THE ROLE OF TECHNOLOGY IN SLOW FASHION PRACTICE WITH AN ANALYSIS OF TURKISH SMES

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ABSTRACT

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Master's Program in Design Studies

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Developing technologies have greatly contributed to the development of the fast fashion concept which has devastating environmental and social effects within the global fashion system. Slow fashion movement takes a stance against the fast fashion system and emphasizes local values and reveals the necessity of a transparent and circular production model for creating qualified and responsible designs based on crafts. However, technological developments cannot be ignored even by the slow fashion movement. This research asks, how the small and medium enterprises use technology in order to change the vicious circle created by production and consumption models and slow down the fashion. By conducting interviews and questionnaires with the SMEs in Turkey, the way they use technology, their tendency to interdisciplinary work and cooperation, the potential relationship between design practices that are shaped by technology will be investigated. The research and data

collected regarding the use of technology in slow fashion models would create a foundation for understanding the necessary skills, know-how, and design methods for the young generation to create a functional, reusable and ecological structure in order to contribute to the training of designers with digital tools. While examining the relationship of the slow fashion movement with technology and a sustainable approach, working in this framework seeks to answer the following questions: To what extent can technological development contribute to the slow fashion movement? Can anything beneficial be revealed from the paradoxical relationship between technology and slow fashion?

Keywords: Slow Fashion, Technology, Sustainability, Education, Innovative Fashion Design, Digital fashion

ÖZET

TÜRKİYE'DEKİ KOBİ'LERİN ANALİZİ İLE
YAVAŞ MODA UYGULAMASINDA TEKNOLOJİNİN ROLÜ

Şansal, İdil

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Gelişen teknolojiler, küresel moda sisteminin oluşmasına çok büyük katkı sağlarken, çevresel ve sosyal anlamda yıkıcı etkileri olan hızlı moda kavramının gelişimini de desteklemiştir. Hızlı moda sistemine karşı bir duruş sergileyen yavaş moda akımı ise yerel değerlere vurgu yaparken, el işçiliğine, zanaata dayalı nitelikli ve sorumlu tasarımların oluşumunda şeffaf ve döngüsel üretim modelinin gerekliliğini ortaya koymaktadır. Diğer taraftan teknolojik gelişim günümüzde yavaş tasarım hareketinin dahi görmezden gelemeyeceği bir noktadadır. Küresel moda sisteminin üretim ve tüketim yöntemlerinin yarattığı kısır döngüyü değiştirmek ve modayı yavaşlatmak için tasarımcılar yerel işletmeler ölçeğinde teknolojiden nasıl yararlanabilir sorusuyla yola çıkılan bu araştırmada sürdürülebilir bir yaklaşımla, yavaş moda hareketini temel alarak, bir üretim ve iletişim biçimi olarak kullanılan teknolojinin tasarımcılar ve yerel işletmeler üzerindeki etkisini ölçmeyi hedefler. Bu çerçevede çalışma kapsamında Türkiye'de faaliyet göstermekte olan küçük ve ortak

ölçekli tasarım işletmelerinin teknolojiyi kullanma biçimleri analiz edilecektir. Bu işletmelerde çalışan tasarımcılarla yapılan anketler yoluyla teknolojiyi kullanma biçimleri, disiplinler arası çalışmaya ve iş birliğine olan yatkınlıkları ölçülürken, teknolojiyle biçimlenen bir tasarım pratiğinin yavaş moda kavramı ile olası ilişkisi araştırılmaktadır. Yavaş moda modelinde teknolojinin kullanımı ile ilgili olarak toplanan araştırma ve veriler, genç neslin, tasarımcıların, dijital araçlarla eğitimi üzerine fonksiyonel, yeniden kullanılabilir ve ekolojik bir yapı oluşturması için gerekli beceri, bilgi, tasarım yöntemlerinin anlaşılmasına zemin hazırlayacaktır. Yavaş moda akımının teknoloji ile olası ilişkisini sürdürülebilir bir yaklaşımla inceleyen bu çerçevede çalışma, şu sorulara yanıt aramaktadır. Teknolojik gelişme yavaş moda hareketine ne ölçüde katkıda bulunabilir? Teknoloji ve yavaş moda arasındaki çelişkili ilişkiden faydalı bir şey ortaya çıkarılabilir mi?

