2003).

Circular economy, interpreted as a new business model for an efficient and sustainable society, includes important social and economic branches of sustainable development (Ghisellini et al., 2016). CE involves not only macroeconomic levels of the economy but as well as microprocesses within companies (Birat, 2015). Closed supply chains are also known to emphasize the importance of circularity. Although the main idea in this closed supply chain is quite close to the concept of circular economy, there are some important differences between those methods. Product development and methods that concern customer expectations can be included in this process strictly to achieve circularity in the design process (Govindan et al., 2015)

The concept of CE basically talks about the circularity of resources. It refers to the cyclical design of the life cycles of products and materials in an economy, from raw material input to the last stage of the transformation of these resources. Circularity can only be mentioned with the systematic implementation of these cyclical design plans. Although they are quite comprehensive concepts, definitions of the circular economy or Cradle to Cradle may not cover the details of all stages (Geisendorf & Pietrulla, 2018).

Circular economy is a system based on waste management and the production of existing materials as new inputs. In today's world, there is an economic model based on the "extract-produce-throw". This approach is a striking result of the increase in greenhouse gas production, which is a fundamental reason for climate change (Rosen et al., 2022). Adopting the approach of circular economy that encourages reuse and repurposing products at the end of their life cycle and making them ready for reuse instead of disposing them makes a significant difference environmentally. Apart from emphasizing economic gains, threats to the continuity of humans, population increases, and unbalanced consumption of resources are all can be minimized by embracing sustainability (Ghisellini et al., 2016b)

Waste management and resource management methods use have undergone a striking transformation with the inclusion of the circular economy into the system. This transformation has led to a growing acceptance of previous consumption patterns and environmental sustainability links put in place to prevent resource depletion. Waste is now a potentially valuable resource rather than just a by-product of consumption with the emergence of new practices that challenge traditional concepts of waste and its economic consequences (Geissdoerfer et al., 2017) Waste management has now begun to be considered as an economic problem with the changing social perception of waste and the methods developed for the recycling of waste. The challenges of separation and recycling encountered in waste management require advanced technology and capital investment. Circular economy emphasizes the need to examine products more systematically with a holistic approach. For this reason, the entire value chain must be considered to optimize waste strategies and resource use (Ferronato & Torretta, 2019). Although many corporate structures control waste management efficiently, consumers often cause difficulties improper disposal at the collection stage. Reverse logistics can benefit from product development and inventory management in facilitating the transition to a circular economy. Bringing post-consumer materials back into the product cycle and minimizing waste contributes to sustainability. (Govindan et al., 2015)

Waste management in developing countries poses many technical, financial, environmental and social challenges. A comprehensive process that covers both socioeconomic and socio-cultural circumstances is required to effectively deal with these challenges. In developed countries, high-income and educated societies make it easier to implement waste reduction methods. However, nowadays increasing environmental awareness with political changes in developing countries is a sign of progress towards more environmentally friendly waste management practices (Vinti & Vaccari, 2022). There is a significant increase in waste production due to rapidly increasing factors such as development rate and population growth. The increase in the amount of waste is inversely proportional to landfill areas. It is expected that the design of waste treatment facilities should implement new methods that decrease the impact of waste accumulation. It is significant to apply 3R strategies to increase the welfare level of society. These designs include expectations such as reducing the impact of waste accumulation and minimizing the amount of waste production (Mahartin, 2023).

Promotion of 3R principles have begun to be increasingly implemented, especially in European countries, the Japan and other developed and developing countries. These principles at the societal level should be among the priorities of policy makers. At the same time, the participation of institutions should be activated, and upstream waste should be minimized. A substantial success of 3R strategies is the opportunities they offer to people towards a sustainable lifestyle. Communities considering the consequences of waste generation on the natural resources can help to reduce the waste we create. Adopting the right lifestyles can have a significant impact, especially in reducing negative environmental impacts (Samiha, 2013). Despite the increase in the implementation of circular economy principles, there is still a lack of awareness about practices regarding post-consumer activities. This limitation indicates that the relationship between circularity and post-consumer activities is still an area that continues to develop. For societies working on the difficulties encountered in waste management and the moderation of resource consumption, circular economy principles offer an important framework to transform these consumption habits. Creating solutions by adopting innovations to recover resources allows for a more sustainable and circular economic approach (Kandpal et al., 2024).

1.2.Value Retention Models in Circularity

With the explosion of the world population, the consumption of natural resources has also increased uncontrollably. This situation has accelerated efforts to increase reuse, reduction, recycling and remanufacturing activities. In this way, many country governments are investigating the maximum resource saving potential in supply chains to utilize the resources (Cochet, 2020; Govindan et al., 2015). One of the most effective ways of the CE's efforts to prevent this situation is the Retention of value. It promotes an understanding that ensures a comprehensive way to recovery and circularity of the resources, by focusing on the re-creation of value through resources. Practices such as reuse, reduce, refurbish are all substantial parts of the circular economy concept. In addition to these important value preservation methods, remanufacturing, repair and recycling also serves the same purpose. They aim to extend the value of products, components and materials to the maximum extent possible. Value preservation methods protect the life cycle of products, reduce waste and increase resource efficiency (Leino et al., 2016).

Value preservation creates a more sustainable economic alternative by reducing environmental impacts. Future research and development on the integration of Industry 4.0 technologies with these strategies may serve to preserve the value of materials. In this way, these strategies, which will be adopted by society, can be optimized and offer a more sustainable future (Kanishka & Acherjee, 2023; Okorie et al., 2021).

1.2.1. Refuse

Refuse is a value recovery method that both the consumer and producer use to minimize substances that harm nature. This conscious avoidance is a form of stopping both the use and production of goods that directly contribute to resource depletion and environmental degradation. This proactive measure promotes an awareness-raising approach to consumption patterns of individuals, businesses and societies. (Reike et al., 2018)

When considered from the consumer's perspective, "rejection" refers to the consumer's choices when purchasing a product. It involves a consumer who avoids purchasing things that seem unnecessary or low value. A consumer attitude that makes mindful choices or avoiding purchasing aimless products is an example of preventing waste generation by refuse. With this approach, consumers observe the result of reducing their environmental footprint (Rosen et al., 2022).

There should be implementation of new methods to differentiate the effects of value retention practices to maximize value protection. Also, the development of business models and policies that support these practices will encourage the adoption of these strategies (Castiglione et al., 2024; J. D. Russell & Nasr, 2022). When considered from the producer's perspective, the concept of refuse is mostly seen in the product life cycle design. It refers to the regulation of product design processes, such as a manufacturer consciously eliminating the use of hazardous substances from production or minimizing the amount of waste. In this way, the contribution of producers to sustainability and circular economy with the concept of refuse is seen from the very beginning of the production process (Reike et al., 2018).

1.2.2. Reduce

The concept of reducing can be examined in three ways: firstly, consumer-oriented, producer-oriented, or more generic. Extending the life of a purchased product by reducing its use or careful use are examples of consumer focus. Repair of a purchased product or support from consumer to consumer are also given as examples (Rosen et al., 2022).

One of the most important contributions that will facilitate the implementation of the reduction principle is the prevention of unnecessary use of raw materials. This provides a more effective result to be observed in the amount of solid waste that needs to be disposed of (Syed, 2006). Limiting the use of packaging in products reduces total waste production and limits unnecessary resource use (Benjamin, 2003). Reducing waste can also be achieved by eliminating the use of plastic bags in stores and reducing the use of kitchen utensils made of plastic or paper materials. It is very important that society moves towards reusable products instead of disposable products that will be turned into waste.

The concept of reduction provides control of the use of resources and waste management in the most efficient way during the production stages. It is also achieved by minimizing waste production or reducing resource use in the product life cycle during the design, production, distribution, and consumption stages. Another method of reducing material and energy use in this cycle is possible by optimizing the energy used. These techniques not only reduce waste but are also provided by designing products that are more durable and prone to long-lasting use (Reike et al., 2018; Rosen et al., 2022). Reduce strategies decrease the demand for resources and reduce the problems encountered with the disposal of waste and the issues associated with the process of accessing resources at the same time. In this

way, this concept serves to maximize resource efficiency and effectively implement circular economy efforts (Rosen et al., 2022)

1.2.3. Resell, Reuse

The concepts of "resell" and "reuse" are closely related. If reducing cannot be applied, reusing products without turning them into waste also benefits circularity by creating an effective way out. Reuse refers to the reintroduction of products to the market for their next use, after their initial purchase by a consumer. The sales process required for second-hand products that are reintroduced to the economy includes both parties, namely the offering and the purchasing parties. In addition to these parties, consumers, collectors, retailers and producers are also included in this concept (Rosen et al., 2022). Repairing or selling a product is among the popular methods of reuse. Apart from that, donating unwanted products to relatives or non-governmental organizations is also an effective method. Reuse plays a major role in reducing waste and is simpler to implement than recycling as it does not require processing. Therefore, reuse is not only environmentally friendly, but it also provides social and cultural benefits (Mansilla-Obando et al., 2022; Nikolaou et al., 2021)

"Reuse" is a concept for the second consumer of a product, where the product generally retains its functionality "like new" and without the need for any replacement. When the concept of reuse is examined from the consumer's perspective, purchasing second-hand products also allows the purchase of a product that is not produced or not on sale in the market of the season. It is generally seen that the consumers might make small touches to use the second-hand product in a cleaner way. It reveals that various e-commerce sites are frequently used to transfer a used product from consumer to consumer when it comes to the most common platforms where these purchases are made (Arman & Mark-Herbert, 2021; Ijaz et al., 2022)

Reselling is a method of prolonging the life of the product rather than throwing it away. The benefits of these reused products are maximized by reselling them in shared places such as second-hand purchases or rental services. This benefit also reduces the demand for reproduction of the same product (Ijaz et al., 2022; Rosen et al., 2022)

The concept of reuse also allows these products to be recycled by diverting them from being turned into waste. It is seen that some businesses use methods to increase the attractiveness of products prepared for reuse through various renewals or packaging strategies for second-hand products. Consumption models such as offering clothing and

decoration products for sale by auction on some e-commerce pages or car sharing platforms allow the products to be used more efficiently by increasing utility, thus encouraging the sharing of resources (Armstrong & Park, 2020; Rosen et al., 2022).

1.2.4. Repair

The main purpose of the concept of repair can be defined as the fixing of deficiencies or various deteriorations of a product to extend its life, including the efforts made to restore the main working function of a product. Repair operations can be done by a consumer or the seller, also by companies that specialize in product repair (Rosen et al., 2022)

Repaired products refer to restoring the working ability of the existing product rather than purchasing a new product. Basic repairs such as repairing a broken or damaged part are also carried out to restore this skill, as well as more comprehensive renovation works (Godfrey et al., 2022). It is observed that methods such as repair service are sometimes implemented through some community workshops, such as providing a consumer with the knowledge and skills to repair the product he/she owns, or they can access spare parts. In this way, it aims to create a repair culture. This repairing culture provides an establishment of a stronger and more adequate consumer relations with the product by reducing waste and extending product life cycle (Godfrey et al., 2022; Svensson-Hoglund et al., 2023).

1.2.5. Refurbish

The concept of refurbish is a complex restoration process that aims to preserve the design, but it is driven by the need to meet the new requirements. Transportation vehicles such as airplanes and trains or complex machine engines are given as examples when it comes to refurbishing in a circular economy. Third party renewal centers or various retailers can provide these services. Recycling is known more than many other strategies. But strategies like remanufacturing and refurbishment allow products to look “as new”. These methods are particularly important for achieving higher quality products (Zacharaki et al., 2021). A significant quality control audit is performed to test the basic functionality of refurbished products after pursuing techniques such as cosmetic improvements to meet aesthetic concern or software updates the refurbishment help to eliminate a significant amount of waste and it contributes to the circular economy (Rosen et al., 2022)

The concept of refurbishment is linked to the product structure that is usually quite large and complex. It is a method in which the other components of this product are refurbished

without changing the products' core purpose and functions. In this case it is observed the main mechanism of the product is preserved by improving and upgrading a complex product compared to its old state. By regaining the functionality of the original components, the overall lifespan of the product is increased and a higher success in product performance is achieved. (Rosen et al., 2022).

1.2.6. Remanufacture

A value retention method that we will talk about is "Remanufacture" which is the complete disassembly of a multi-component product and the remanufacture of its industrial structure. This concept refers to a product that is first disassembled, cleaned, checked, and transformed by repairing the necessary parts. Then replace the missing parts with new parts. The concept of refurbishment is linked to the product structure that is usually quite large and complex. It is a method in which the other components of this product are refurbished without changing the products' core purpose and functions. In this case it is observed the main mechanism of the product is preserved by improving and upgrading a complex product compared to its old state (Rosen et al., 2022).

It is very common to see after the remanufacturing process that a product is upgraded compared to its previous state. The remanufacture method can be done with a product only consisting of recycled parts. The replaced components must be assembled to match the specifications of the original product. These products can perform as well as new after passing certain tests. Remanufacturing requires a complex set of advanced engineering skills and production equipment since these products are generally from the automotive, aviation, and Electronics sectors (Fofou et al., 2021; Krottil, 2019)It also allows the provision of advantageous products to the consumers at the end of this process by helping with cost savings. Value preservation processes offer a lot of environmental and economic benefits. However, it is seen that their implementation is not widespread. An example of one of these strategies that has not yet been sufficiently adopted by societies is remanufacturing. Remanufacturing exists in only a small portion of manufacturing in the US and EU (Okorie et al., 2021). There is a lack of clarity on how the value retention methods differ. The lack of data of their specific effects also poses an obstacle to activating these strategies (Russell & Nasr, 2022).

1.2.7. Repurpose

Products can begin a different life cycle by repurposing discarded goods or by adapting the parts for another function. Repurposing refers to the differentiation of the primary purpose intended for a product and obtaining an alternative purpose (Rosen et al., 2022). For example, transforming the materials used for packaging into artistic products by adding a creative value or upcycling can be given as an example. An innovative perspective, creativity and skill are required to benefit from this method. It is a method that increases the existing value of products in a different way by saving them from being disposed of, thus contributing to the circular economy (Kozłowski et al., 2022; Nallapaneni et al., 2023).

1.2.8. Recycle

Recycling specifically refers to the disposal of a product after use and its recycling through various methods such as sorting and melting, and after this application, the structure of the original product is deteriorated. Firstly, used materials must be collected to create new products or raw materials. The concept of refurbishment is linked to the product structure that is usually quite large and complex. (Benjamin, 2003; Sinha & Modak, 2021) It is a method in which the other components of this product are refurbished without changing the products' core purpose and functions. In this case it is observed the main mechanism of the product is preserved by improving and upgrading a complex product compared to its old state. It benefits the circular economy by minimizing the need for raw materials and raw materials created by processing the same type of materials gathered (Rosen et al., 2022).

Recycling not only reduces environmental degradation and creates new business opportunities. Various chemical processes such as separation and shredding can be performed depending on the type of these materials. Third parties support the screening of materials during the recycling process. If waste is still ready to provide benefit they are recycled from landfills rather than causing a huge waste pile. Recycling plays a very important role in achieving maximum efficiency by preventing unnecessary use of natural resources (Neumann et al., 2022; Yu et al., 2020)

In addition to increasing research on recycling in many different sectors, the efficiency of these processes varies depending on the awareness of manufacturers and end users. It offers a solution that does not consume primary resources in the recycling process which offers a solution proposal has been found to be quite successful (Laparra et al., 2021) However, it

has become clear that recycling is not always an optimum option due to limitations such as the high amount of energy it requires and the waste it produces. There is a minor difference between 'Reuse' and 'Recycling' terms used interchangeably by society. 'Recycling' is the extraction of raw materials from a used product. These raw materials can be used to make a new product from scratch. However, 'Reuse' is use of an object by the same or different people without the need for reprocessing, so it extends the life of a product (Sinha & Modak, 2021).

1.2.9. Recover

Recover is the collection of a used product after completing its product life cycle, and then the process begins with the necessary operations, disintegration and classification of the materials and then these classified components are cleaned and to finalize the recovery process. Also, the method of extracting the necessary elements from a used product is another well-known method of recovery. Recovering the energy needed from the collected waste in waste management provides additional value (Larcher & Tarascon, 2014; Rosen et al., 2022).

A good example of these remediation methods is the use of compost for organic waste. A balanced resource use and efficiency in energy production can be achieved, making a significant contribution to environmental sustainability thanks to the additional resources extracted from waste streams (Boloy et al., 2021; Brydges, 2021b)

1.2.10. Re-Mine

An often-forgotten issue in the implementation of the circular economy is how to retrieve materials at the stage of landfilling. Retrieving valuable parts from discarded products in the global North and South regions has emerged under very different conditions and created a kind of informal sector (Rosen et al., 2022).

Warehouse mining is a process in which developing countries that have been storing controlled waste for many years, businesses have now begun to obtain valuable resources stored in old landfills by mining. Remining involves extracting valuable materials from existing waste deposits, such as mine tailings. These strategies aim to extract previously discarded resources, reducing the need for new mining and minimizing environmental impacts (Debrah et al., 2021; Tian et al., 2023) People often encounter hazardous materials when collecting valuable materials and items from landfills to make a living in developing

countries. This poses significant health risks for them, known as "scavengers" and the process of selectively removing valuable parts is called "cannibalization". The main factor mentioned in this term is that parts that can be used in other products or components can be recovered (Rosen et al., 2022).

Complex preparation is required for remining operations, involving environmental management and resource recovery technologies to make a safe and efficient recovery of valuable materials from waste deposits. This contributes to resource conservation, waste reduction and circular economy by utilizing existing waste streams (Maest, 2023)

1.3.Overview of Circularity and Post-Consumer Activities

1.3.1. Waste Collection and Sorting

Rapid urbanization causes an increase in waste production per capita. Waste brought together with non-environmentally friendly collection methods lead to severe environmental consequences, especially with the large amounts of garbage generated by domestic environments. Household recycling requires the identification of different waste compositions. Separating these wastes based on their types is the consumers' responsibility to dispose of them correctly in the garbage containers, cardboard, metal, and plastic, provided by the local government (Guiot et al., 2019).