Anahtar Kelimeler: Yavaş Moda, Teknoloji, Sürdürülebilirlik, Eğitim, Yenilikçi Moda Tasarımı, Dijital moda

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CHAPTER 1: INTRODUCTION

1.1. Problem Definition

The fashion industry, which is accelerating with the developing production technologies, has also transformed the relationship between production and consumption. The concept of fast fashion created by the fashion industry, which has turned consumption into a hobby with accelerating trend cycles and has become an important part of the global chain, has emerged with the ever-increasing production of unqualified clothes that are worn a few times and then thrown away. The fast-fashion system is mainly defined by the global economy which adapts increasing consumerism as its main target. As Busch puts it:

> "*It's not about whether consumption is producing more or less, or not, it is a consumption that constantly reproduces more consumption*." (Busch et al., 2014)

Although the technologies used to consist of contribute the formation of this vicious linear system and allow more production and consumption, technologies based on recycling are also used with the necessity of creating a circular, sustainable system. Defining sustainability as a three-legged chair, Farrer defines the first leg as human, the second as economy, and the third as nature, arguing that all three legs must be as good and solid as possible to create a sustainable fashion industry (Farrer, 2011).

Slow fashion as a method of sustainable fashion takes an ethical approach against fast fashion by adopting local production and consumption patterns against globalism. The concept of slow fashion, which takes a stance against the destructive effects of the irresponsible development of the sector in an unsustainable manner, emerged as a movement that creates value and protects under the umbrella of sustainability and has been developed in this direction. Therefore, the concept of slow fashion, which protects all these criteria with a sincere, fair, and transparent structure,

reveals the nature of fashion in the pre-industrial period with its stance that emphasizes craft, handicraft, and culture.

The environmental and social problems have become more noticeable with the effect of the pandemic, and slow fashion has become a more well-known movement with the power of communication technologies. With the effect of increasing digital platforms, the way of doing business and interactions of craftsmen, designers, and businesses have also been transformed.

Technology, which is used as a form of making and communication, has been transformed into innovations such as revolutionary artificial intelligence, cybernetic energy systems, informatics, genetic engineering, material inventions, 3D printing, and augmented reality. In addition, the design culture shaped by technology has spread the use of three-dimensional software. With 3D design software and augmented reality, the designs are cred with a realistic 360-degree view to be presented without being produced which are supposed to have less environmental impacts.

Therefore, while miniature information technologies and the real and virtual worlds are intertwined, digital views, sustainable material innovations, and interdisciplinary collaborations come to the fore. In this context, it raises the question of how slow fashion would develop along with the social and environmental effects of fast fashion.

In the light of these ideas, this study takes a stance against the concepts of speed and innovation, which are the backbone of the fashion system. The slow fashion movement that contributes to the local economy, problematizes its ability to benefit from technology and regards to design practice. Following a relevant literature review on slow fashion, through a survey and interview, focused on SMEs, designers, and craftsmen, the study questioned how technological innovation can be beneficial to slow and responsible fashion.

1.2. Aim Of the Study

The main purpose of this study is to draw attention to the effect of technological know-how on slow fashion practice. It is aimed to evaluate the ways of using technology in the production and design stages by examining SMEs. The conventional fashion system has a linear working model, consisting of design, production, and consumption processes. Each stage of this linear model aims to increase consumption and consists of a hierarchical structure. On the contrary, slow fashion has a circular structure, that contributes to the local economy, while revealing a transparent and clear process. The thesis will search for the possibility of building a circular model through the use of technological tools.

In slow fashion practice, it would be sought if the technological advances can be used as a form of craft in an interdisciplinary manner. Within the scope of these concerns, the study reuses these questions;

- How can technology position itself to create a positive balance between production and consumption and to change the future of fashion into a more responsible, transparent, and ethical environment?

-To what extent can technological progress contribute to the slow fashion movement?

-Can a useful model be uncovered from the paradoxical relationship between technology and slow fashion?

-How important is the role of technology within an interdisciplinary approach in regard to production and transformation practices?

Briefly, the study asks; infertile circles created by the production and consumption methods of the conventional fashion system could be transformed into a virtuous cycle by the relationship between technology and slow fashion. How can designers, and local businesses benefit from technology?

For this reason, the goal of the study is to raise awareness about the negative effects of the conventional fashion system on humans and the environment, while contributing to the understanding of slow fashion and education, as it develops an ethical approach to the way of designing and transformation using technology.

1.3. The Structure and Methodology

The study, based on the slow fashion movement, would try to measure the effect of technology used as a form of making and communication on designers and local businesses. Methodology of the study, questionnaires, and interviews planned to be examined within this scope, the answer to how labor should be sustained and organized was questionnaires and interviews held jointly with SMES, platforms, and artisans in craft production. The main goal of the questionnaires and interviews is to evaluate the usage of technology.

The first chapter covers the examination of the structure of the conventional fashion system and presents an analysis of the environmental and social problems caused by the system and why the fashion system should slow down in order to reveal the causes of the problems created by the system.

Following with the second chapter “Transformation from Fast Fashion to Slow Fashion”; with the examination of the production and consumption cycle of the fast fashion system (as a result of the consumption culture), it was aimed to exemplify the structure that shapes unqualified design identity. In order to explain the slowness approach that displays a counter stance by examining the actors, institutions, and fashion centers of the fast fashion system from social, cultural, and economic perspectives. With the theoretical framework provided by Hazel Clark, Otto Von Busch, Kate Fletcher, Holly McQuillan and Alison Gwilt, the importance of sustainable and slow fashion and unique design methods, the cultural value of the locals, and the developments experienced were discussed from a sociological perspective.

In the "Relationship of Technology with Sustainable Fashion" section, the relationship of technology with the concepts of craft, production and craftsman was examined. While examining the relationship between, slow fashion design production

practices and technology, the possible relationship between the concept of slowness and new technologies are analyzed through examples. Besides the relationship of technology with the concepts of craft, production, craftsmanship, and design were examined. These analyses were based on the theoretical framework provided by Alastair Fuad Luke, Richard Sennett, Kate Fletcher, Victor Margolin, Ezio Manzini, Şölen Kipöz, Duygu Atalay and the ideas, analysis, and observations of Hazel Clark and Sandy Black. Furthermore, examples such as Suzanne Lee, Iris Van Herpen, Hussein Chalayan, Jessica Rosenkrantz, Anouk Wipprecht, and CuteCircuit were also included.

The current applications of the technologies used for a sustainable future scenario and the possible potentials of the technologies used for sustainable fashion design under the titles of production, design, material, and user relationship within the framework of slow fashion were investigated in detail and the possible relationship of cognitive information technologies with these issues was examined.

In addition, while the importance of the product life cycle was conveyed with the thoughts of Niinimaki, McDonough and Braungart, the methods used within the framework of sustainable strategies (3R) were mentioned and supported by the thoughts of the Turkmen. While how technology is used in this field is supported by the example of DeNature, the relationship between skill-based and labor-oriented practices and technology is examined and supported by examples such as Ganit Goldstein, Manus x Machina exhibition, Iris Van Herpen, Hüseyin Çağlayan. Emphasizing the importance of interdisciplinary studies, these robust design examples support that technology, user, craft, design and production concepts are intertwined.

Also, in this section where the relationship between technology and the workshops organized with the "Participatory Design Approach" and "Do it Yourself" practices are examined, Technology is defined as a transparent bridge between craft and production and it is stated that it plays an important role in sustainable fashion production. Zero waste strategy was examined with the thoughts of Kipöz, Atalay and Rissanen, while zero waste methods were examined within the framework of “McQuillan, Carrico and Kim”. The relationship between primitive design and production practices developed under the zero-waste strategy and technology has been

examined through the examples of McQuillan, Enes and Yıldıran. In addition, in this section where the main problem of the textile industry is emphasized, the "on demand production" model is examined through examples and supported by Black's thoughts. It has been examined that a zero-stock system can be established instead of a system that creates dead stock with the on-demand production model. In this context, applications such as Sharecloth, UnmadeOS, Techpacker were examined, while the importance of technology in a responsible fashion system was examined.

In the fourth chapter of the study, questionnaires and interviews were conducted and the results were evaluated. The fact that design-oriented small businesses meet the changing demand efficiently and respond to consumer needs by using local, new, smaller-scale production methods, exhibits a remarkably successful stance. However, it raises the question of whether developing technology can help sustainability and design businesses to survive.

This thesis study, which was conducted with the hope of rediscovering a slow fashion design culture that can be fed with technology, emphasizes the importance of seeking separate ways of doing, the importance of interdisciplinary work to be adapted to the design practice, to build a more sustainable future for fashion.