In waste management, the existence of a well-functioning collection and separation system increases the performance of pre-recycling activities (Buttitta et al., 2023). This means that how well resources are separated and collected has a significant impact on the life cycle and recovery level of these products. Pre-sorting of the resources must be done during the collection phase and post-sorting must be carried out after the collection process is completed to carry out this process with the required quality. Especially in the final separation phase, large amounts of waste are treated to recover functional parts. The post-sorting process requires a large amount of energy consumption (Gu et al., 2022; Popova & Sproge, 2021).

The ever-increasing world population has increased the demand for raw materials. Therefore, the piles of waste caused by intensive production have gradually increased. The main waste worldwide is from homes, workplaces, markets, and industrial facilities. In addition, the amounts of waste produced from sewage facilities, construction, and

agricultural activities are also the main areas. One of the most challenging problems faced by local government is the collection of domestic waste that occurs especially in unplanned urban areas. This situation leads to limited access of the waste collection of the low-income populations in society (Adedara et al., 2023; Worku et al., 2023)

Better management of waste collection in only high-income neighborhoods is a challenge in developing countries. In this operational issue, especially the most developed cities have access problems due to their inconvenience such as width and slope. Responsibility for the collection of waste is managed by the municipality, with limited participation by some private contractors and informal waste collectors (Kinobe et al., 2012).

Waste pollution has become a worldwide issue due to wrong practices. It is an environmental problem that requires an urgent solution, and it is important to apply waste sorting correctly to prevent permanent damage to natural resources. The method of separating recyclable materials from non-recyclable materials should be stored according to certain standards during the process. The sustainability of resources is utilized by transforming the waste into new resources by using techniques such as release, handling, or storage (Brydges, 2021b; Popova & Sproge, 2021).

An environmental protection movement characterized by pro-environmental behaviour is a way to support environmental awareness and social relations (Videras et al., 2012). Waste sorting is a result of a substantial pro-environmental behaviour. Individuals with high environmental awareness know to classify these waste materials of different types according to the correct standards. These individuals contribute to the successful separation of waste from resources (Guiot et al., 2019).

The concept of waste sorting dates to the mid-20th century. And the first country to implement this was Germany. Starting with the encouragement of Germany, the waste sorting method quickly spread throughout Europe. Waste separation, which has become an important waste management concept that has spread all over the world today, refers to a broad concept that can be explained as separating recyclable and non-recyclable wastes within their source and transporting them to landfills (Zhao & Zhang, 2023). Accurate classification at the source increases waste sorting performance to an effective level. Waste sorting is a method that includes different stages. It starts with classification according to new resource categorization and is stored according to predetermined standards. Then releasing or handling techniques are applied (Popova & Sproge, 2021).

Waste sorted at households reduces the waste management costs of municipalities. In this way, individuals support sustainable development by enabling the government to save in its financial budget to promote their country (Yokoo et al., 2018).

Collection is an important strategy in solid waste management practices of municipalities, and it contributes to obtaining the maximum benefit from waste. Another important criterion of waste collection is collecting the materials in a timely and economical manner and facilitating the next waste separation stages. This utilizes sorting and increases the reuse of resources. Municipalities may apply different collection methods according to the population density of the regions or urbanization plan. At the same time, designing waste collection strategies considering public acceptability is important for the efficiency of waste collection practices (Erdem, 2022; Kaza et al., 2018)

1.3.2. Reverse Logistics

The concept of reverse logistics includes the components of reuse, recycling and remanufacturing among the R strategies. Logistics is simply the process of planning and controlling the efficient flow of raw materials, in-process inventory or finished good. It also includes the transmission of necessary information from the origin of a product until it reaches the consumer (Letunovska et al., 2023)

Reverse logistics is a process of controlling all the necessary steps to recapturing the value of goods. It can be implemented on raw materials, in-process inventory, finished goods and information from the consumption to the origin point. It can be also used for disposal (Elmas & Erdoğmuş, 2011).

Reverse Logistics strategy is the process of moving goods from their end points to their starting points to gain value from a good or to dispose of a good correctly without damaging environment. Some refurbishments or remanufacturing activities can also be implemented under this concept. It is possible for products to go backwards in the supply chain process not only as materials and equipment but also as a whole technical system (Letunovska et al., 2023; Shakhov et al., 2020).

Reprocessing of some goods due to poor quality is a problem encountered during manufacturing. even if the components are of good quality another issue that can occur is the return of leftover materials at the end of manufacturing process. The concept of reverse logistics is a relatively a new phenomenon created on damaged goods. It refers to the return

of these goods to the manufacturers and the return logistics, or reverse distribution terms belong to the reverse logistics literature (Letunovska et al., 2023).

Reverse logistics is an integrated network structure concept that involves the backward flow of goods from the customer to the manufacturer. This network includes all logistics and distribution processes such as collection, inspection, classification, and pre-processing. Reverse Logistic principles aim to add value to the goods after the manufacturing and to include the disposal of goods with environmentally efficient methods (Dabees et al., 2023; Letunovska et al., 2023).

Traditional logistics involves the flow of goods from producers to end consumers. However, reverse logistics moves from customers to the point of origin therefore providing after-sales repair services in the manufacturing sector is largely a matter of reverse logistics. Offering such options provides efficient product management for manufacturers (Dabees et al., 2023)

In addition to the fact that the goal of a company is to make a profit by reducing the size of the materials used, minimizing the waste created increases this benefit. The production of highly efficient products through reverse logistics contributes to creating a way to reduce the resources used by saving energy (Tan et al., 2022)

If the purpose of a business is to reuse components and then maximize the recycling of the waste generated, this stands in contrast to the little attention given to final products at the end of the traditional logistics chain. An important explanation of this situation is that reverse logistics also considers the disposal of waste (Mallick et al., 2023)

Consumers are concerned about the environmental impacts of the products they use, starting from the disposal, and generally, this flow moves from developed countries to developing countries. Developed countries now aim to significantly reduce the amount of waste produced by promoting new waste prevention solutions. reverse supply chain has attracted the attention of industrialized countries with better use of resources and increased compliance with sustainable consumption patterns (Matsui, 2023)

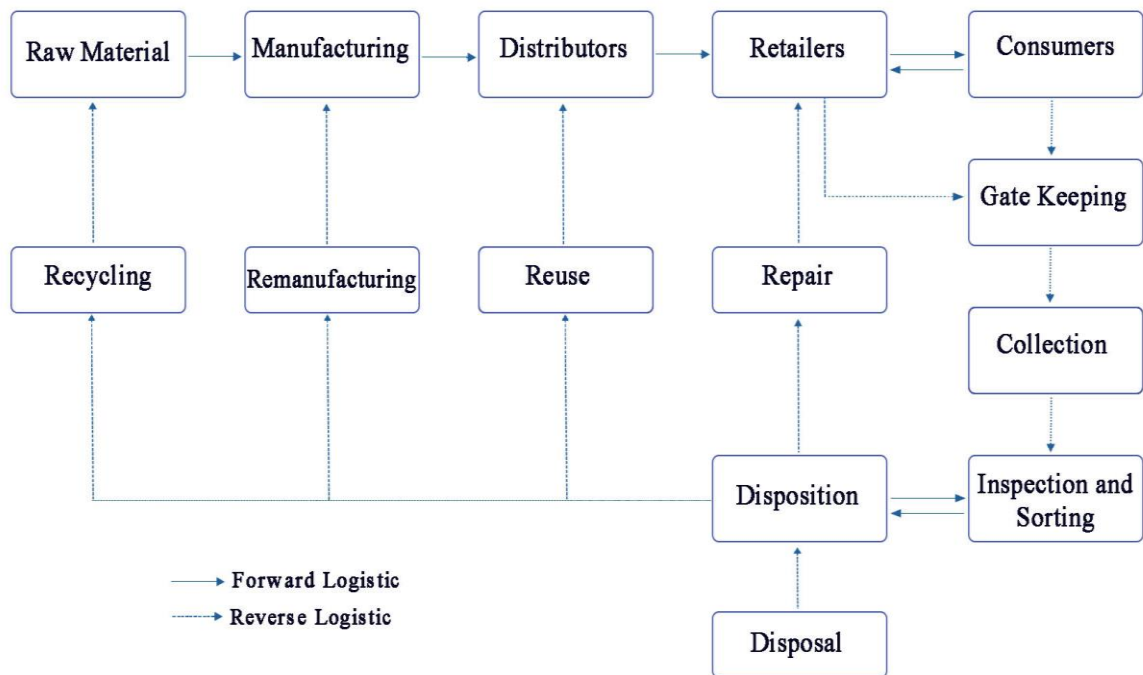


Fig. 1. The Flow of Forward and Reverse Logistics (Adapted from Agrawal et al., 2015).

The gatekeeping process refers to the return of used products, thus ensuring that the products taken back from end users go through various processes to achieve better quality. Product acquisition is an important step in a successful backward supply chain. Product acquisition and collection strategies are steps that enable the reintegration of returned products. Therefore, they take their place as crucial elements in reverse logistics (Hosseini-Motlagh et al., 2020).

Because this stage is the critical beginning point of reverse logistics. Product acquisition, which includes a series of systematic processes applied by businesses when selecting products to be released to the market, ends with the solution of the problems and the return of the products to the user (Mu et al., 2023)

There are various financial and environmental determinants might be in the reverse logistics concept. When these motivations are considered, various contradictions may arise. Profitable reverse logistics strategies are becoming increasingly important as they appear financially attractive. However, the solution to the challenges faced by many companies is

increasing the use of information technology and making collaborations (Mall & Dabas, 2011).

When a customer returns the product, he/she purchased to the business, this business makes the final decision on the product. While they can send the product back to the supply chain for necessary procedures, they can also give the product back to the consumer. This decision-making process is involved in reverse logistics as retailers' gatekeeping (Agrawal et al., 2015).

Collection is an activity carried out by the producers to gather products before sending them the sorting and inspection step. A firm can collect the product directly from the customer. Apart from this, they can collect their products through retailers or 3rd party logistics companies. The benefits of a supply chain network designed with rival collection centres are mentioned. The establishment of certain quality standards in reverse logistics for returned products is aiming to create a vital value in product acquisition applications (Bajani et al., 2022)

There is an environment in which third-party collectors compete in acquisition management. This approach of these participants focusing on the quality of products in the reverse supply chain creates a beneficial coordination for all parties that increases the quantities and quality of items received by the remanufacturer (Hosseini-Motlagh et al., 2020).

Although it is a very common reason for a customer to return a product, they purchased due to faulty manufacturing, in some cases, they may want to return their product for unclear reasons. Separate inspections should be made on returned products due to these differences in reasons. After the completion of these investigations, the components of the products can be sorted and be ready for their evaluation (Agrawal et al., 2015).

The Disposition process has an inevitable impact on reverse logistics. The reason for this critical effect is that it directly affects the performance of reverse logistics applications. The reverse supply chain in parts production in the automotive industry can be given as an example. Studies show that disposition practices create an opportunity for strategic efficiency (Skinner et al., 2008).

Disposition is a critical concept in reverse logistics, and the processes involved in implementing these strategies vary from one sector to another. Destroying a product can

sometimes be the best option, especially when resources are limited due to available resources. While there are adequate resources considering refurbishing or remanufacturing options will lead to a higher performance (Skinner et al., 2008).

Disposition success is closely related to adaptation to the external environment. Implementing the right strategic business objectives is as critical a determinant as external factors. Contrary to what is assumed, it does not only emphasize the importance of cost reduction or sustainability rules (Lechner & Reimann, 2019; Skinner et al., 2008).

The concept of disposition is also a process that has a direct impact on outcomes other than sustainability and strategic business performance. In this Logistics process, the literature recommends considering internal resources to optimize reverse logistics operations. In addition, considering external demands emphasizes the need for a critical distribution approach (Agrawal & Singh, 2019; Lechner & Reimann, 2019; Skinner et al., 2008).

1.3.3. Upcycling

Upcycling is a concept that has been gaining trend in recent years. It is the process of waste materials into a new product by using different components together to create a product of both higher quality and value. In this way, it is aimed to reduce waste generation and extend the life cycle of the products instead of turning them into waste. Upcycling offers an alternative to slow down material cycles (Earley & Goldsworthy, 2015; J. Singh, 2022)

Excessive consumption of resources and the amount of waste produced have caused to the search for solutions. It creates a circular solution instead of mass production and consumption by reducing the use of raw materials. The concept of upcycling, which also reduces energy consumption, encourages consumers to live a sustainable lifestyle. In fact, although it is a promising application, it is not yet very widespread in practice. From a consumer perspective, upcycling has offered an efficient solution by repurposing a product (Boloy et al., 2021; J. Singh, 2022).

Upcycling creates the possibility of creative or innovative reuse of products in such a way that the results have equal or greater value. This concept is intertwined with many other strategic concepts in the Circular economy. These include strategies that renew and upgrade products, such as recycling, repurposing, and remanufacturing. Upcycling plays a major role in reducing negative environmental impacts. Therefore, it is a very valuable and high-quality concept that contributes to the economy and society (Sung et al., 2021).

Upcycling offers a method that does not need to exceed current costs and requires low levels of change. Another benefit is that it enhances the customer's experience. In this way, upcycling, which is a concept that is an effective source of value, is about changing the perspective of the society and creating awareness(Sung, 2023).

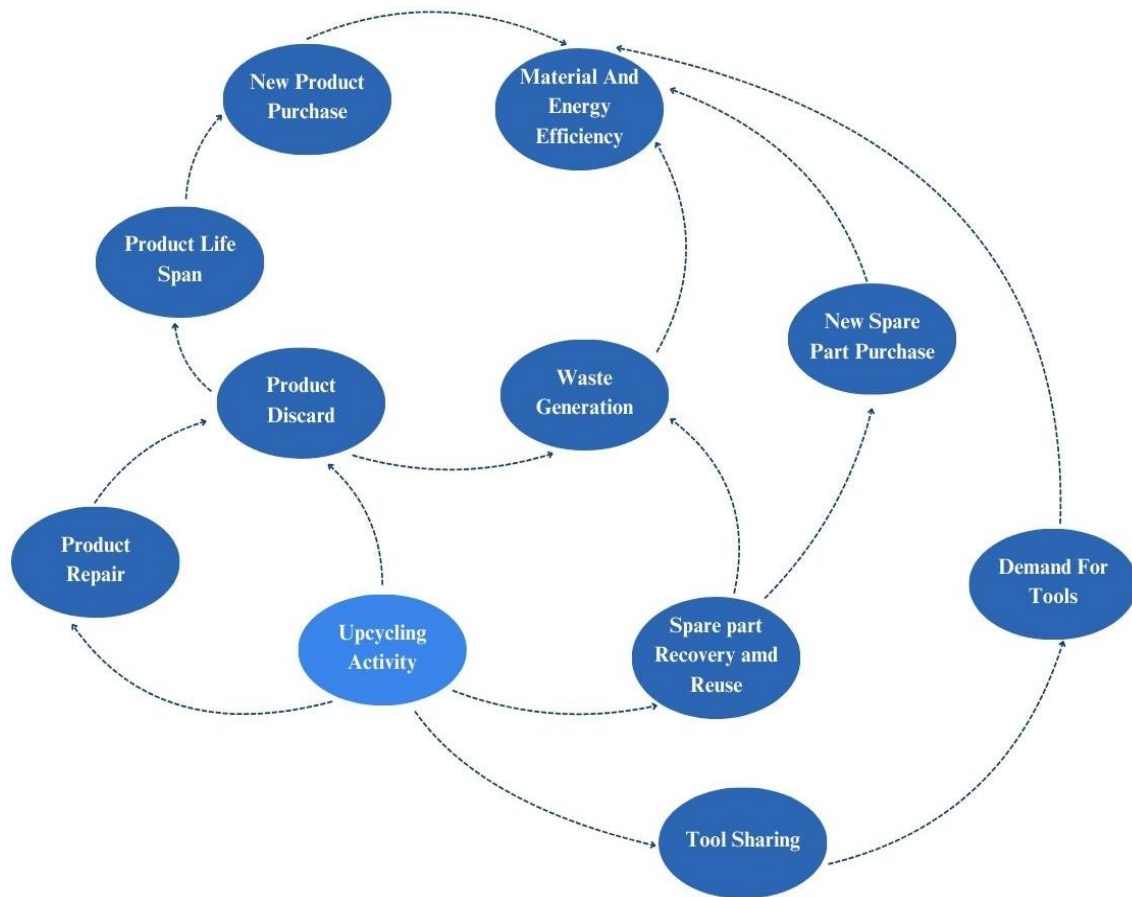


Fig. 2. A loop diagram in upcycling about system variables (Adapted from Singh, 2022).

This loop diagram describes the relationship of interdependent variables involved in upcycling activities. This causality relationship depicts the collective contribution of the components to the circular economy. This system is aimed to extend the life of the products and increase material and energy efficiency by using repair and upcycling methods (J. Singh, 2022)

Reusing products prevents waste generation extends the lifespan of products and materials. Product repair plays a crucial role in this system, helping to reduce the frequency of purchasing new products. This decrease in demand for new products supports the efficiency of material and energy use (Mahartin, 2023). Recovering and reusing spare parts from

discarded products prevents the waste of natural resources by reducing the need to purchase new spare parts. Another solution that reusing spare parts offers against waste production is that they are preferred over the use of new spare parts in upcycling activities (Ahmad & Riffat, 2020; R. Singh, 2022)

Tool sharing at the bottom of the diagram appears as another important element that encourages upcycling. Sharing the tools needed for repairs contributes to the spread of upcycling by reducing the demand for the purchase of new tools. This common use helps spread upcycling activities by making them more affordable. The main purpose of these variables shown in the diagram is to optimize the use of existing resources and minimize environmental damage by increasing material and energy efficiency (R. Singh, 2022; Yadav, 2021)

A well-known example of upcycling is the do-it-yourself, DIY, method of packaging that many companies offer to consumers. In the first stage, some models were created to see the durability and feasibility of this idea. By conducting feasibility studies on the prototypes that went through the testing process, the ideas that would pass through these processes were filtered and identified. The last selected ideas were developed further for implementation of upcycling (Eissenberger et al., 2023; R. Singh, 2022).