CHAPTER 2: TRANSFORMATION FROM FAST FASHION TO SLOW FASHION

Since the Industrial Revolution, because of the opportunities provided by industrial capitalism, the exploitation of labor has increased due to the developing machine technologies and mass production. Therefore, it brought together product groups that produced more than necessary and offered a variety of non-functional products. This also incremented overproduction and consumption.

Developments in the fashion industry, although it initially seemed like the democratization of fashion as it reached people from all target groups, it has resulted in the emergence of the concept of fast fashion, which is a pro-capitalist system. Fast fashion can be defined as clothes that present a more accessible imitation of the line created by luxury fashion brands, and transform them into an accessible fashion by imitating the ideas from the catwalk and luxury culture. It has become a linear vicious circle created by an ever-increasing overproduction and consumption system that causes clothes to become cheaper with the product options and cheap costs they offer.

Fast fashion system, where even seconds are important in production stages, the aim is to get the maximum number of products from the workers. While the pressure of speed and performance forced the products to end up poor quality, and thousands of thrown away identical “Orphan” - clothes with no history (Atalay Onur, 2020). Cost reduction efforts of brands and non-transparent supply chains create environmental and socially destructive effects on the global fashion system.

With globalization where appearance became important to the global fashion system, fed by the concept of impermanence, which is the essence of consumption, lead to the oblivion of craft practices. However, the basis of fashion is craft but the artisans who produce in the global fashion system have turned into workers created by the system, who are tasked with making a single piece and are alienated from what they produce (Atalay Onur, 2020).

At this point, the concept of slow fashion emerged, which exhibits a sustainable, qualified, transparent, clean, and natural stance against the destructive vicious circle created by increasing consumption and production amounts. Despite the multinational nature of global supply chains, slow fashion shares a labor-intensive

production process with all its transparency. Therefore, the concept of slow fashion, which protects the cultural heritage with natural material choices and fair production processes, develops a conscious approach that repairs, heals, and transforms against the destructive effects of fast fashion.

2.1. Environmental and Social Impacts of the Fast Fashion Industry

The fashion industry, which has undergone a profound transformation since 2000, has undergone a profound transformation by creating increasingly severe negative effects with increasing production speed and quantities. This process, which shortens all the design, production, and distribution operations, reducing the production cycle to three to eight weeks, can bring a fast, accessible adaptation of the luxury fashion show culture to the stores within a month. Therefore, global and cheap fashion brands, trapped in the competition cycle created by the fashion industry, create a destructive vicious circle of faster sales and production times.

The speed-based fashion system, which emerged in the late 1990s, has grown gradually under the leadership of global fashion brands producing ready-made clothing, following the "just in time" production philosophy and "quick response" strategies. Targeting consumers who are passionate about fashion and trends, the system has begun to offer high fashion looks at instantly reduced prices. Consumers, who got used to this fast system with global consequences, continued to consume with the desire to buy more new clothes with affordable attractive prices and the latest trendy product options. Therefore, this global market, which is growing at an incredible rate, has replaced the traditional clothing model with seasonal production and built a global fashion system that acts with a just-in-time production strategy and responds quickly to the latest fashion trends (Birtwistle et al., 2003).

For this reason, the desire of consumers to follow the changes and innovations and the urge to own fashion products, and the development of irresponsible consumption habits cause the unconscious use of labor and environmental resources (Fletcher, 2010).

Basically, the main problem is the rate of change in fashion, hence the rate of production. Mentioning that the excessive cost of good-looking cheap fashion is the real cost of the fast fashion system. Cline stated that decreasing the prices of clothes

means poorer production conditions. It has been revealed that consumption serves to expand this system and results in a huge waste of materials and people (Cline, 2013). Therefore, this vicious circle, which always encourages more consumption and new things, has various negative environmental and social impacts.

Figure 1. Fast Fashion and its speedy degrading impact upon the environment (Source: Swadesh, 2020)

The global fashion industry involves resource-intensive processes, with some natural fibers such as cotton, wool, and silk having more environmental impact than many other materials. The amount of water and chemicals used during their production causes the release of greenhouse gas, which is one of the causes of global warming. Cotton, which is the most used fiber due to its comfort and ease of maintenance, needs a large amount of water during its cultivation. 2,700 liters of water is consumed for one T-shirt (WWF, 2013). In addition, soil fertility decreases due to the pesticides used during cotton production. Toxic chemicals used in the textile mix into rivers and drinking water due to the inadequacy of treatment facilities. Greenpeace's detox campaign against the production, use, and release of hazardous chemicals since 2011 exposed the wrong practices of brands (Greenpeace, 2012). When there is not enough treatment process, it affects not only the production environment but also the humans and even the entire ecosystem.

To illustrate this environmental problem, according to the 2018 report published by the United Nations Economic Commission for Europe, while the clothing industry produces 20 percent of global water waste and 10 percent of global carbon emissions, 85 percent of textile products - 21 billion tons - are reported to be sent to landfills every year (Sherman, 2019). The fashion industry, which is one of the least environmentally sustainable industries, generates approximately 2.1 billion tons of CO2-e emissions per year (McKinsey, 2020). This amount represents 4 percent of the annual global emissions. More than 70 percent of these emissions come from the manufacturing processes, and the rest from retail, logistics and product use (such as washing and drying). The fashion industry is a resource-intensive process that uses significant amounts of water, soil, pesticides to grow raw materials such as cotton. In addition to this, 17.5 cubic meters of textile - the equivalent of a garbage truck - is either incinerated or sent to the landfill every second (Ellen MacArthur Foundation, n.d.).

In addition, the environmental and social impact that begins to take shape during the design phase covers all processes from design to distribution. The hierarchical structure between the designer, producer, and consumer presented by the global fashion system, isolating the craftsman, designer, and consumer, brings seasonal, poor-quality products in which cultural and human values are destroyed. More unqualified purchases encourage shallow, short-term relationships between users and products (Yanpar Coşdan, 2020). Besides, in the production processes where human rights are violated, a fair distribution of financing could not be provided, and the working conditions in the procurement processes turned the craftsmen into workers (as a tool) working in sweatshops. Whereas craftsmen are "productive people" who are devoted to their practical activity, and their labor should not be a tool used for any other purpose (Sennett, 2008).

The scandal of the Rana Plaza factory, which collapsed due to the poor conditions of the building, is the most painful example of this situation. Working conditions of garment workers have become visible by, The Rana Plaza disaster, (see Figure 2.) which resulted in 1138 deaths and hundreds of injuries in Bangladesh in 2013, which has led to the publication of numerous reports by many trade unions and

international non-governmental organizations focusing on the working conditions of textile workers (The True Cost, 2015).

Figure 2. Rana Plaza disaster - Bangladesh. (Source: The Finery Report, 2018)

According to Clean Clothes Campaign's 2015 "Living Wage Now" report, (Cleanclothes, 2015) workers, who are deprived of job security and work with wages that make it impossible to live humanely, are subject to conditions of modern slavery. Therefore, the most socially destructive impact of the textile industry is labor-intensive manufacturing. In underdeveloped countries where the labor cost is low, the increasing production amount and the ever-growing market have increased competition and built a profit-oriented exploitation-based structure that does not care about working conditions or the age of workers. This labor-intensive production is concentrated in underdeveloped countries such as Bangladesh, Vietnam, India, and Cambodia due to the cheap labor force. The global system created by this competitive industry, which isolates and exploits the producer, creates a multinational production model and supply chain (Pookulangara and Shephard, 2013). While today's artisans are becoming lonely workers in this system, where no one knows anyone, the designer can be from Europe, the producer can be from Africa, and the consumer can be from America (Atalay Onur, 2020).

In this context, a system that transforms and improves in social, environmental, and economic scope should be developed in order to build a sustainable structure while reducing the severe and destructive effects of the global fashion industry.

2.2. Necessity of Sustainable Production and Consumption Cycle in Fashion Industry

The fashion industry, which is accelerating with its just-in-time production strategy, creates a vicious circle that encourages continuous consumption and production. It promises synthetic happiness through communication channels that are essentially based on human exploitation, unfairness, excessive production, and playing an active role in its marketing. This temporary environment of happiness, created with a focus on production and consumption, creates a linear vicious circle that imposes buy-use-dispose consumption habits, which makes both the producer and the consumer fundamentally unhappy with the unqualified, poor-quality clothes and unfair working conditions it offers.