The current worldwide take, make, use and dispose system is a linear economic model. The circular economy, which emerged as an alternative to this model, reduces the negative environmental impacts. It creates a closed loop by creating an environment suitable for resource circulation to reduce waste growth to a certain extent. This circularity offers an economy model based on reuse (Ellen MacArthur Foundation et al., 2016).

Upcycling used materials or products may require various improvements in the composition elements. These improvements may only be cosmetic changes that will appeal to the user's aesthetic perception, or they may include more technical changes. For example, the features added to the new product may include improvements that bring greater benefit to the user, such as improved performance, increased reliability, extended product life. The result of upcycling can be like a completely new product due to such improvements (Sung et al., 2021). These processes help consumers perceive the upcycled product as being of higher quality than before. Upcycling carried out by professionals such as a designer or company can also make a significant positive contribution to consumers' quality perception of the product (R. Singh, 2022)

Repairing a product requires spending a significant amount of time. Because it replaces other activities that affect overall resource consumption. Therefore, DIY repair activities create a new set of complex socio-economic interactions that drive sustainable consumption in societies. It is likely to lead to behavioural innovations in consumption patterns by changing individual time use (Singh, 2022).

Upcycling, a design-based solution and a practice that preserves environmental integrity, uses discarded, obsolete materials. It is creative or innovative when incorporating multiple material processes into product formation. Upcycling contributes to minimizing waste and reducing pollution by saving energy and water. Uses various strategies like repair, upgrade, redesign, refashion and remanufacturing if necessary. New products and materials obtained with upcycling have higher quality and values than the original elements (Sung, 2023).

The DIY activities are carried out through repair, upgrade, reuse and recovery of material resources from urban waste. It is a method that closes or slows down the material flow, contributing to the prolongation of the life of the products. Product sharing or mending activities are also reducing the use of spare parts. Apart from that repairing offers the potential to prevent the purchase of new products by helping a more sustainable environment. Developing these skills also offers social and economic benefits such as it promotes increased social cohesion in local communities (Singh, 2022).

1.3.4. Extended Producer Responsibility (EPR)

Extended Producer Responsibility refers to a method that advocates that manufacturers should be responsible for product lifecycles at the stage of product design and include these products in the recycling processes. In other words, it underlines the producers are accountable for the disposal of the product through end-of-life management. These policies aim to encourage producers towards a circular economy by taking on a role in reducing waste generation, thus drawing attention to their responsibility for the consequences of their environmental impacts (Tumu et al., 2023) One of the effective solutions to reduce waste to design solutions to environmental problems before these consequences occur. Extended producer responsibility requires a management system beyond the renovations of production facilities or waste disposal practices. It is more important to develop product design, delivery and collection systems to achieve effective results in extended producer responsibility (Doppelt et al., 2001) .

One of the reasons for the increasing interest in this method is the shortage of landfill areas and this shortage also has led to a rise in the requested fee. This situation has prompted the need for alternative waste management strategies in many communities. Nowadays waste landfills in many Western European countries are almost full hence a decrease in suitable garbage storage capacities has occurred. Many governmental bodies are investigating methods such as reducing resource consumption or incineration in their waste management (Doppelt et al., 2001).

The responsibility of the producers does not end after a product is distributed to the market and delivered to the end consumer. A manufacturer avoiding liability for its product lifespan is an important reason for disrupting environmentally friendly production. Adoption of production models that create such negative effects not only increases waste generation but also creates an accumulation in garbage areas (Doppelt et al., 2001; Lebreton & Andrady, 2019). However, increasing the responsibility of producers creates various economic incentives. Producers, who undertake the costs of waste production, introduce easily recyclable products to the market. Thus, these businesses play an influential role in reducing waste sent to landfills (Cochet, 2020; Hou et al., 2018)

The toxicity of wastes has been investigated as an important reason for the interest in extended producer responsibility. The rapid progress of industrialization and the expansion of technological innovation have increased the demand for computer production. As a result, lead, cadmium, and other toxic compounds that threaten human health are used in the production of computers. It has been observed that most similar technological products, that have reached the end of their product life cycle, are directly mixed into the waste stream. Since these wastes are incinerated together, they release toxic substances into the atmosphere (Doppelt et al., 2001).

EPR addresses the responsibility of producers in waste management, and it also prioritizes the design of recyclable products. Many countries not only use less materials in packaging but also implement EPR policies in the electronic devices and automobile industries (Hanisch, 2000).

The primary principle of EPR is related to the increase in the amount of waste. EPR underlines that producers should be held responsible for the environmental consequences of the waste they produce for this increase, which has become a global problem. Because this situation results in the internalization of costs. It states that the company is responsible

for bearing the costs and its environmental impacts as a result of market dysfunction (Doppelt et al., 2001).

Product take-back programs, an important practice in EPR policies, require manufacturers to properly dispose of their products at the end of their life cycle or take them back for recycling. It produces a sustainable solution for end-of-life products and supports resource recovery. EPR offers product take-back programs by emphasizing the need for producers to take product lifespan into consideration. The basic principle of these programs states that manufacturers should be involved in the collection, recycling or disposal of products after consumption. There is empirical research that supports the effectiveness of effectiveness of producers' participation. For instance, producers can be motivated to develop new environmentally friendly practices through take-back programs that encourage eco-innovation (Peng et al., 2020).

2. The Impact of the Circular Economy on Global Value Chains

2.1. Global Value Chains

Global Value Chains refer to the international networks where production processes are spread across multiple countries and GVCs add value to each stage from raw materials to the final product reaching consumers. The value added to these stages must be carried out in different countries at least two of these stages for this process to be considered GVC. This chain includes concept development, design, production, marketing, distribution and support activities in the final product (World Bank, 2020). Producers spread the production processes across different locations in GVCs and the structure of it is complex and hard to map since various companies and technologies are involved. The tendency for global value chains to spread over a wide geographical area also reinforces this complex problem (Dutta, 2021). Internationalizing the chains allows these companies to benefit from the various advantages created by country location differences. For instance, benefit from cheaper labor, advanced technology or favorable legal conditions. GVCs distribute their business functions among multiple companies internationally (Awan et al., 2022)

GVCs distribute their business functions among multiple companies, often across national borders. Specialization in different types of production tasks for each country is allowed

by the division of labour in production. GVCs provide convenient conditions for global trade through less complicated contracts (Dutta, 2021).

In that respect, an important issue that attracts companies to benefit from the opportunities offered by GVCs is the fact that it increases the overall efficiency and considerably reduces the costs of companies (Lwesya, 2021a). In this regard, specialization in industries at different levels of production by companies also facilitated. Among such activities, examples can be listed as the possibility of producing the product in a place where labour is cheap or assembling the final product in a place with a logistics advantage. Apart from optimized production results, one of the most important effects of GVCs is that it enables companies to compete better in the global market, creating a competitive leadership opportunity for these producers (Dutta, 2021).

Global Value Chains are linked to the fragmentation of global production. This link impacts the dissemination of social and environmental standards; however, they are in danger of disruptions from international trade protectionism policy. These protectionist policies may lead to restructurings, leaving GVCs vulnerable to policy risks. The protectionist policies observed in GVCs disrupt many practices necessary for the proper implementation of GVCs. It also threatens the exposition of businesses to uncertainty and risks by hindering the sustainability of global trade (Zahoor et al., 2023).

Effective Global Value Chains strategies considerably raise the level of economic development in many countries, especially developing countries. It enables the latter to draw from the industrial infrastructures of the more developed economies by dispensing with large investment facilities. This eliminates the necessity of establishing factories, which requires serious investment, thus allowing it to contribute to the acceleration of industrialization in developing countries (Antràs & Chor, 2022; Zahoor et al., 2023).

Global Value Chains contain strong regional dominance and are not limited to global activities only but also show a considerable amount of activity even in regions such as East Asia and North America. The increase in the integration of GVC processes into trade in sectors such as electronics, machinery, and transportation equipment has been observed in these places as a regional concentration, resulting especially from the presence of large companies that dominate trade flows (World Bank, 2020).

GVCs enable countries to mutually benefit from each other's technological and organizational know-how. The creation of new and better job opportunities and the

promotion of talent development stand out among these gains. Thanks to the integration of GVC processes, many companies in the world make great contributions to the economic development of their countries by going beyond the national market and reaching more diversified international markets. In addition to that, it enables the facilitation and increase in the quantity of foreign direct investment in those countries. Improvements to be made on factors such as production capacity, infrastructure, and trade policies are the basic elements in the integration of global value chains into the new system (Del Prete et al., 2017; Maksymenko, 2019).

Global Value Chains try to enable the conditions for international trade and a flow of production According to the importance of today's international trade. Opportunities in economic development come with several policies in many dimensions of GVCs. This is including enhancing competitiveness and overcoming barriers of small and medium-sized enterprises (Del Prete et al., 2017; Lwesya, 2021).

Businesses take into consideration not only the stage of production they are in but also the location of their production in countries with low-cost production. In this manner, companies minimize the marginal cost of production. However, maintaining production in different locations leads to high fixed and variable costs corresponding to many service connections. Exceeding this optimal fragmentation level prevents effective GVC management because this amount varies depending on the level of trade and production costs (de Backer & Miroudot, 2014).

Global Value Chains have a network advantage in the global market as they can produce in locations around the world. This situation has also strengthened the links among the economies of the country by uniting them on common platforms. In the new production model offered by global value chains, products are not completed in just one country but are produced through the joint efforts of many different countries, and this production model produces more effective results than traditional methods. Contrary to many established practices, more products and services than ever before can now be said to be “made in the world” because they are created through the collective efforts of many countries rather than being produced solely domestically and competing with foreign-branded products. Therefore, in fact, many countries compete based on their economic contribution to the value chain (de Backer & Miroudot, 2014). GVCs have been shaped by the strategies followed by companies becoming a global bond encompassing many sectors.

In the Global Value Chain industries offers varies functions such throughout the supply chain, many countries no longer tend to specialize as before(Schlegelmilch, 2022). This is being replaced by companies specializing in certain functions of production. Such services facilitate transactions by participating in many global value chains. Raw material industries are also seen at the beginning of many of these chains. The reason there is specialization in a particular function of the value chains is basically due to the presence of a large network of global value chains used for producing several goods and services (de Backer & Miroudot, 2014; Dutta, 2021).

2.2.An Overview of Fashion Industry's Global Value Chains

The global fashion market is expected to grow and reach a revenue of \$770 billion by 2024. The market is set to record further growth from 2024 to 2029 at an 8.94% CAGR and reach up to \$1,183.00 billion by the end of the same year. The largest share of this will come from China, generating \$236.80 billion in revenue in 2024 and fashion users are expected to reach 2.8 billion in 2029 (Statista, 2024). Fashion retail is expected to reach a total of \$3 trillion by 2030, at an expected yearly growth rate of 5.8%. The industry employs around 430 million people with a 12.6% of the global workforce, participate directly or indirectly in the production of fashion, clothes, and textiles, mostly in Asia (Ariella, 2023). This situation points out how important Fashion GVCs are since they are deeply based on networks of supplier's manufacturers, and retailers across different regions of the world.

LVMH conglomerate led the ranking among fashion companies with €44.2 billion in global revenue in 2021. This shows that luxury brands are drivers of dominance and alter market dynamics, further underlining that the nature of the sector ranges from mass-market fast fashion to high-end luxury good (Ariella, 2023).

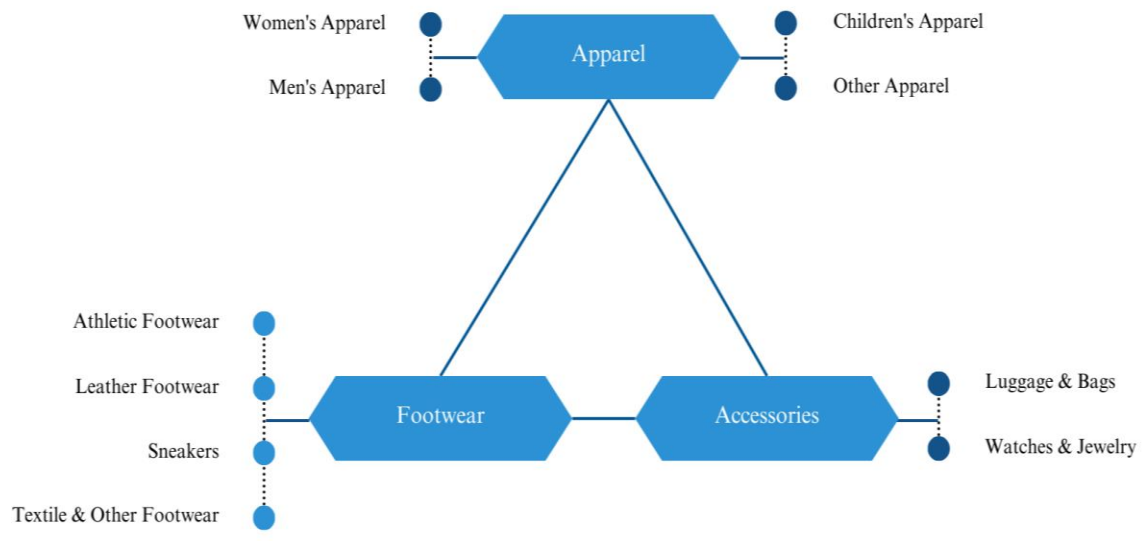


Fig. 3. A diagram of Fashion Industry Segmentation (Adapted from Statista, 2024).

The fashion industry has been segmented broadly based on the various categories targeted to diverse consumer needs and preferences. Apparel constitutes a broad category of garments; these may be formal or casual: the main focuses are Men's, Women's, Children's, and Other Apparel. Meanwhile, footwear is categorized as athletic footwear, or the material, which can be leather, sneakers, textile or other types of footwear. Luggage bags, watches and jewelry are under Accessories, which accompany clothing for functional and fashion purposes.

	VALUE	SHARE IN WORLD EXPORTS			ANNUAL PERCENTAGE CHANGE			
	YEARS	2005	2010	2022	2010-22	2020	2021	2022
EXPORTERS								
China	182	26,6	36,6	31,7	3	-7	24	4
EU	156	29,3	26,9	27,1	4	-8	20	4
Extra-EU	45	8,5	7,5	7,7	4	-13	14	4
Bangladesh	45	2,5	4,2	7,9	10	-19	30	27
Vietnam	35	1,7	2,9	6,1	11	-9	11	13
Türkiye	20	4,2	3,6	3,5	4	-6	22	6
India	18	3,1	3,2	3,1	4	-24	24	10
Indonesia	10	1,8	1,9	1,7	3	-12	24	8
Cambodia	9	0,8	0,9	1,6	10	-9	8	12
Pakistan	9	1,3	1,1	1,5	7	-3	37	5

Fig. 4. Top Ten Clothing Exporting Countries (Adapted from World Trade Organization, 2023).

The data shows that China keeps the leading position in world clothing exports with a share of 31.7% in 2022 although losing its peak reached in 2010 with a share of 36.6%. The EU comes in second with 27.1%, which has had a relatively stable trend from 2010 onward. Bangladesh whose share increased greatly within this period from 2.5% in 2005 to 7.9% in 2022, and Vietnam, whose share surged from 1.7% to 6.1% in the same period among other notable exporters.

Asia region dominates as the main source of global clothing exports, commanding over half of global clothing exports, which is driven mainly by China, Bangladesh, and Vietnam. Major fashion chains and apparel retailers have increasingly outsourced supply from these countries to achieve diversified affordable high-quality clothing with regular lead times. This has promoted regionalization and vertical integration in Asian production. However, this model has faced challenges recently due to the COVID-19 pandemic and rising geopolitical tensions between the US and China. (Fernández-Stark et al., 2022).

The last 5 countries -Turkey, India, Indonesia, Cambodia, and Pakistan- have more modest shares in clothing exports than other countries, and growth rates in Turkey and India have fluctuated over the years. Bangladesh and Vietnam show the highest recent growth rates,

especially in 2022 respectively 27% and 13%, showing their rising importance within the global chain for the supply of clothing.

	VALUE	SHARE IN WORLD EXPORTS			ANNUAL PERCENTAGE CHANGE			
	YEARS	2005	2010	2022	2010-22	2020	2021	2022
IMPORTERS								
EU	215	37,4	37,6	35,5	4	-7	16	10
Extra-EU	111	19,4	21,2	18,4	3	-9	12	15
USA	116	28,7	22,1	19,2	3	-14	29	9
Japan	27	8,1	7,2	4,5	0	-12	1	2
UK	26	8,1	7,1	4,3	0	0	-12	12
Canada	14	8,7	2,2	2,3	4	-7	15	15
S. Korea	13	2,1	1,2	2,2	9	-12	17	15
China	11	1	0,7	1,8	13	6	30	-12
Australia	9	0,6	1,3	1,6	6	1	18	9
Switzerland	9	1,1	1,4	1,4	4	4	11	-3

Fig. 5. Top Ten Clothing Importing Countries (Adapted from World Trade Organization, 2023).

While the EU is the main importer with a stable share of around 35.5% of global imports in 2022, its share has fallen significantly from 28.7% in 2005 down to 19.2% in 2022, the USA is the third largest exporter. Extra-EU countries with shares falling slightly from 21.2% in 2010 to 18.4% in 2022. Japan's and the United Kingdom's share is smaller but held steady. The shares of South Korea, China, and Australia are relatively much smaller; there is, however, an impressive increase in the import share in China, from about 0.7% in 2010 to 1.8% by 2022, which attests to the development of their consumer market in clothing. Another parallel observation is that the import share of Australia, from 2010 to 2022, grew by 0.3%, reflecting domestic consumption demand in clothing. The total import trends show a diversity in the global clothing trade with new emerging clothing markets.

2.2.1. Fashion Industry Market

The fashion market is expected to grow at a CAGR of 8.60% from 2023 to 2028, reaching a market value of \$999.50 billion, although this market will originate from a relatively low base in 2023 (10xHire, n.d.).

Company	Country	Marketing Cap In SB
Inditex	Spain	\$117.17
Nike	USA	\$92.89
LVMH	France	\$84.81
TJX	USA	\$49.13
Hennes & Mauritz	Sweden	\$44.47
Hermes	France	\$42.70
Rolex SA	Switzerland	\$37.00
Fast Retailing	Japan	\$36.33
Adidas	Germany	\$34.98
Chanel	France	\$32.67

Fig. 6. Top Global Companies by Market Cap (Adapted from Ariella, 2023).