The competitive production structure created in this linear model has brought along many environmental, social, and economic problems such as unfair production conditions that exploit worker and employee rights, environmental pollution caused by waste problems, chemicals that threaten human health, and resource constraints. Therefore, nature, which should not undertake a task such as increasing one's material gains and providing spiritual satisfaction for the sake of self-destruction, it is necessary to consider sustainability in every aspect possible (Koszewska, 2018).

The basis of the concept of Sustainability, which has developed in this context, is based on the explanations of Rachel Carson in her book "Silent Spring" published in 1962, expressing the effects of pesticides on animals and humans. She stated that the continuity of our lives depends on the ecosystem (Türkmen, 2009).

The concept of sustainability, which was used for the first time In the report "Limits to Growth 2" (1972), started to become popular with "Our Common Future" in the Brundlant Report published in 1987. 1992 Rio de Janeiro World Summit, which brought the concept of sustainability to the international stage and created a turning point in sustainability (Cebeci, 2013).

It is a concept that has emerged with the aim of limiting the use of resources and keeping the destructive effects on the ecosystem at a level that does not exceed the capacity of the system in order to ensure the continuity of our lives that depend on the ecosystem, to ensure that ecological diversity and non-renewable resources can be

preserved and transferred to future generations (Ercoşkun, 2007). Therefore, it is necessary to realize all the dynamics (ecological, economic, and social) that make up the concept of sustainability, which has 3 basic principles:

-Ecological sustainability aims to ensure the protection of nature and the environment for future generations by using physical and environmentally friendly recyclable resources instead of toxic chemicals.

-The aim of economic sustainability is to ensure that economic resources such as raw materials, energy, and labor are used as much as needed.

-The purpose of social sustainability is to create a fair environment where the needs of the workers are met by considering human and worker rights (Yüksel and Gürcüm, 2011).

However, recycling is considered a sustainable criterion, even though there are many ready-made clothing companies that adopt cyclical material flow and prefer recycled fibers, there is an intense use of energy and chemicals due to high production quantities. To illustrate this situation, during the Black Friday event held in 2011, in order to raise awareness Patagonia Brand organized an advertising campaign with the slogan "Don't buy this jacket", which included information on the amount of water consumed in the production process and the carbon emissions caused by the manufacture of the jacket. Even if it is a durable, environmentally friendly jacket produced in ethical conditions from 60% recycled polyester, it is clearly seen that it has an environmental impact (Yanpar Coşdan, 2020).

For the sustainable fashion of the future, according to the data of McKinsey Report November 2020, it was stated that consumers expect fashion brands to focus more on sustainability. In this context, the report indicates that it is possible to talk about a future in which circular business models are not optional (McKinsey, 2022). The Circular Economy model points to a cyclical process that aims to keep the products, materials, and resources on the system as long as possible with the values they contain (Merli et al., 2018). The main goal of this concept, which is used to describe a closed-loop industrial system, is to prevent the environmental damage of industrial production by developing sustainable design, repair, remanufacturing, and

resource renewal strategies. Eliminating waste production and preventing carbon dioxide gas emission can be stated as the first basic goals. It was stated that products made from sustainable materials to be used, and even recycled materials and materials with lower CO2 impact such as organic cotton to be used instead of normal cotton (McKinsey, 2022).

In addition, the fashion industry contributes to the loss of biodiversity in the world, with 23% of pesticide use used in cotton farming and 25% of industrial water pollution from textile dyeing and processing (WWF, 2014). Building resilience in the sustainable fashion of the future is also about protecting and restoring natural environments, because biodiversity and climate agendas are critically interdependent. According to the McKinsey report, nearly half of the world's population could be exposed to climate hazards related to heat, drought, flooding or water stress if temperatures increase up to 1.5 degrees Celsius (IPCC, n.d.).

Therefore, according to Anna Granskog, halving overproduction from where it is today would greatly contribute to the industry's lower carbon footprint. In the report, which emphasizes the need to redefine the criteria to be a sustainable brand, it is stated that there will be a net growth in different types of sustainable fashion consumption. It emphasizes that resale, leasing, repair, and renewal opportunities and services, which are defined as a circular business model, will gain importance. In the report, which reveals the necessity of the transformation of the business models of the fashion industry and circular business models, it was questioned how this situation could have spread and become mainstream. In this direction, the report emphasizes the impact of the circular consumer experience, and it is considered that system designs in which new technologies play an active role will cause mass participation where it becomes enjoyable to bring products into the circularity cycle with applications (McKinsey, 2022).

Therefore, the perception of innovation in the fashion industry and all traditionally used strategies go through a process of questioning and transformation. The circular economy model, which emphasizes a holistic transformation in fashion design and production processes, emphasizes the problem-solving aspect of design while pointing to a holistic change in matters such as material selection, product numbers, mold systems, and technology use (Atalay Onur, 2020).

Figure 3. Atelier & Repairs Factory (Source: Atelier & Repairs, n.d.)

Founded in 2015, Atelier & Repairs is a design-driven product and service platform dedicated to circularity. Atelier & Repairs, which has workshops and an online store in London and Los Angeles, was founded by Maurizio Donadi. Atelier & Repairs helps reduce the environmental impact of fashion by “redesigning and transforming” existing denim garments and textiles. Aiming to create a new standard of endless reuse by reducing industrial-level excess, the company aims to transform a product for use over many lifetimes, using consciously chosen leftover and sustainably produced textiles, while producing with as little environmental impact as possible (Atelier & Repairs, n.d.).

Known for transforming vintage Levi's 501 jeans, the brand uses reclaimed denim and dead fabrics to create one-of-a-kind pieces. By adding interesting patchwork to designs, they cut jeans into new products. Stating that they did not produce, transform, or manipulate someone else's design by hacking, Donadi stated that they improved, changed, reduced, and enlarged depending on their creative mood. (Atelier & Repairs, 2019) The denim giant asked Levi's Atelier & Repairs to create a capsule collection that reinvents the classic pleated chino using pieces from the Dockers line. In collaboration with Atelier & Repairs x Dockers, a new collection has been created for chinos with camouflage, fabrics such as chambray, and additional embellishments (Nieder, 2020). Atelier & Repairs has launched a program called

Brand-2-Brand to support clothing brands and retailers in reducing pre-existing waste stocks, as well as offering customization services to customers who want to create their own pieces (Atelier & Repairs, 2019).

By responsibly linking creativity with sustainability while transforming obsolete things, and old stocks, the firm has embraced the circular production cycle. A cyclical process is built by redesigning reclaimed clothing and textiles using creativity. Aiming for 100% transformation by re-imagining an existing product, the company is transparently redefining the applicability of a circular system and a global standard. The company, which cooperates with the industry, brands, and manufacturers with innovative thought, basically does not produce, it transforms (Atelier & Repairs, n.d.).

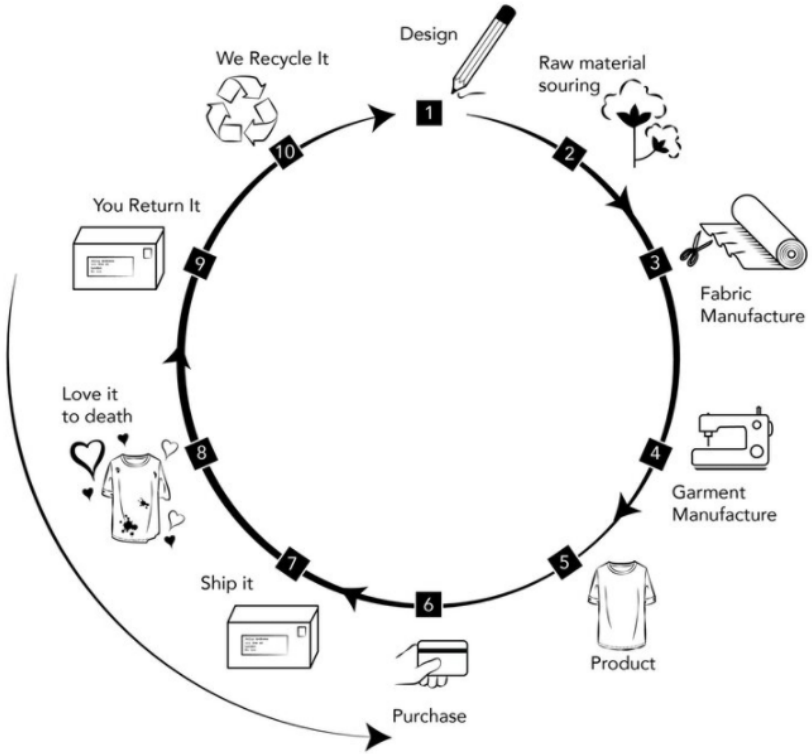

Figure 4. Circular lifecycle (Source: One-kind LTD, 2021)