The top ten companies in the fashion industry by market value are spread across different geographies and market segmentations. Inditex stood at the front because of its profitable fast-fashion business model, fuelled by the quick turnover and worldwide reach of its sub-brands. The market value was \$117.17 billion. Nike features an innovative yet robust market position in sportswear with \$92.89 billion. Among the other leaders are Hennes & Mauritz (\$44.47 billion), a massive fast-fashion retailer, and TJX (\$49.13 billion), a retailer, mainly for its off-price retail model.

LVMH with a \$84.81 billion and Hermès with a \$42.70 billion market cap took the lead by earning off vast profit margins and worldwide demand for high-end products. Overall, these companies highly go under the categories of the luxury and fast-fashion and sportswear industries; therefore, it is easy to observe their multiple strategies as well as different influence in the global market.

2.2.2. Fashion Industry Trends

Key trends in the fashion industry involve a strong push towards sustainability and ethical fashion; consumers are pushing brands to use eco-friendly materials and apply ethical practices. Secondly, innovations such as AR powering virtual try-ons and AI powering personalization become mainstream. AI also powers a growing amount of personalization and virtual try-on experiences in the fashion industry. Virtual dressing rooms use AI to immerse customers into trying on digital garments, assisted by a human image consultant. These applications constitute a strong use of AI through realistic simulations for customers, complemented by personalized advice (Manfredi et al., 2023). Several secondary and resale markets are finding leading positions, especially among young and ecologically conscious consumers. Besides that, customization and personalization continue to rise such as brands use AI for personalized products and services. The increasing consumer demand for sustainable and ethical products is a key driver of the fashion industry with emerging technologies such as AI, AR/VR, and blockchain will continue to reshape the future of the fashion industry with even more transparency and a superior customer experience. Virtual try-ons, smart clothing markets, and more have been touted as seeing phenomenal growth in the next few years. Fashion retail is highly influenced by e-commerce and omnichannel which provide a more effective shopping experience, better consumer interaction with the brand and higher performance in marketing because of both physical stores and online sales channels (Manfredi et al., 2023). E-commerce and omnichannel retail gain significant importance when brands look at seamlessly integrating digital and physical touchpoints.

2.3. Integration of Circular Economy Across the Global Value Chains

The gradual exhaustion of natural resources has brought about the quest for different models that consider ecological integrity protection to take the place of a linear economic model. Thanks to transitioning into a circular economy, it creates an alternative to environmental degradation and waste caused by the linear economy practices.

The economic model of companies that integrate recycling processes into these Global Value Chains is more sustainable. Besides, the shift to greener supply chains under global value chains effectively helps mitigate the adverse environmental consequences of businesses. The circularity of Global Value Chains not only increases the competitiveness of businesses but also facilitates compliance with international standards.

When the importance of integrating circular economy practices into global value chains is investigated, it is seen that GVCs, where products are produced, distributed, and consumed globally, consist of complex networks. Also, environmental concerns have started to increase over the trade links between countries; therefore, industries are compelled to drift towards sustainability.

The efficient adoption of Circular Economy practices requires cooperation by penetrating all stages of the global value chain and stakeholders also play an important role in this transition. An example of these roles is that suppliers provide resources such as materials suitable for circularity in production processes. For instance, many chances for sustainability have been provided by the producers by keeping the use of recyclable material in mind while designing. CE's cooperation in this global chain enables the transformation of more efficient GVCs. Circularity regarding the transparency of materials and products in GVCs increases the traceability of this process.

When integrating Circular Economy practices into Global Value Chains, transparency and traceability of materials and products are important. Firms should track the production processes in other countries throughout their Global Value Chains due to the different sequences of the process. Blockchain and IoT technologies offer transparency and traceability in company activities, making it easier to track how material processes progress along Global Value Chains. Companies can also take part in the Circular Economy systematically at every stage of maintaining it.

The integration of the Circular Economy into the Global Value Chains requires the establishment of shared value between these concepts. The importance of this shared value is not evaluated only in terms of enhancing a company's profitability but also the understanding of global integrity, whereas companies reconsider how they create value in environmental and social impacts. The application of Circular Economy urges companies under the GVC to follow up on one shared value among all kinds of producers and stakeholders by developing recycling programs. Co-operation with local communities or practices of businesses within the scope of social responsibility activities can be given as examples. It also helps these companies strengthen their corporate image.

2.3.1. Global Transition to Sustainability

The global economy is inextricably linked with the consumption of natural resources. The circularity of GVCs reduces the ecological damage and improves economic resilience and social welfare. For the economic contribution, it gives outputs that enhance the competitiveness of many firms competing in the international marketplace. The Circular Economy strategies that increase resource efficiency and reduce waste production in the Global Value Chains, thus providing serious benefits in waste management, provide a global transition (Solomon et al., 2024). The emergence of Global Value Chains over time created pressure on the global production network of firms as well as on natural resources. The Circular Economy needs to find a solution to this pressure on the natural ecosystem through practices that extend the product life cycles.

Integration of Global Value Chains with Circular Economy practices reduce demand for raw materials; this minimizes the negative environmental impacts of the manufacturers and reduces production costs. Numerous big international companies support Circular Economy practice that focuses on enabling global transitions to sustainable ones within value chains (Pedersen & Clausen, 2019).

The integration of Circular Economy principles is critical to accelerating sustainability in Global Value Chains. One of the examples of this that can be seen in many different sectors is in the construction value chain. Embracing Circular Economy strategies provides a substantial contribution through processes such as material recovery, recycling, and upcycling (Huovila & Westerholm, 2022). Circular business models are crucial to the sustainability of Global Value Chains to spread this adaptation throughout the chain (Geissdoerfer et al., 2018).

It requires better utilization of resources for GVCs concerning environmental sustainability and, at the same time, encourages better technologies and increased cooperation between industries to achieve sustainable development goals (D. Zhang, 2023).

Hence, Circular Economy strategies should be embedded within GVCs for global sustainability with reduced climate change. Besides it plays a transformational role in the Circular Economy, contributing to reducing raw material dependencies and promoting resource efficiency. Integration into industrial systems also entails strategies that assist in shifting away from linear economic models to the circular model of resource recovery, reuse, and regeneration (Solomon et al., 2024).

The circularity practices of Global Value Chains create considerable positive impacts in effectively balancing resource consumption with waste reduction. At the same time, this integration contributes to value creation by increasing resilience against problems arising from the uncertainty of external factors and helping sustainable growth contribute towards global results through changes that are induced in the patterns of production and consumption to the ideal application of sustainability (Solomon et al., 2024). The global trends have shifted towards sustainable production and consumption within these factors. It further promotes resource efficiency by enterprises and governments through the facilitation offered to place circular economy practices on the international agenda.

2.3.2. Climate Change Mitigation

Application of the Circular Economy principles to Global Value Chains can contribute significantly to climate change mitigation. Such cooperation increases the efficient use of limited resources, thus reducing environmental footprints. Circularity embedded in global value chains, can greatly reduce climate change and enhance the efficiency of resources and it helps to reduce greenhouse gas emissions as well as reduce waste production (Obiuto et al., 2024).

Though the high contribution of circularity practices in reducing climate change is known, the extent they would be effective may vary. For instance, using recycled concrete in the building industry can reduce material footprint by up to 50%, yet the reduction potential for the climate footprint is limited and can be highly larger with wet processing for the water footprint (Mostert et al., 2021). This situation points to the trade-offs encountered when Circular Economy strategies are to be integrated into a system, for this reason, it is important to evaluate environmental trade-offs correctly.

Circular Economy principles as an auspicious strategy to mitigate climate change due to adoption across Global Value Chains and all these principles are in line with sustainable development goals and provide valuable contributions to reducing carbon emissions (Muljaningsih et al., 2023). It is seen that Circular Economy practices with Global Value Chains integrations are highly in demand since this integration makes it possible to use existing resources more effectively during the production processes. This will be directly related to the optimization of waste management; in other words, it will mean reduced carbon emissions.

2.3.3. Resource Efficiency

The major advantage of this approach is the reduced consumption of virgin resources. This dependence explains the nature of the global economy which is primarily dependent on the extraction and processing of finite natural resources. The GVCs will commit companies to using secondary or recycled and renewable materials in production. This method reduces the consumption of certain raw materials which are in depletion due to over-exploitation and overuse. Traditional material flows are being repurposed towards operational behaviours that are more compatible with the need to establish more sustainable and resilient supply chains.

The need for natural resources arises as a dependency because the complexity between CE and climate change requires more interdisciplinary research to address these knowledge gaps. At the same time to fully understand the effects of CE on GVCs. For instance, carbon recovery technologies, recycling of materials, and circular agriculture models are among this future research. Also, it is necessary to establish the interdependent relationships that exist among bioeconomy, climate and energy, and natural resources (Nika et al., 2022; Romero-Perdomo et al., 2022).

Circular Global Value Chains are associated with resource efficiency. This integration supports the environmental methods throughout the supply chain. Circular Supply Chain Management helps to assess the necessity of Circular Economy strategies in the supply chain steps (A. Zhang et al., 2021).

2.3.4. Product Design and Innovation

The Circular Economy suggests designs that would create less waste optimization of processes and innovation in business models. In traditional GVCs, waste is one of the most important results of pollution and environmental degradation; the new approach reduces waste generation at every step of production and distribution. Product design and innovation are a key route to the adoption of Global Value Chains into a Circular Economy, since they make conditions for transforming from linear into circular models possible with the inclusion of the principles of sustainability and resource efficiency at the very beginning (Solomon et al., 2024). Circular economy integration in GVCs enables a platform where businesses reduce the generation of waste at every step of production and distribution.

There would be less waste generation at each step of production and distribution with the integration of circular practices into GVC. Examples include the closed-loop systems whereby by-products get reintegrated into the cycle towards "zero waste" goals. It will protect the environment and be in tune with global efforts to address climate change and realize the Sustainable Development Goals

The long-term need to innovate materials in product design drives the integration for improved circularity within Global Value Chains. It puts partial emphasis on sustainable manufacturing and Circular Economy ideas, proposing a methodology by which the principles of sustainability and circularity can be integrated into the design of a product. A metrics-based framework allows designers to consider, at the early phase of the design process, the triple bottom line of economic, environmental, and social impacts of a product across its life cycle (Hapuwatte & Jawahir, 2021).

Product design and supply chain management decisions are interrelated and end-of-life thinking during the design of the product is needed, and an operational framework should be established to ensure a shift in strategy toward a Circular Economy (Burke et al., 2023). Circular practices are crucial at disconnecting economic growth from resource consumption and as such reducing costs by reviewing the life cycle of products for reusing, remanufacturing, and recycling.

Circular Economy encourages long-lasting design and material innovation so that products designed are durable, repairable, and upgradable. Innovation in sustainable and recyclable materials opens new perspectives toward possibilities of transformation that, at each stage of the production process, may reduce the environmental footprint of products. This is in respect of higher benefits offered by the products while reducing significantly the material flow in the GVCs. Eco-design incorporates concern for the environment at the very early stage in the development of a product. This involves selecting materials that, in further stages, will have a reduced potential impact on the environment; design processes with minimized potential harm to the environment in all life phases; energy consumption limitation; application of sustainable materials; and ease of disassembly, repair, or recyclability at end life.

Eco-design prioritizes the production of environmentally friendly products from the beginning. Whereas circularity prioritizes the repeated use of not only the product but also the material for a maximum period. As a result of this, in the long-range it will help in

minimizing the large amounts of energy, emission and waste. If producers adopt eco-design principles, they will inherently be more compatible with the workings of circular systems by design, in that products become more durable, repairable, and recyclable. Eco-design methods are integrated to create products with a cradle-to-grave perspective to facilitate reuse, recycling, and reduction of waste and some of the fundamental principles of the Circular Economy (Galanton, 2024; Khan Pathan et al., 2024). Eco-design is offered by circular economy provide another sustainable design solution. Products that are designed with the eco-design principles in Global Value Chains minimize the environmental impact throughout a product life cycle. This can be observed from the stage of production down to the end of life of such products, by contributing to the decrease in consumption of energy, waste, and emissions.

Interestingly, eco-design deals at the very early stage of product development at hence circularity deals with every step of the Global Value Chains from the extraction of the raw materials up to its end-of-life management (Galanton, 2024; Hapuwatte & Jawahir, 2021). The application of eco-design principles enables the development of products that can be repaired, upgraded, or recycled with ease, hence promoting circularity in the global value chain (Hapuwatte & Jawahir, 2021). Circular Economy principles apply in different phases of production and consumption from the raw material supply to end-of-life management. Therefore, it emphasizes the design of systems allowing resource recovery and reduced waste generation, hence exerting pressure on businesses and industries to adopt circular practices to ensure sustainability along value chains.

Eco-design and Circular Economy can impact the sustainability practices in the Global Value Chains stages. In this respect, the priority of eco-design is to integrate design principles in a product which will minimize the possible negative environmental impacts that a product may go through during its life (Hapuwatte & Jawahir, 2021). Eco-design is the act of integration of environmental considerations at the product design stage. Designers that consider the environmental consequences right from the beginning of product creation have products, that are much more sustainable throughout their life cycles and therefore those designs are more sustainable in terms of material use, energy efficiency, recycling or ease of use. Products designed with green design principles will best support circularity since they can easily be repaired, upgraded, or recycled.

2.3.5. Resilience and Risk Mitigation

One of the important dividends of the Circular Economy's applications to Global Value Chains is that it offers solutions which enhance resilience in risk environments. The most common risky situations faced by global chains are known as various interruptions in the supply chain, resource shortages and regulatory pressures.

Circular Economy principles applied to GVCs reduce the flexibility of chains and offer a strategy to reduce the risks. Meanwhile, a resource-efficient and circular economy maintaining the continuous use of materials makes GVCs more flexible and more responsive to changes through decreased dependence on primary raw materials. This contributes to increasing the resilience of supply chains (Singh, 2022; Solomon et al., 2024). Integration of Circular Economy principles into production operations helps reduce security risks in addition to help the durability of GVCs by supporting environmental sustainability (Obiuto et al., 2024). The pandemic period, the COVID-19 outbreak, can be shown as an example of these environments where many disruptions occur in global supply chains and risks and uncertainties are intense. These disruptions have revealed the weaknesses of global value chains and pointed to the necessity of change. The design of localized Circular Economy policy for sustainable international trade practices offers an effective method of building up the resilience of the Global Value Chains.

Companies' tendency towards recycled materials or sourcing their materials from various secondary sources reduces dependence on volatile situations in the raw material market. Countries' focus on resources in their local markets reduces foreign dependency and protects these companies from supply chain shocks in the international market. One major part of the literature on the Circular Economy concentrates on environmental sustainability in general; the association with strains in supply chains is just starting to make barely a niche of interest. Hence, a suggestion from the literature could be a synthesis between internal and external factors and supporting and hindering factors with a company perspective on the flexibility potential of circularity in supply chains (Constance Obiuto et al., 2024). However, several challenges must be overcome before these principles can be implemented effectively such as the need for technological, regulatory, and stakeholder cooperation is among these challenges (De Angelis et al., 2018; Solomon et al., 2024).

2.3.6. Economic Opportunities and Competitiveness

The Circular Economy strategies on Global Value Chains are creating numerous opportunities for the design of new revenue streams. Economic advantages such as cost reduction and competitiveness are among these opportunities. Resource recovery, reuse, and regeneration strategies can enable cost reduction and perhaps even revenue growth through new business models that decrease the consumption of resources and waste (Solomon et al., 2024). Adaptation of Circular Economy activities in Global Value Chains creates economic growth and new jobs. Companies that encourage circular practices-such as material recovery strategies-accelerate the transition into an innovative economic system, designing economic activities to create benefits for the environment and society. Companies that adopt such principles can establish stronger bonds with consumers who demand ethical and sustainable products.

Adoption of Circular Economy principles by GVCs not only offer a path to imitating cost management but also open new revenue models offering economic opportunity and competitiveness. The transformation toward a more Circular Economy presents challenges but also opens the door for innovation and strategic advantage. Companies orienting their strategy with circular practices in the supply chain will harvest the cost reduction of brand offering and loyalty from the customers, as envisioned by studies (Jain et al., 2018; Munro et al., 2023). The goals of Circular Global Value Chains include higher efficiency in cost management models and the creation of new revenue models. The Circular Economy helps a Global Value Chains reduce operational costs through higher efficiency in material and energy use, reduced waste generation by the companies and opens new models of revenue streams through the creation of markets for production and sales opportunities by secondary materials.

Closed-loop economic models enhance supply chain management towards the improvement of corporate contribution to sustainable production and consumption, moving from narrow approaches through efficiency towards wide-scale redesign, reuse, and transformation of products (Theeraworawit et al., 2022). The strategic adoption of Circular Economy strategies, however, would play a big role in improving the sustainability and long-term resilience of the firms, thus creating a competitive advantage from improved operations, cost savings, and market differentiation (Munro et al., 2023). The strategic frameworks developed for performance measurement in circular supply chain management

give key parameters that touch base on reducing material consumption and waste, thus providing competitive opportunity by performance (Jain et al., 2018). The Competitiveness of firms is increased by Circular Economy practices within GVCs through the alignment of customer demand for sustainability, regulatory compliance, and market position at best performance based on transparency on the origin of the resources and production processes.

2.4. Circularity of the Fashion Industry



Fig. 7. The Timeline of Circular Fashion Evolution within Global Value Chains (Author's Elaboration).

The above timeline explains the development stages of circular economy strategies on global value chains. The differences that lead to this adaptation are investigated and the important processes from the beginning of the 2000s to the present day are emphasized.

2.4.1. Early Stages and Awareness

The transition to circular fashion started in the early 2000s, driven by increased awareness the increased awareness of the negative impacts of the fashion industry on the environment and the social sphere and various studies have been conducted on the fashion industry, which has been under the spotlight. The focus of these studies is particularly on waste production, resource consumption and working conditions (Fletcher, 2012).

With the increasing awareness of environmental and social sustainability, energy and water consumption, environmental pollution, scarcity of natural resources, and greenhouse gas emissions, the environmental impacts created along the chain, from fabric cultivation and production to post-consumer goods reaching landfills, are huge, and such is the level of the environmental-resource challenges being faced by the sector. Therefore it is necessary that more circular applications need to be adopted in the fashion sector (Jacometti, 2019).

The evolution of Fashion GVCs has been shaped by the growing awareness of environmental and social impacts. For that matter, the circular fashion envisioned the pursuance of the closed-loop production system where there is minimal generation of waste and maximum material recycling, reuse, refurbishing, or reprocessing (Papamichael et al., 2024). The shift towards sustainability can be explained by the eco-friendly approach such as the organic material used for the garments (Sawant et al., 2024).

The Circular Economy concept has become increasingly widespread since many fashion consumers and activists were more aware of the damaging aspects of the industry. This has raised many brands' awareness, thus forcing them to adopt new methods such as the use of organic materials, reduction of water and energy consumption. The environmental footprints are reduced and working conditions are improved significantly although the circularity is not yet at the central focus.

Resource efficiency in the fashion sector optimizes welding cycles and recycling of materials, thereby enhancing the perspective of minimized resource use with reduced pollution. It increases the safe raw materials usage to avoid adverse impacts along the product life cycle. The main approaches to resource efficiency are the utilization of renewable and sustainable raw materials, minimal resource consumption, and waste minimization. The environmental footprint is directly related to the raw material selected for that product. A life-changing replacement is also needed for toxic chemicals used in various bleaching, sizing, and coloration processes with its bio-based alternative to minimize environmental harm (Jacometti, 2019).

2.4.2. Emergence of Circular Economy Concepts

The period of 2010-2015 was an important turning point, for it saw the emergence of recognition of the concept of a circular economy. Some institutions popularized the circular economy model that the resources must be kept in use as long as possible, and waste is minimized. The period witnessed the fashion industry commence taking up of circularity

through the integration of its potential enablers such as design for longevity, recycling, and reuse of materials. The circular economy points to various possible ways to reduce the problems of sustainability at each stage of the life cycle of the fashion product beyond what is covered under traditional waste management.

In the Circular Economy model, the design of products needs to safely return them to the environment or otherwise be made for reuse or recycling, even though pure biological cycles might not be the best disposing solution for garments of synthetic material. For such garments, an appropriate alternative would be a longer life for the product and an improvement in recycling for circular pathways (Dissanayake & Weerasinghe, 2022).

The most important aim of circular fashion would be to extend the consumption cycle of materials and, by doing so, minimize the volume of waste produced. The use of sustainable raw materials and such strategies to reintroduce items into the production cycle after their lifespan are key elements in this approach. Recycling and reusing specific raw materials as part of circularity aims to minimize or perhaps completely eradicate waste, which is the foundation of sustainable fashion (Jacometti, 2019).

H&M produced a garment collection project was one of the first concrete instances of circular fashion in 2013. For instance, this project allowed customers to return used products to the firm. And H&M transformed waste into new products. A circular production model could be pursued by focusing more on the development of recycling technologies. H&M stated in *Conscious Actions Sustainability Report, 2013* that 92% of waste in warehouses was recycled in 2012.

2.4.3. Integration into Global Value Chains

From 2016 to 2020, the integration of circular practices into global value chains became more pronounced. Fashion brands started to embed circularity into every stage of their operations, from design and material sourcing to manufacturing and end-of-life management. This was meant to be a closed-loop system whereby products and materials were continuously cycled back by applying circular strategies. Collaborations between fashion and technology companies have increased to develop solutions to support circularity within the global value chain during the same period. Besides, technologies such as Virtual Reality (VR) and blockchain are emerging as more innovative enablers for raising sustainability awareness and verifying the environmental quality of fashion products (Guo et al., 2023; Spadoni et al., 2024).

Nike's *Move to Zero Climate Change Initiative, 2019* was a notable example of circular integration in the fashion industry. Nike was committed to a production with less waste and lower carbon, zero waste future in response to climate change. "Move to Zero" forms part of Nike's holistic strategy, including technological innovation, supply chain transformation, and consumer engagement by decreasing the environmental footprint through innovative recycling technologies and sustainable practices.

Furthermore, regulatory bodies like the began to introduce policies that encouraged circular economy principles marking a significant policy shift, influencing how companies structured their global supply chains to align with circular principles. This is the period when there was increased collaboration between fashion companies and technology providers on creating solutions that support circularity right through the Global Value chains.

2.4.4. Mainstreaming Circular Fashion

The circular fashion a central strategy for many leading brands and retailers from 2021 to the present in this period and circular fashion a central strategy for many leading brands and retailers from 2021 to the present. The COVID-19 pandemic stimulated the need for sustainability with the awareness of consumers and their demand for responsible fashion. The transformative potential of digital technologies in fostering principles of the circular economy, essential in IoT, blockchain, and AI to act aimed at resource efficiency increases for achieving sustainable economic growth in GVCs. (Williams et al., 2024). Digital technologies, such as blockchain, AI, and IoT, have greatly supported global value chains with much-needed transparency and traceability for the successful implementation of circular fashion principles. Precisely in this regard, the emergent technologies embrace blockchain, Artificial Intelligence, and the Internet of Things.

The improvements in digital technologies are likely to have a very serious impact on the evolution of Global Value Chains for circular fashion (Zhou & Zhao, 2024). These technologies could trace, recycle, and reuse apparel products for stronger circular economy practices within the fashion industry. The key developments are smart recycling bins, blockchain transparency introduced, and AI optimization in recycling operations for sustainable fashion.

Mainstream fashion moved to circularity, led by brands like Patagonia and Eileen Fisher and new business models, like cloth rentals, resale platforms, and clothing as a service,

have further nailed the idea of circularity in this industry (Business of Fashion & McKinsey & Company, 2021). These companies are at the forefront of applying circular principles in tackling the menace through incorporating recycled materials into their design for longevity and introducing take-back programs. Such models deviate from the traditional models of ownership and consumption patterns and emphasize reuse and resource efficiency. By integrating the circularity principle at the operational and business model levels, these brands and platforms demonstrate to the industry the possibility of combining financial success with environmental accountability.

The European Commission proposed an EU Textiles Strategy considering the feedback received from industry and other stakeholders due to the complexity of the textile GVCs. The strategy focus on such aspects as tackling fast fashion and promoting new business models, expanding the EU market for sustainable and circular textiles, including the textile reuse market, and enhancing industrial competitiveness and innovation in the sector (European Commission, 2020). The approach also ensures competitiveness and innovation, placing the EU at the frontier in approaches toward sustainable textiles and thereby representing an integrated plan on the road to sustainability and circularity of textiles. A core focus of the strategy is on the negative impact of fast fashion known for its harm to the environment. They instead propose the creation of circular business models: leasing of clothes, platforms for second-hand resale, and repair services. This is an EU plan designed to help accelerate the pace of circular economy practices with the view of extending product life and consequently reducing waste generation.

The developments reflect the urgent need to make the fashion industry more sustainable in the Circular Fashion Global Value Chains. Major brands announced ambitious commitments to zero waste and carbon neutrality, marking a dramatic shift from one-off initiatives into full-scale integration across the industry. This development responds not only to consumer demand but is also a more radical rethink of how the industry works within a resource-constrained world. From creating awareness to mainstream adoption, the journey of circular fashion develops a clear perspective on ongoing industry commitment toward resource and waste reduction and environmental responsibility for a more sustainable and circular fashion future.

3. Circular Fashion GVCs: Integrating Stages and Post-Consumer Activities

3.1. Circular Stages of Fashion Global Value Chains

The applications of Circular Economy principles to the stages of the fashion Global Value Chains are starting with the design stage. The circular integration in the design stage of the fashion value chain that extends the product life cycle and prioritizes product durability will be examined. Circularity encourages the restructuring of practices on both materials and production processes. Besides it helps to achieve results and prioritize efficiency in resource use through this integration. In distribution, this takes the form of optimized logistics and environmentally friendly packaging to reduce carbon emissions related to transporting fashion products.

The emphasis of the consumption stage of fashion Global Value Chains lies in promoting a conscious and ethical approach toward consumer behaviour. This is a very critical stage in increasing demand for circular products or encouraging practices such as garment repair and reuse, also discussed in more detail in the post-use stage. Finally, value recovery looks at recovering valuable materials from post-consumer garments. The fashion industry can become more resilient to risks by implementing circularity in global value chain stages.

3.1.1. Design Phase

The design stage, as the first stage of the fashion Global Value Chains, is the starting point where circularity principles are embedded in a product. Critical decisions are made to change the entire life cycle of a garment, from material selection to end-of-life, during this stage. Sustainability at the design stage allows for focus on durability, repair, and reuse, therefore reducing discards, extending the life of a product or garment into continued use, or redistribution within the circular economy.

Circularity in design processes has a vital place for reaching a more sustainable fashion industry. Designers can contribute much to a more circular fashion system by embedding in design principles such as durability, which guarantees a long life for the product; reparability, making maintenance and refurbishment efficient; and durable aesthetics that are immune from the effects of fast fashion. This strategy relies on slowing down the rate of disposals which will place greater value on consumers' clothes for a longer period (Denizel & Schumm, 2024).

The lifecycle thinking design technique invites designers to consider each stage of the life cycle that relates to the garment in question. In the selection of materials, particular interest should be taken in recyclable or biodegradable materials, or materials coming from sustainable Fibers. Embedding sustainability at all design stages allows designers to highly reduce the ecological impact of fashion products, creating a Circular Economy based on the reuse and recycling of material rather than on removing it after one-time usage (Niinimäki, 2013).

The integration of sustainable materials, along with the design for durability, is thus considered an integral component of the Global Value Chains in the fashion industry, particularly at the design stage. These practices finding solutions for environmental problems and supply for sustainable products (Guo et al., 2023; Ma et al., 2024). It is noteworthy that the adoption of eco-friendly materials constitutes a prevalent business strategy; however, it can affect both the financial costs and footprint of the fashion items (Guo et al., 2023). Circularity can be achieved among fashion firms through the incorporation of sustainable materials. However, it also tends to be that some increased costs come with the eco-benefits. This hence suggests that such firms might face certain difficulties in striking a balance between economic feasibility and environmental sensitivity. For instance, the fashion designed for longevity can surely lead to a substantial decrease in the overall generated waste and carbon footprint of fashion brands, which, of course, is pretty much synonymous with less frequent replacement of products (Ma et al., 2024). In this way, the commitment of a brand towards environmental sustainability will rise while reducing costs in the long run.

To conclude, two key initiatives of the fashion Global Value Chains perspective for circular design are eco-friendly materials and considering durability at the design stage. The circular design process reduces the ecological damage of fashion products while responding to consumers' increasing interest in sustainability.

3.1.2. Production Phase

The fashion and textile industry, with its complex supply chain and the use of not only natural resources but also toxic chemicals, requires the production of Circular Economy solutions specific to this industry (Denizel & Schumm, 2024). Circular production in fashion global value chains helps to transform an approach toward better resource efficiency and ethical practices. The inclusion of sustainable sourcing of materials,

reduction of waste, and closed-loop recycling in circular production implies reducing environmental impact and simultaneously aims at social responsibility. This shift must be joined by ethical working conditions and thus by fair labor in the supply chain. The fashion industry must be in harmony with economic development, environmental protection and social justice.

The efficient use of resources and ethical production together are integral in the circular economy of fashion Global Value Chains at the stage of production. The Circular Economy framework thrives on the power of reduced waste and extends the life cycle of any resource through reusing, recycling, or remanufacturing (Solomon et al., 2024). Therefore, it is crucial in the fashion industry, as the sector has a serious environmental footprint, and fast fashion increases resource consumption along with waste (Brydges, 2021).

Although the concept of Circular Economy is gaining momentum in a lot of industries, some challenges are witnessed in the fashion industry. The reason is, a transition to occur from the linear model to the circular model requires integration of the circular strategies along the full supply chain, not only at the waste stage (Brydges, 2021a). Ethical production in the Circular Economy ensures that attention is given to transparency, fair remuneration, and safe conditions of work, while materials are responsibly sourced with innovative strategies in place for the recycling and reuse of waste (Pal & Gander, 2018). This method as part of the Circular Economy, is built on the concept of transparency throughout the supply chain, while inculcating fair remuneration for labourers and safe working conditions, to implement social justice within the fashion industries. It is seen that many companies like this apply sourcing methods that will increase biodiversity. For instance, organic or recyclable sourcing can help make this situation possible. A minimal-waste approach with different strategies of innovation, one such strategy is closed-loop recycling, whereby new products are constantly remade with raw materials.

3.1.3. Distribution Phase

Traditionally, fashion Global Value Chains worked linearly from the sourcing of raw materials right through to manufacturing and distribution to consumption and final disposal. Regarding the growth in environmental problems and urgent appeals for sustainability, fashion GVCs are gradually moving to a more circular distribution model. The latter relates to circular distributions in fashion GVCs, which emphasize sustainability through ongoing usage of product-material-resource for as long as possible. This is a

digression from the conventional linear model. The circular applications help to maximize many environmental and economic performances such as increased profitability and efficiency in resource use (Amico et al., 2024). A closed-loop production system offers various circular strategies, product recycling, upcycling, reutilization, or even product redesign. In addition to that the product life cycle can be extended in the maximum time. Therefore, more circular distribution reduces costs for fashion companies and minimizes waste.

This would meet not only the increasing consumer demands but also a growing increase in more severe regulatory requirements concerning environmentally responsible corporate behaviour. Thanks to these applications, a more durable and sustainable future is aimed in the fashion industry. The distribution stage is another critical phase of GVCs in the fashion sector, when merchandise realized from the factory must be delivered to the final customer. This stage will, therefore, cover logistics and marketing channels and supply chain relationships management (Schlegelmilch, 2022). However, several issues regarding coordination across the global value chain in supply chains and the adoption of Industry 4.0 technologies hinder the application of GVCs to fashion (Karmaker et al., 2023).

The context of fashion GVCs, circular distribution is a business strategy that promises an improvement in the degree of sustainability according to two key axes: reduction of waste and extension of product lifecycles. The adoption of Circular Economy practices within GVCs also tends to exert positive impacts on the management of corporate performance and environmental resources (Alamelu et al., 2023; Amico et al., 2024).

3.1.4. Consumption Phase

The goals of circular consumption concept in the fashion Global Value Chains are extending the life of fashion items, thereby allowing materials to be continuously used via sharing, upcycling, repairing, renting, and recycling. Promoting circular consumption in fashion GVCs requires committed consumer education and activation. It is about raising awareness of the environmental and social adversities of fast fashion while promoting more sustainable behaviours: choosing high-quality, durable products; joining clothing rental schemes; or opting for pre-owned fashion items. It is possible to increase the demand of consumers for sustainable products and this situation ensures the strengthening of circular fashion applications in the fashion sector thanks to education that are raising awareness among consumers.

New business models including resale platforms, garment rental services, and garment take-back initiatives have been recently emerging in fashion companies as a means of extending garment circulation. Supply-chain collaboration between the manufacturer and the retailer also serves to create consumer transparency and trust in sustainable practices. This will completely drive circular consumption, increase consumer education in the fashion industry, and further move into a sustainable future. The circular consumption model represents a real opportunity for the fashion business to not only reconsider its relationship with consumers and the planet but also shift toward a more ethical global value chain. Even though the potential benefit of circular consumption is acknowledged widely, serious challenges also lie in actual practice. In practice it requires methods that significantly change the business model structure, such as various improvements in the supply chain and consumption patterns (Kaur, 2023). Besides, transition to circular consumption requires substantial business model changes, such as long-life models, sharing, or reuse. Of particular importance is changing consumer behavior to develop a mindset that prefers sustainable consumption over fast fashion and disposability, which necessarily involves sound education and incentive programs.

The underpinning of supply-driven innovations along with changes in consumer behavior lies with the consumption phase in fashion GVCs (Taplin, 2014). The latter have been designed to meet the new consumer demand for more ethical and environmentally friendly alternatives. Greater ecological awareness on the part of consumers has pushed the industry to take seriously the concept of sustainability and to conduct further supply-driven innovations.

3.1.5. Post-Consumer and Value Recovery Phases

The post-consumer stage of the garment represents a point in the Circular Economy for GVCs of the fashion industry where the dependency is shifted from disposal and discarding towards techniques which emphasize the repurposing of material and extending the life of a garment. Interest therefore shifts to developing mechanisms for the proper processing of used garments at their end of life, such as recycling, upcycling, and refurbishment. The return of valuable materials to supply chains be done through garment take-back and resale programs and help to diminish the overall waste effectively. This pathway contributes to less environmental harm and a more Circular Economy in that textiles become circulated back into continuous productive use in support of a more sustainable fashion industry. In

this case, post-consumer textile recycling can reduce the environmental impact of the fashion industry, but to be even more efficient, it will need advanced recycling technologies and infrastructure (Sandin & Peters, 2018).

Circular post-use practices of fashion supply chains involving the collection and recycling of garments are capable of waste reduction. Although interest in sustainability practices is emerging, a significant gap still exists between consumer participation in post-use programs, which is integral in the development of a circular fashion economy (Wu et al., 2020). Closed-loop recycling has great potential to enable the fashion industry to recover some useful materials and reduce the requirement to produce virgin fibers. Consumer awareness and participation in post-use collection schemes are key to any form of circular strategy (Hillman et al., 2015).

In the fashion industry, the most prevalent circular business models are the ones related to garment take-back schemes and resale initiatives during the post-use phase of products. While those business models provide economic value with reduced environmental impacts, at the same time, they require increased investment in consumer engagement and education to increase the efficiency of such circular practices (Bocken et al., 2016).

Value recovery, in the context of GVCs for fashion, refers to recovering and reusing materials and energy from end-of-life garments in the most resource-efficient manner with minimum environmental impact. In this phase, material recovery and energy recovery are both focused on recovering materials of value in the form of fibers, fabrics, and dyes from the overall waste for further reuse or recycling; non-recyclable textiles are transformed into energy through incineration, among other methods.

Effective value recovery not only decreases the demand for virgin raw materials but also reduces the environmental burden of fashion production. The fashion industry should assess the Circular Economy practices through advanced recovery technologies and cooperation networks between supply chains to contribute to sustainable development. In that respect, waste becomes resources, adding value to circular and resilient fashion. Energy produced with non-recyclable textiles may offset the energy requirements for virgin textile production in fashion GVCs, therefore contributing to an overall reduction in carbon emissions and moving closer to a more circular economy (Zamani et al., 2018).

Energy recovery in the fashion industry entails the conversion of used textile waste into useful energy through incineration. This has emerged as a controversial method since it

involves carbon emission, although effective in the management of non-recyclable textiles, especially when complemented by advanced technologies reducing the emission of gases and other particles into the atmosphere (Woolridge et al., 2006).

Material recovery in fashion GVCs will involve not only recycling fibers but also recovering dyes and chemicals used during textile processing. The efficient recovery system could greatly reduce the environmental and economic costs of new material production, thereby enhancing the sustainability of fashion supply chains (Zamani et al., 2017). This helps the fashion industry to reduce the waste landfill and decrease the need for raw materials, in return, sustainability and efficiency will be enhanced regarding supply chains.

3.2.Existing Post-Consumer Activities in Circular Fashion GVCs

Circular fashion emphasizes on the post-consumer activities to reduce waste and extend the life cycle of garments through sustainable practices. It creates solutions to retain the value back from the products after their use. From cultivation and fabric manufacturing to the disposal of post-consumer products in landfills, a significant ecological footprint is created. In addition, while environmental and social sustainability, energy and water consumption, pollution, and other increasing problems are struggling with major challenges, adopting a more sustainable behavior is very important for the development of this sector (Shirvanimoghaddam et al., 2020).

The practices encountered when disposing of clothes are disposal for reuse, disposal for recycling and disposal for incineration. Practices aimed at reuse consist of donating, taking back, selling or exchanging clothes. Disposal practices for recycling include throwing clothes in recycling bins. Disposal for incineration involves throwing waste together with traditional garbage (Soyer & Dittrich, 2021). Retailers such as Zara and H&M are known for their fashion-focused business models that attract media attention and attract young female customers to stores frequently, constantly renewing their product ranges (Barnes & Lea-Greenwood, 2006).

Consumers who incorporate sustainable purchasing into their lives choose environmentally friendly brands or adopt clothes made with plant-based materials and recycled materials. Following the principles of circularity, these consumers reduce fashion consumption by purchasing fewer but higher quality products. This purchasing behavior, which involves

rethinking what to buy, can also increase consumer tendency towards used clothes. Sustainable usage is possible with the proper storage, maintenance, repair and renewal of clothes, when necessary, while sustainable disposal includes behaviors such as reuse, repurposing or recycling (Soyer & Dittrich, 2021). Many brands have started to look for alternatives to recycle their products and take back used products with the increasing environmental awareness in the fashion industry. Consumers are paying attention to dispose of their used clothes and reduce their fashion consumption. Therefore, they are supporting new circular fashion strategies with their purchasing, use, and disposal choices. Reduced attachment eases the pain of parting with a product, pushing consumers to discard rather than keep products that they feel less attached to when they hardly use them. Thus, they may be more likely to resell a fashion product (Huang & Wong, 2024).

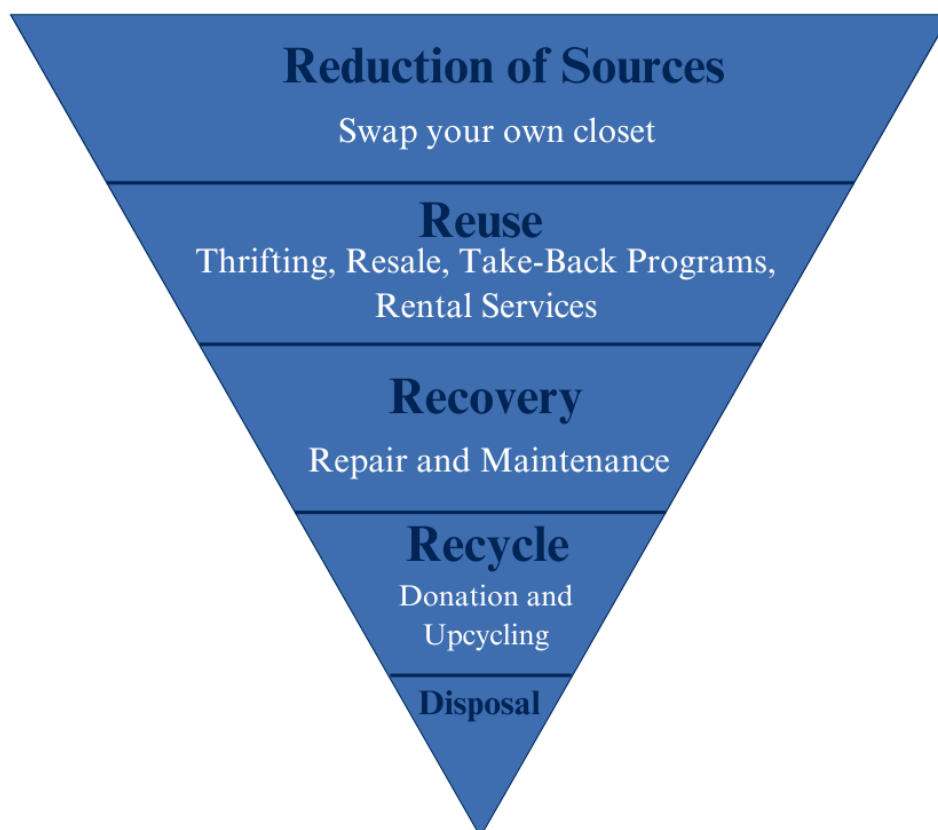


Fig. 8. A Diagram Demonstrates the Hierarchy of Post-Consumer Fashion and Textile Waste (Adapted from Kim et al., 2021).

The figure above illustrates a hierarchical method of dealing with post-consumer fashion and textile wastes in an inverted pyramid format. The first step toward a sustainable fashion

cycle would involve a resource reduction strategy aimed at reducing the build-up of such clothes items. To obtain a more sustainable lifestyle, the consumer should shop and replace the items in their wardrobes rather than making new purchases (Kim et al., 2021). “Source Reduction” sits at the top of the pyramid, drawing attention to minimizing fashion consumption by utilizing our existing wardrobe. Following this is Reuse, which prolongs the life cycle of textiles through resale of garments, buying second-hand, take-back programs, and rental services.

Recovery is concerned with restoring textiles to extend their lives. Recycling follows this in the hierarchy, promoting donations, and upcycling to avoid waste generation. Disposal is staged at the bottom of the pyramid as the least favorable alternative that represents a place where textiles are thrown away, usually landfilled. The hierarchy emphasizes the priority on waste prevention, reuse, and recycling to minimize environmental impacts, hence, with disposal as the last resort. After clarifying this scheme, we will investigate the widely used post-consumer activities in the fashion industry.

3.2.1. Thrifting, Resale, Rental Services

The resale fashion market received a lot of attention since changing consumer attitudes and pressure for sustainability within the fashion industry. The market is varied, ranging from thrift shops, through different digital marketplaces, to virtual social communities reflecting a different approach to servitization in this sector (Cardoso & Spagnoli, 2023) The online fashion resale practice is becoming part of consumers' daily consumption practices (S. Liu et al., 2024). The resale market also includes luxury items like jewelry and new AI systems have been developed that autonomously assess resale prices, adopting methods that combine visual information for jewelry (Yamaura et al., 2019).

However, they reveal that the motives of second-hand shoppers are not only economic since the channels provide sources of direct interest for the shoppers. The economic and recreational motivations are intertwined. About the second aspect, access to second-hand products is obtained from various channels which meet a host of motivations in a way that traditional retail channels cannot (Guiot & Roux, 2010). Another emerging solution within the circular fashion is the renting/leasing of clothes for temporary use (Musova et al., 2021)

Apparel is a semi-durable good that might be disposed of after a short span of usage. Therefore, due to the emergence of new fashion, fitting issues, or wear and tear it is expected that these goods are being disposed of. Consumers usually dispose of fashion

items by donating to charity, using recycling facilities, and giving to family and friends to make room for new clothing (Joung, 2013).

The sharing economy offers convenient use of a particular product, for a certain purpose instead of buying one type of product for consumers. Besides, it also holds economic benefits such as lower capital investments (Puschmann & Alt, 2016). Fashion sharing is offered mainly by the Business-to-customer business model, where professional firms offer a wide range of clothes that these firms only own for sharing and renting out (Laudien et al., 2023).

The popularity of the sharing economy is increasing and many different sharing platforms can be found all over the world. For instance, Rent the Runway and Le Tote, ByRotation in the UK, Air Closet in Japan, Style Theory in Singapore. As consumers become more environmentally rational nowadays, the fashion industry is using sharing services to satisfy the needs of consumers (N. Liu et al., 2023).

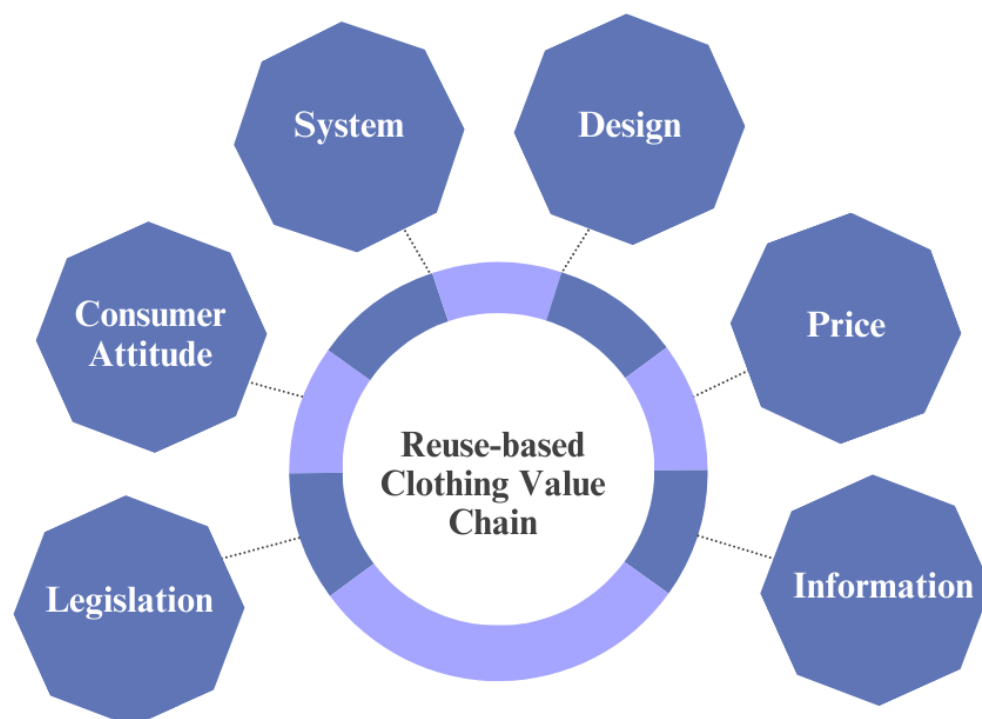


Figure. 9. Main Factors Affecting the Reuse-based Clothing Value Chain (Adapted from Paras et al., 2018).

The figure above explains the six main factors that influence the reuse of clothing. The main strategy in circular design principles, designing products that are easily taken apart, repaired, and reused (Melo et al., 2018). Interestingly, design for reuse goes beyond the product itself and Computational systems are embedded in fashion life cycle management for tracking, recycling, and reusing the apparel efficiently (Zhou & Zhao, 2024). The markets for second-hand clothes increase the supply of garments at lower prices than new products, therefore thrifting is attractive to budget-conscious consumers (Laitala & Klepp, 2018).

The legislation and consumer attitude contribute to the development based on reuse value creation. On the other hand, the political environment may influence the effectiveness of any reuse initiatives (Paras et al., 2017), and consumer attitudes act as the driving force in this model either as donors or buyers (Paras et al., 2018).

3.2.2. Take-Back Programs

Take-back programs at fashion companies significant over the past years as a post-consumer activity that works in concert with circular economic principles and addresses the concerns of sustainability within the industry. Such take-back programs would pick up the used garment from the consumers for proper recycling or reuse, hence potentially reducing textile waste and supporting more sustainable consumption (Dragomir & Dumitru, 2022; Trejo et al., 2024).

Collection programs for used garments have been inducted into the sustainability programs of fast-fashion brands. These programs strengthen brand awareness and image building positively, which proved that used garment collection schemes can provide a marketing tool for retailers to establish a green brand image and enhance their market competitiveness (Choi et al., 2015).

This approach explains how post-consumer activities support environmental and business objects. However, whether take-back programs can lead to the accomplishment of true circularity is very debated. Major fast fashion companies implement complicated strategies for their environmental impact such as educating customers on circularity and promoting habits of recycling or reuse. However, the actual exercise of circular models does vary amongst retailers (Dragomir & Dumitru, 2022). Moreover, studies in emerging markets like Brazil show disconnections between the willingness of consumers to change their

habits and the effective involvement of consumers in circular actions along the fashion chain (de Aguiar Hugo et al., 2023).

To conclude, take-back initiatives emerge as a promising post-consumer activity in the fashion industry for their potential environmental benefits and marketing advantages. Their success depends on effective implementation, active consumer participation, and integration with the greater circular economy strategies along a full value chain (Brydges, 2021).

“The North Face Renewed” take-back program allows consumers to return products to the brand's stores in exchange for a certain amount of credit. These products are subjected to various renewal and improvement procedures and resold in second-hand quality. The brand disposes of products that cannot be repaired by applying various circular economy strategies (Russell, 2022).

The North Face Renewed Take Back Program has a detailed process followed in restoring pre-owned apparel to its best state. After pre-sorting the non-renewable items are upcycled, donated, or recycled. Technicians then inspect and spot issues that need repair, followed by cleaning. Items are then restored to like-new condition by repair specialists and finished with the touches necessary to certify them, thereby making them ready to wear (The North Face Renewed, n.d.).

3.2.3. Repair and Maintenance

Apparel items whose product life is extended through repairs and makeovers are a more environmentally friendly purchase than newly manufactured products (McNeill, n.d.). Even though repairing is a crucial approach for increasing sustainable consumption it is a complicated process, as attachment, memories, and materiality may be aspects to affect users in deciding whether to repair or discard their garments (Maguire & Fahy, 2023).

Patagonia brand has launched its “Worn Wear” program to empower its customers to consume sustainable fashion. The program encourages the repair of second-hand clothing and decreases the amount of environmental destruction fashion discards leave behind. Despite the brand's high competitiveness, it is a good example of how circularity can be integrated into the fashion world by not only focusing on sales but also encouraging ethical fashion consumption (Bürklin, 2019).

Repair and maintenance activities play an important role in the circularity of fashion by extending garment life spans with major steps, and secondly, it reduces textile waste. These activities are part of the very core that establishes a closed-loop system within the fashion industry in such a way that it highly reduces the demand for virgin resources and avoids the obsolescence or disposal of clothes (Maguire & Fahy, 2023).

It is viewed as the indispensable repair and maintenance activity in the development of longer lifestyles for fashion goods and the economically circular process of the industry. Therefore, business becomes increasingly aware of such activities as core relevant in reducing environmental impact and fostering sustainable consumption practices (McLaren et al., 2016; Zhou & Zhao, 2024).

From the consumer point of view, their behaviors and perceptions are an important aspect because consumer decisions on the repair or maintenance of certain garment types are influential in the products' durability (McLaren et al., 2016; Nazlı, 2021). Interestingly, even while awareness of the need for sustainability is growing, significant barriers still stand towards wider-scale repair and maintenance behaviors. For instance, Sandez et al. 2023 note that within the context of electronic appliances, general levels of maintenance remain low, with limited reparability or reuse. On the other hand, it indicates that individuals are willing to repair things if the manufacturers can provide a way to do so generally. This contradiction shows that there is indeed room for improvement in the fashion industry if only brands can facilitate such repair and maintenance services. (Larsson, 2018; Spagnoli & Iannilli, 2023).

The fashion industry can incite repair, maintenance, and recovery of fashion products through different approaches: for instance, by implementing Product-Service Systems in retail settings that will increase consumer awareness (Spagnoli & Iannilli, 2023), through certification schemes to avoid greenwashing and empower consumers to act responsibly (Adamkiewicz et al., 2022).

3.2.4. Recycling, Upcycling, Donation

Old textiles and clothes can be recycled and hence avoid landfilling of such fashion commodities. For instance, textile products that are in good condition can be donated and resold to customers. However unsold items can be bought by secondary markets to meet industrial requirements (Kim et al., 2021).

Recycling in the fashion industry has turned out to be one of the foremost post-consumer activities which urges the need for sustainable practice with the whole new developing apprehension towards environmental concerns. Consumers have developed more eco-sensitivity, leading to the increased recycling of post-consumer textile waste with outstanding reuse and recycling potential (Domina & Koch, 1999).

Generally, textile waste recycling methods are classified into two main categories, mechanical and chemical recycling. Textile wastes going into mechanical recycling are subjected to physical treatment to separate them either into fibers or yarns. Mechanical recycling process applied to natural fibers such as cotton and wool and some synthetic Fibers. Techniques in the mechanical process include classification, shredding, and re-spinning of fibers into new yarns that can be rewoven or knitted into new fabrics (Damayanti et al., 2021). Although mechanical recycling is a frequently applied method, it is sometimes faced with various difficulties due to mixed fiber content or in maintaining fiber quality. Chemical recycling is when the textile wastes are broken down at a molecular level and these involve various procedures such as pyrolysis, enzymatic hydrolysis, hydrothermal treatment, and glycolysis (Baloyi et al., 2024; Damayanti et al., 2021). Biochemical recycling has proved to be quite an efficient alternative, more so in the case of natural fibers. Anaerobic digestion, fermentation, and composting are some of the current methods under exploration for managing textile waste. All these methods will go a long way in recycling textiles but also probably yield some valuable by-products. (Juanga-Labayen et al., 2022).

There are also chemical and biochemical recycling methods which treats the complex fiber mixtures to obtain recycled materials with a good quality. The final choice depends on the fiber composition, the desired end product, and the technology available. Advances in sorting technologies and the integration of IoT are further increasing the efficiency of these recycling processes (Baloyi et al., 2024; Damayanti et al., 2021). On the other hand, Textile recycling involves reprocessing waste from consumers or manufacturers to create new products that can be used again in the same or different industries. A more generous concept of textile recycling is being examined, including the recycling of non-textile materials and products into textile products such as polyethylene terephthalate (PET) bottles (Sandin & Peters, 2018).

Upcycling plays a crucial role in value-added products along with textile waste reduction and it helps the fashion industry to move toward a circular economy (Vadicherla et al., 2017). Upcycling in fashion can be seen as a sustainable solution contributing to the tremendous high levels of waste emanating from the fashion industry. It takes pre- and post-consumer textile waste into remanufactured fashion products for higher-value applications, diverting material from landfills (Han et al., 2017a; Sung et al., 2020). Besides that, this process minimizes waste apart from less consumption of energy, material resources, and chemicals usually used in traditional fashioning methods (Sung et al., 2020). While overcoming some hurdles can take some time, successful upcycling businesses created novel solutions like building efficient sorting systems and training the design teams in what constitutes "good" and "bad" damage (Dares, 2021).

Fashion upcycling is a promising direction for sustainable fashion production with potential environmental, economic, and social gains (Han et al., 2017b). While upcycling is offering quite a few environmental benefits, scaling up proves to be a challenge as well. Some of those are production scale, labor, material cleaning, and retail challenges like pricing, stigma, and narrative (Dares, 2021). The 'Conceptual Design for Upcycling Fashion' is among such models developed to guide designers in the development of successful upcycled fashion collections that will finally pave the way for this transition (Elias & Wu, 2023). This approach could influence efforts toward sustainability by fashion as consumer awareness increases and in conjunction with the number of businesses upcycling.

Garment donation is an outstanding post-consumer activity in the fashion business, as it effectively addresses problems related to textile waste brought about by fast fashion and rapid consumption habits (Bianchi & Birtwistle, 2012). Clothing donation is an effective post-consumer practice to reduce the negative effects of fashion pollution that adheres to the tenets of circular fashion, thus being a realistic solution in managing the waste of textiles (Papamichael et al., 2024).

Apparel that was higher quality and thus more expensive was primarily donated to charitable organizations. It is observed that poor-quality items were discarded when they were no longer wearable. Among the most preferred disposal methods chosen by used clothing owners were charity stores, hand-downs to family/friends, resell outlets such as eBay, and other second-hand shops, and swapping activities (Senthilkannan Muthu Editor, n.d.). That virtual networks of the sharing economy model in fashion may be one such

avenue to help contribute to more sustainable economic development since millions of pieces of clothing enter landfills daily, and sharing or renting the same items can facilitate the shift toward a greener economy (Ruiz-Navarro et al., n.d.)

Reuse of apparel can be made by selling the items online or giving them to friends or charities and it helps consumers to save more space in their closets. especially to the consumers who do not attach any importance to ownership, this practice ensures prolonging the usefulness of fashion items and cooperative consumption is always welfare-enhancing for the consumer. (Ruiz-Navarro et al., n.d.; Yuan & Shen, 2019).

Fast fashion production and consumption bear serious environmental impacts. Approximately 100 billion garments are produced annually in this fast-production fashion model. Fashion trends change with fair rapidity, with low-priced, poorly constructed clothes made from low-quality materials shortly replacing clothing (Ruiz-Navarro et al., n.d.). These reuses of apparel facilitate the creation of new business ideas and also thanks to social networks, this approach shifts the use of goods and services when needed, rather than owning them. The sharing economy as opposed to the ownership-based nature of the traditional market model, is predicated upon the “use and share” approach of goods and services among other things (Puschmann & Alt, 2016).

4. Case Study Analysis: The Jeans Redesign Project

4.1.Introduction to The Case Study

In the previous chapter, the existing post-consumer activities of circular fashion Global Value were explored. Continuing that discussion, the present chapter brings into light the case study of the post-consumer activities of the Ellen MacArthur Foundation's Jeans Redesign project. While the project covers the whole life cycle of jeans, from production to disposal, our interest here is in how it enables and enhances post-consumer processes: take-back programs, repair services, and recycling.

The Ellen MacArthur Foundation works toward creating a circular economy that is restorative by design, generates no waste or pollution, and circulates products and materials at their highest value, follows the extract value-added principle, and regenerates nature. The system should be to the benefit of business and people while that of the environment as well. The organization works across sectors

and showcases practical examples of the circular economy's principles in practice (What We Do | Ellen MacArthur Foundation, n.d.). The Foundation defines the circular economy as being, by its very nature, "restorative and regenerative" by keeping products, components, and materials in continuous high utility and value (Ashby et al., 2019).

The Ellen MacArthur Foundation has a vision for the fashion industry wherein clothes would be redesigned to be used more and longer, remade, and produced with safe, recycled, or renewable materials. For such circularity of fashion to become real, what is needed is industry and government collaboration, significant investment, innovation, transparency, and traceability (A Circular Economy Vision for Fashion and Textiles Industry, n.d.).

The initiative gathered industry leaders in February 2019 to co-design a vision for circular jeans, resulting in the development of the Jeans Redesign Guidelines with brands, manufacturers, recyclers, and academics. The guidelines offer a detailed explanation of how to design jeans with circularity in mind, from durability to material health, recyclability, and traceability. Over 70 organizations have since adopted them to create jeans that reflect the circular fashion model (Ellen MacArthur Foundation, n.d.-b).

4.2. Methodology

This case study on the Jeans Redesign Project of the Ellen MacArthur Foundation follows a qualitative research approach that utilize both thematic and comparative analyses to investigate how the referred project contributes toward circular fashion, with attention to post-consumer activities like recycling, repair, and reuse. Thematic analysis will be utilized in identifying key principles of circular fashion and key post-consumer activities in data gathered. It allows for a flexible detailed exploratory analysis of qualitative data taken from reports, industry documents, and academic research concerned with the Jeans Redesign Project. These methods are also appropriate for analyzing qualitative data where no complicated statistical methods are required.

Comparative analysis complements of brands' approaches to sustainability thereby highlighting effective strategies, challenges, and areas for improvement. Specific attention is paid to 14 brands currently participating in the Jeans Redesign Project, a diverse cross-section representative of the fashion industry, ranging from fast fashion to premium and sustainable labels, and taking into account countries of origin. Selected brands and retailers' commitment levels to circularity differ and it is especially appropriate for comparative

analysis. Also including industry leaders and firms with potential for growth in this analysis offers valuable insights into best practices. The unique strategies each brand brings to the table add to the goals of the initiative differently, while providing really valuable insights into what practical applications of the principles of circular fashion look like.

The methodology is exclusively based on secondary data provided by publicly available sources of participating brands such as sustainability reports, ESG impact reports, and website information. The Ellen MacArthur Foundation's reports to the extent of guidelines provided, progress updates, and insights from the participants are included as key data sources. Further, detailed knowledge of the respective practices and strategies surrounding post-consumer activities of textile recycling and garment repair will be acquired via a review of the sustainability and ESG reports published by the brands. These are informed by a literature review concerning circular fashion and global value chains through relevant academic literature and industry publications, providing the theoretical framing for this analysis.

A multi-sourced approach to such understanding deeply enriches the Redesign Jeans Project for circular fashion initiatives. This will involve synthesizing information emanating from multiple viewpoints to give strength in assessing how the project contributes to the implementation of sustainable practices within the denim industry. The thematic and comparative analysis together reinforce depth and rigor in findings will allow meaningful conclusions about the impact of participating brands on reinstating circular practices.

4.3.Objectives of The Jeans Redesign Project Case Study

This case study primarily analyzes how participating fashion brands and retailers of the Ellen MacArthur Foundation's Jeans Redesign Project contribute to the principles of circular fashion concerning post-consumer activities. Further support will be provided by a detailed analysis of the diverse initiatives undertaken to offer value to extended product longevity and durability, since both factors are relevant to waste reduction and fostering sustainable consumption patterns.

The study will also look at the recycling strategies of such brands that are effective in reclaiming materials from textiles, thereby reducing environmental impact. Also, this case study looks at how participating brands ensure the materials used in denim production are

safe for consumers and the environment by adopting strict material safety and sustainable input standards, how brands engage with customers such as how they communicate their sustainability efforts and encourage consumer participation in circular practices like repair, resale, and recycling. Since this study focuses on post-consumer activities, the findings will underline practical strategies to enhance product longevity and durability to encourage more sustainable consumption. Besides, the analysis of recycling programs and material safety will help in finding out how effectively this type of activity will be performed within the industry.

4.4.Key Players

The Jeans Redesign has evolved to a collaborative effort of more than 100 influential players throughout the entire clothing value chain from brands and retailers to garment producers, fabric mills, and vertically integrated units. Representatives come from over 25 countries across five continents, demonstrating worldwide dedication to circularity in the denim industry. (The Jeans Redesign Insights Report, n.d.; *The Jeans Redesign Participants*, n.d.) Levi's, GAP, HM and Chloé are collaborating with the manufacturers to implement circular fashion practices along the value chain of jeans as major brands and retailers. The existence of vertically integrated units supported easy integration of sustainability from raw materials sourcing up to product completion. Hence, this initiative is thereby executing a systems thinking approach where material safety, resource efficiency, and longevity of denim products are to be improved (The Jeans Redesign Insights From The First Two Years, n.d.; The Jeans Redesign Insights Report, n.d.)

4.5.Data Analysis

Thematic analysis was first informed by extensive familiarization with the data from reports, case studies, and sustainability statements provided by key brands participating in the Jeans Redesign Project. The preliminary exploration sought an overview of circular fashion initiatives, focusing on post-consumer activity such as reuse and recycling together with consumer interaction. It was done based on the sustainability reports regarding the management of the post-consumer phase of their products, engagement of consumers through education materials, and in-store campaigns. The first key theme that is material safety and sustainable inputs show the need for the use of recycled and renewable inputs

within the fashion industry. Sourcing materials from post-consumer waste reduces environmental impact and improves consumer safety. Sustainable inputs minimize resource use and reduce waste. The longevity and durability theme underlines strategies oriented towards prolonging the life of denim products. Recycling and closed-loop systems present initiatives focused on reusing old denim, such initiatives decrease the dependence on virgin materials and contribute to a more sustainable life cycle of denim products. Customer engagement and education themes demonstrate that customers need to be educated about such topics through campaigns or interactive platforms raising their awareness for responsible consumption. By doing so, the brands empower the consumer to make informed choices which will reinforce their loyalty and drive collective change in the industry. I conducted a comparative analysis together with a thematic analysis to establish how different brands implement these circular fashion principles and the various levels of commitment to post-consumer activities. This showed patterns in best practices and exposed specific areas of implementation gaps among participating brands. The dual methodology underlines those important jeans' lifecycle moments from sale to end-of-life management, which contribute directly to post-consumer activity.

4.5.1. Presentation of the Data

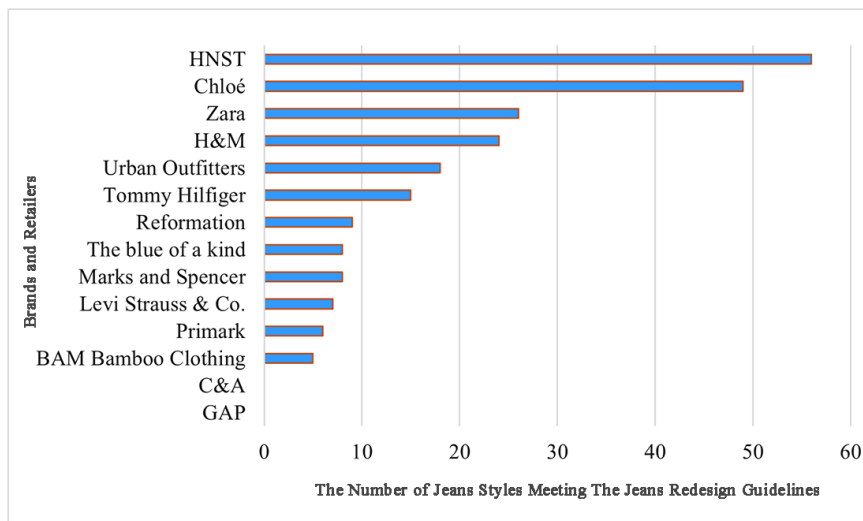


Figure 10. Jeans Styles Compliant with The Jeans Redesign Project (Author's elaboration based on data from The Jeans Redesign - Company Reports - List of Companies, n.d.).

The bar graph above illustrates the number of SKUs (Stock Keeping Unit) that meet The Jeans Redesign Guidelines across various fashion companies that participated in Jeans Redesign Project. First, among them all is the Belgian brand HNST with 56 SKUs, while the French firm Chloé falls closely with 49 SKUs, reflecting very strong compliance. H&M also performs well with 24 SKUs. Zara with 26 SKUs and H&M with 24 SKUs also show a solid performance. Brands such as Marks and Spencer, The Blue of a Kind and Tommy Hilfiger show moderate engagement with their SKUs number. In contrast, GAP and C&A don't have SKUs that meet the guidelines which reflects a significant lack of commitment to the circular principles of the project.

4.5.2. Material Safety and Sustainable Inputs

Material safety and sustainable inputs are key themes in developing circular fashion practices, with particular relevance to the Jeans Redesign Project. This theme emphasizes that fashion brands need to base their choice of materials on preference for recycled and renewable ones since these greatly reduce the consumption of virgin resources, hence reducing environmental impact. This approach not only protects consumer health but also increases the trust between brands and consumers. Besides, the integration of recycled materials from post-consumer waste is critical in extending the life cycle of textiles. Coupling material safety with sustainable inputs, brands heighten their environmental responsibility and make constructive contributions toward a fashion industry based on ecological integrity.

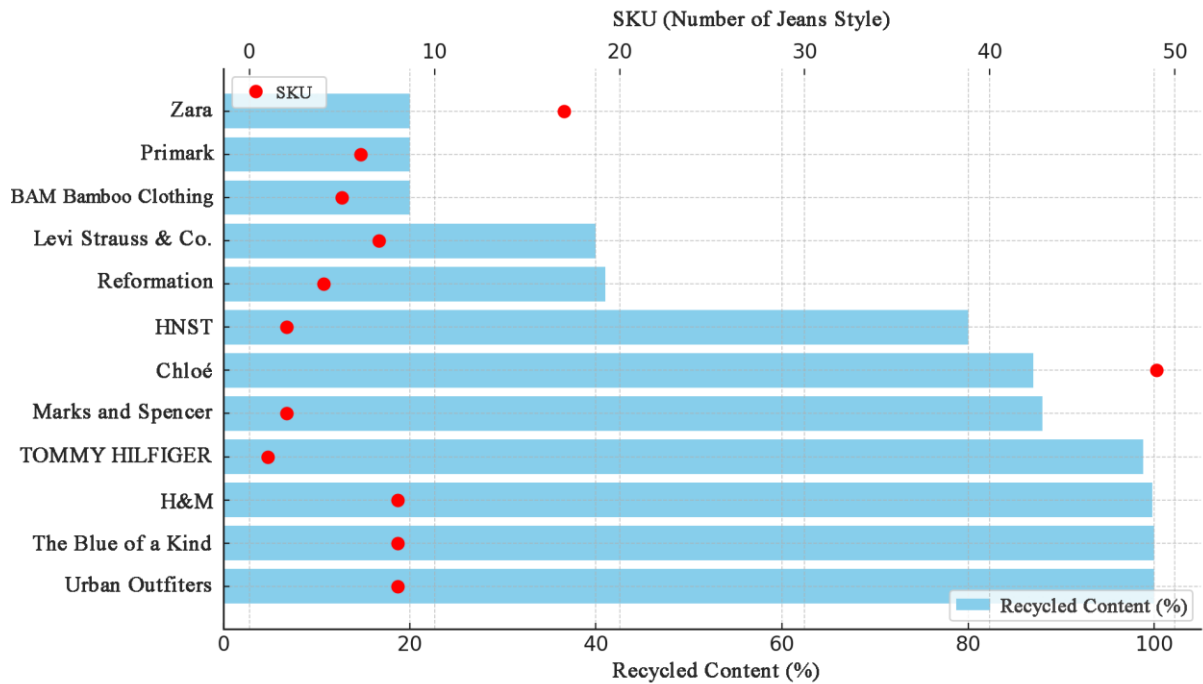


Figure 11. Comparison of Recycled Content Percentages by SKU Count Among Fashion Brands Participated in the Jeans Redesign Project (Author's elaboration based on data from The Jeans Redesign - Company Reports - List of Companies, n.d.).

The graph above demonstrates how brands have responded to the Jeans Redesign Project's requirement of recycled content and product offerings. Against the backdrop of the Jeans Redesign project by the Ellen MacArthur Foundation, which requires at least 5% recycled content by weight in the textile composition of every garment, several brands have overperformed the guidelines in various ways (Ellen MacArthur Foundation, n.d.-b). Urban Outfitters, and The Blue of a Kind significantly surpassed the threshold, with 100% of the reviewed products having recycled content. After that, Tommy Hilfiger, H&M are almost reach a 100% of recycled content for their SKUs offerings. Each of them has very limited SKUs on offer 1 to 8. Chloé meets the guideline with 87% Recycled Content over 49 SKUs. Their score indicates that they manage a good balance between high Recycled Content and wide-ranging product lines. Zara, Primark, and BAM Bamboo achieved the minimum threshold of 20% with product ranges between 5-17 SKUs. Reformation had a very high score above 41% on 4 SKUs, while Levi Strauss & Co. also scored high at 40% across 7 SKUs.

Marks and Spencer have also ensured material safety through sourcing strategies. They focus on man-made cellulosic fibers sourced from supply chains at low risk of deforestation

and with advanced manufacturing technologies. Their approach to cotton sourcing includes programs designed to benefit farmers while ensuring soil health critical for sustainable agricultural practices. Through factoring in only lower-impact materials, Marks and Spencer has started developing a standard of responsible sourcing of material that is not only beneficial to the ecosystem but also for the local communities. Such material produces less harm to the ecosystems or native species (Marks and Spencer Group plc, n.d.).

In 2021, Chloé came through with the B Corp certification as proof of using sustainable materials and promoting a positive social and environmental impact across all its operations (Chloé, n.d.). Levi Strauss & Co. develops a chemistry program called Screened Chemistry to avoid using hazardous chemicals. Significant suppliers of the company support the Zero Discharge of Hazardous Chemicals, the so-called ZDHC Roadmap to Zero. As a result of these activities, the company managed to achieve foundational and progressive certification levels for 65% and 35% of its suppliers correspondingly (Levi Strauss & Co., 2023). HNST adopts a contemporary approach with the Smart-Indigo dyeing technique which emits a much lower number of toxic elements than ordinary dyeing procedures (Impact – HNST Studio, n.d.).

H&M takes conscious steps in the right direction on material safety and chemical management matter. For instance, H&M reported in 2023 that foundational water quality targets were met by 93% of its facilities-almost a tripling from 74% the previous year. Another added incentive: 90% of chemicals used were verified by the ZDHC Gateway, meaning that enhanced management practices were in place (H&M Group, n.d.-b).

4.5.3. Longevity and Durability

The Jeans Redesign Project mandates a performance after at least 30 home washes to ensure that the quality of the jeans can be maintained, visible care instructions on the garment must be communicated to the consumer for appropriate maintenance of the product. (Ellen MacArthur Foundation, n.d.-a)

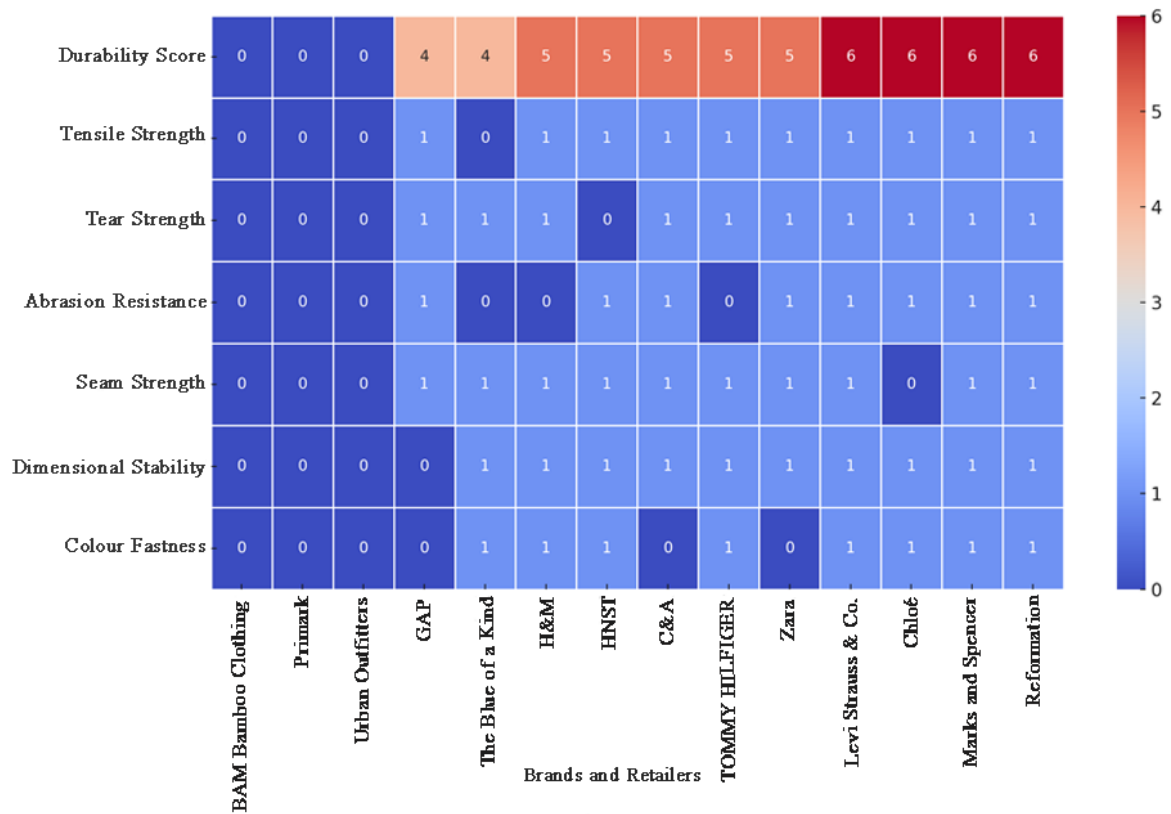


Figure 12. Durability Test Compliance of The Jeans Among Fashion Brands and Retailers in the Jeans Redesign Project (Author's elaboration based on data from The Jeans Redesign - Company Reports - List of Companies, n.d.).

The heat map above indicates the durability tests conducted on the fashion brands that participated in the Jeans Redesign Project based on their performances of the longevity of their product where 0 signifies failure (No) and 1 stand for a pass (Yes). Levi Strauss & Co., Marks Spencer, and Reformation came in top, with each performing all six necessary durability tests. This stringent accomplishment underlines that their denim is very appropriate to resist at least 30 home laundries with real durability for key metrics that include tensile and tear strength, abrasion resistance, seam strength, dimensional stability, and color fastness.

On the contrary, each of GAP, H&M, C&A, and Zara succeeded with only five out of the six tests. GAP did not perform dimensional stability and color fastness tests; this affects the shape and color retention after multiple washing. Tommy Hilfiger passed just five, failing in abrasion resistance, hinting at issues of the fabric in the long run. Besides, the performance of The Blue of a Kind and HNST was inconsistent, while both high seam

strength and dimensional stability, neither of them passed the tensile strength test, and HNST also failed the tear strength test. These inconsistencies raise question marks over their long-term durability. BAM Bamboo Clothing, Primark, and Urban Outfitters didn't provide any durability tests mentioned above which suggests they did not perform similar durability tests as the other brands. Amongst the specific failure areas, color fastness and dimensional stability presented some problems, where color fastness showed several brands in failure, including GAP, C& A, and Zara.

Although companies assess performance indicators such as tensile strength, abrasion resistance, and color fastness on an individual basis, there is currently no uniform measurement throughout the industry. The provided guidelines seek to create a foundational framework for harmonizing durability standards. Physical Durability focuses on garment construction and reinforcement to improve resistance to damage (Ellen MacArthur Foundation, n.d.-b).

4.5.4. Recycling and Closed-Loop Systems

The theme of recycling and the closed-loop systems are part of the brands' strategies in participating in the Jeans Redesign Project is underlined by an approach like "made to be made again". It provides easy, effective postconsumer processes so jeans can be collected, sorted, and recycled both mechanically and chemically. The project prioritizes the use of 98% cellulose-based fibres and aims to reduce reliance on virgin material while consequently decreasing the overall environmental footprint of denim manufacturing (Ellen MacArthur Foundation, n.d.-b).

COMPANIES	98% MINIMUM CELLULOSE-BASED FIBERS	CELLULOSE-BASED THREADS	EASY-TO-DISASSEMBLE COMPONENTS	NO RIVETS INCLUDED	EASILY IDENTIFIABLE FOR RECYCLING
GAP	✓	✓	✓	✓	✓
URBAN OUTFITTERS	✓✓	✗	✓	✗	✓
BAM BAMBOO CLOTHING	✓	✓	✓	✓	✓
ZARA	✓✓	✗	✓	✗	✓
C&A	✓✓	✓	✓	✓	✗
LEVI STRAUSS & CO.	✓✓	✓	✓	✗	✓
CHLOÉ	✓✓	✓	✓	✓	✓
H&M	✓✓	✗	✓	✓	✓
HNST	✓✓	✗	✓	✓	✓
MARKS AND SPENCER	✓✓	✓	✓	✓	✓
REFORMATION	✓✓	✓	✓	✗	✓
PRIMARK	✓	✗	✓	✓	✓
TOMMY HILFIGER	✓✓	✓	✓✓	✓	✓
THE BLUE OF A KIND	✓✓	✗	✓	✓	✓

Figure 13. Evaluating Recyclability Criteria Among Fashion Brands and Retailers in the Jeans Redesign Project (Author's elaboration based on data from The Jeans Redesign - Company Reports - List of Companies, n.d.).

The above table shows the recycling criteria of the Jeans Redesign Guidelines met by the brands. Double check marks indicate exceeding requirements, a single check mark indicates meeting the requirements, while X is for when the requirements are not met. The first criterion will refer to the utilization of at least 98% of cellulose-based fibers, and from this criterion alone, it can be noted that many exceed expectations. For the second criteria that relate to the optional requirement of cellulose-based threads, quite evidently, most of the brands do not get to the set standard. The third one, although many brands successfully go through, Tommy Hilfiger is well ahead as it exceeds expectations. As for the "no rivets included", quite well-known brands like Zara and Levi Strauss & Co., Urban Outfitters, and Reformation have not attained compliance.

In 2023, H&M reached the important milestone of 79% of its polyester coming from recycled materials, well on the way to its goal of 100% in 2025 (H&M Group, n.d.).

Along with the Ellen MacArthur Foundation, Levi Strauss & Co.'s designs a systems-based approach to foster a circular fashion economy and address systemic barriers related to regulatory issues and technological limitations concerning recycling. Their take-back initiatives prompt consumers to bring back previously loved apparel in turn, help support efforts at recycling and prolonging the life of such products (Levi Strauss & Co., 2023).

4.5.5. Customer Engagement and Education

Customer engagement and education on the practical adoption of circular fashion practices, especially projects such as the Jeans Redesign Project, are quite critical. This concept aligns with earlier discussions on material safety, sustainable input, product longevity, durability, and closed-loop recycling systems. Actively engaging consumers in circularity would enhance their understanding of the benefits that come from the circular consumption. Strategies such as encouraging consumer participation in donation and recycling programs, education on the care of garment products to enhance their durability, and second-hand markets. Such initiatives are very important in the empowerment of circular fashion and, therefore, fostering the transition towards a circular economy within the industry.

H&M	2021	2022	2023
Shop/Sell on Sellpy	24/4	24/7	24/8
Second-Hands Traded on Sellpy	-	+ 8 M	10.8 M
Online Markets Offers Take Care Advice	46	58	60

Figure 14. H&M's Performance in Second-Hand Trade and Circular Consumption through Sellpy (Adapted from H&M Group, n.d.).

The table above explains the performance of Sellpy from 2021 to 2023 which is an online second-hand fashion marketplace offered by HM. The “Second-Hands Traded on Sellpy” category indicates an increase in the volume of trade reported from 8 million items in 2022 to 10.8 million in 2023. The Online Markets Offers Take Care Advice cell has increased from 46 in 2021 to 60 in 2023 gradually. Secondly, circular consumption is encouraged as ensured by the company through second-hand campaigns.

Levi Strauss & Co.	2021	2022
Number of Cloths Reclaimed/Extended	28,000	18,000
Number of Items Resold	14,000	13,000
Number of Consumers Buying Second-Hand	10,000	9,000

Figure 15. Levi Strauss & Co Recommerce Platform Performance in USA (Adapted from Levi Strauss & Co., 2023).

The table above highlights the performances of a recommerce platform owned by Levi Strauss & Co. in 2021 to 2022, in the USA market. It is reclaimed 28,000 pieces of clothes and resold 14,000 items with 10,000 consuming customers of used products in 2021. However in the next year number of reclaimed clothes declined to 18,000 items, 13,000 items are resold, the platform engaged a less people which is 9,000 consumers for second-hand purchases. This is considered a slight drop in activities across all categories from 2021 to 2022.

The brand builds on customer engagement with the comprehensive choices of extending denim product lifetimes. In-store take-back programs and Levi's Second-hand platform enable customers to recycle and resell their jeans. Levi Strauss & Co. 's Tailor Shops

platform offers the repair and personalization of fashion items. They reinforce garment longevity and supports consumers in their choices for sustainability by promoting customer engagement activities (Levi Strauss & Co., 2023).

4.6. Discussion

The results of this case study point out some useful indications about the contributions that fashion brands participating in the Ellen MacArthur Foundation's Jeans Redesign Project make to a circularly advancing post-consumer activity. It became clear that the various levels of compliance of the participating brands with the Jeans Redesign Guidelines reflected diverse levels of commitment to sustainability among the many observations. HNST and Chloé designed the higher level of SKUs that met with the project guideline; others like GAP show great potential to improve compatibility with circularity.

In terms of material safety and sustainable inputs Urban Outfitters and The Blue of a Kind have highly integrated products made from recycled materials. They are leading to show sustainability can align with product offerings. Meanwhile, Tommy Hilfiger, H&M, and Chloé will follow with strong numbers, proving large brands can implement high levels of recycled content, though scalability across more SKUs remains to be seen. Meanwhile, Tommy Hilfiger, H&M, and Chloé are also posting strong numbers, proving that even large brands can implement high recycled content, though scalability across more SKUs remains to be seen. Whereas brands such as Zara, Primark, and BAM Bamboo only meet the minimum requirements suggesting they still have significant room for growth in this area. It is gratifying to know that they are taking part in the practices towards material recycling however, poor performance could be a signal that something needs to be done to push toward true circularity.

Durability assessments indicate brands notably Levi Strauss & Co., and Reformation, perform exceptionally well in metrics such as tensile strength and abrasion resistance which shows their commitment to producing long-lasting products. In contrast, brands like BAM Bamboo Clothing, Primark, and Urban Outfitters underperform since they didn't provide any common durability tests in these areas, highlighting a critical challenge for maintaining product longevity that is a cornerstone of circular fashion that seeks to reduce waste through extended product lifecycles. This situation highlights the importance of common durability standards for jeans-producing brands. The theme of recyclability and the closed-loop

system demonstrates that several brands are taking positive steps in the adoption of cellulose-based fibers, though most are inconsistent in terms of compliance with recycling standards-particularly in making the materials easily identifiable and separable for recycling.

Even though many brands have promising developments in their recycling strategies it is seen that there is still a substantial number of challenges in the industry, especially about the complete integration of recyclability into design and production processes. Customer engagement and education are becoming vital components in the success of circular fashion. Fashion brands and retailers are aware of that their relationship with their consumers is where their sustainability journey begins. Online platforms such as Sellpy by H&M illustrate how customers could be involved in the circular economy via second-hand markets. Finally, the attention needs to fall to those circular activities which must be created concerning customer interaction and education. Consciousness among consumers is growing; therefore, great opportunities are open for post-consumer strategies, especially recycling, resale, and repair. All these findings show that collaboration between consumers and producers is needed for a more circular fashion industry.

4.6.1. Limitations

Even though this case study analysis provides a comprehensive understanding of the Jeans Redesign Project's contribution to circular fashion, there are some limitations to this research that should be acknowledged. First, relying solely on secondary data prevents deep insight into individual brand practices or consumer behavior. Secondly, there is inconsistency in how data collection was done across brands, which makes direct comparison hard and therefore could reduce the strength of the analysis. Moreover, the scope itself can misjudge small or emerging brands pioneering new practices circularly, hence providing only a partial view of the development of the industry.

The ever-evolving nature of the fashion industry, with fast-changing consumer preferences and continuous technological changes, is another limitation. This case study examines studies conducted over a specific period and therefore it lacks data on possible future developments and improvements. A more comprehensive analysis requires ongoing research to take into account and record prospective data. Therefore, the limitations require

more extended and elaborate research for insight to be gained deeper on the concept of the circular economy within fashion.

4.6.2. Contribution to Circular Fashion

This analysis emphasizes the role of the participants in the Jeans Redesign Project in leading the fashion principles of circularity. These brands shift the paradigm toward a circular model of production and consumption by focusing on post-consumer activities within product longevity, durability, and recyclability. Participating brands showcase innovative material sourcing, the removal of hazardous chemicals, and strategies that aim at extending garment life-proving sustainability can be part of core business without jeopardizing either quality or profitability. Besides, the recycling programs and repair services involving consumers are becoming increasingly crucial in circular fashion practices. However it is necessary to put future emphasis on the education of customers about circularity. Further enhancing circularity, commitment to material safety and sustainable inputs will go a long way toward consolidating consumer trust in the products offered. The work collected here is a pathway into how the industry can demonstrate that the application of circular economy principles can lead to environmental value creation as well as economic value generation.

4.6.3. Conclusion and The Closing Statement

This study has established that the Jeans Redesign Project has thrived in encouraging brands to promote circularity, longevity, and recyclability practices within a circular economy framework. Meanwhile, these features integrated into business underline an urgent need for value retention of textile discards, along with the extension of the life cycle of denim garments. The findings reveal varying degrees of commitment among brands, such as Levi Strauss & Co., and Chloé showcasing innovative strategies to enhance sustainability while fostering consumer trust and loyalty.

It is seen that some participants stand out for their use of recyclable materials and their engagement with consumers, others showed room for improvement, most especially in meeting the more general industrywide standards about durability and recyclability. The

research points out standardized metrics are required, along with ongoing collaboration by the brands, consumers, and other stakeholders.

Future research areas can focus on customer engagement and education in a circular fashion, particularly engagement with customers in post-consumer activities effectively by brands. The exploration into the challenges faced by customers in engaging with the circular initiatives of recycling and clothing donation may hence help through strategic recommendations on how to raise awareness among customers and create marketing campaigns. It can also be investigated how educational campaigns influence consumer choices regarding sustainable and second-hand fashion. This case study analysis could be used to support the enabling role of consumers in the success of circularity practices, therefore justifying a greater focus on participation and individual education for a circular fashion ecosystem.

Consequently, this research focused on the role of fashion brands within the frame of the initiative known as the Jeans Redesign Project in the transition to a Circular Economy. Brands and retailers should advance toward the fashion of the future with an approach that gives utmost importance to sustainability and responsibility in circular post-consumer activities. However, a full circular fashion cannot be achieved in a hurry but it needs to be nurtured continuously and must be supported by close cooperation from all the stakeholders involved in speeding up the process. The case study concludes with findings indicative of a positive change in the fashion industry, serving to highlight collective responsibility to enhance the possibility of a more sustainable and circular future.

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