Hence, the choice of material, color, and model during the design phase determines how much water, energy, and chemicals should be used in the production phase. During the material selection, features such as the source of the raw material, the chemical treatment it undergoes, and the suitability for recycling after use determine the degree of this environmental impact. Therefore, design planning should

be done by considering its environmental and social effects. According to the McKinsey 2022 report, fashion companies need to work with both upstream partners and downstream retailers to make real progress. It has highlighted the importance of collaborating with non-fashion companies and technologists to accelerate change for sustainability. In addition, it was stated in the report that no part of the value chain can create sufficient impact on its own, and that meaningful change requires a concerted effort across the industry and sufficient investment in related technologies. Sustainable decision making in the design phase, material selection, waste generation and recycling adoption of companies should guide the process that need to act according to a climate strategy to achieve net zero emissions (McKinsey, 2022).

One of the most important steps of slowing down in fashion is to increase the lifetime of the product. Models that are timeless, comfortable, customizable, and produced with quality craftsmanship are effective ways to increase their usage time. Therefore, it could be said that the cyclical model creates a planned quality, recovery, and transformation against the "planned obsolescence" (Gregory, 1947) of the clothes adopted in the design and production processes created by the linear model and turned into a demand creation tool.

Consequently, it has been emphasized that the vicious circle created by this linear economic model can only be changed with a new economic model that can be developed in line with the sustainable approaches of the system, by putting forward the necessity of creating a sustainable structure that takes into account global interests instead of individual interests and acts with a responsible consciousness by thinking about future generations (Koszewska, 2018).

2.3. Slow Fashion Movement

Many philosophical movements/approaches have emerged under the umbrella of sustainability for the solution to the global threats created by the fashion industry. The slow fashion movement, which is thought to have a more diffuse identity compared to many organizational structures such as slow city and slow food, protects local knowledge, talents, and traditions by adopting transparent and fair production methods that support a certain local economy, unlike global.

The concept of slowness that we encounter as an activist movement shaped in this direction was initiated by Carlo Petrini in Italy. The "Slow Food" movement, which was initiated under the leadership of Carlo Petrini and Padovani. This movement aimed to create a gastronomic culture by creating a deeper knowledge about local traditions, resources, production capacity, alternative production, and consumption methods. (Petrini and Padovani, 2006) “Slow Food”, which is the first spark at the beginning of a real transformation in fashion, protects and supports the local people who play a significant role in sustainability by valuing traditional knowledge and competence. It creates an honest and fair environment for a transparent and safe relationship between the designer, manufacturer, and user. It aimed to protect the environment by using natural raw materials, following the rhythm of nature, and creating a sustainable value. While Sass Brown describes a structure that can survive without consuming natural resources, Viktor Margolin supports this situation with his idea of sustainability culture (Margolin, 1998).

The slow food movement, created by the resistance of those who want to preserve their culture, led the fashion industry to publish a slow design manifesto in 2006. The concept of slow fashion, which should not be seen as a reaction to fast fashion, suggests a more careful and conscious approach to repositioning design, production, consumption, use, and reuse strategies. With this approach, it poses possible objections to the fundamental pillars of the global system (Clark, 2008).

The concept of “slow fashion”, was created by Kate Fletcher in 2007 (Fletcher, 2007), and it represents a movement in which production and consumption processes are slowed down and the producer, worker, and environment are protected. It aims to transform the structure of 'planned obsolescence' and 'use-dispose-society' (Hawley, 2011) due to the slow fashion movement that opposes the consumption culture created by the linear system of design, production, consumption, and destruction processes. Therefore, the concept of slow fashion, which offers a sustainable alternative to fast fashion, follows a slower, craft and experience-based process in production periods.

Emphasizing that the global system should slow down, this movement is about producing and purchasing designs with slow production schedules, fair wages, low carbon footprint, ideally zero waste, quality, and longevity. This movement, which aims to overcome the idea of clean design, adopts an ethical and transparent approach

in all production stages while using local resources (Clark, 2008). In addition, the slow movement that supports local capabilities has the potential to re-emerge forgotten local and regional styles.

With this movement, which aims to be socially and environmentally conscious and raise awareness, it is expected that all stages are presented to the consumer with transparency open to inspection, where the entire production process is examined. The Slow Fashion movement brings models for a more socially sensitive design. Clark, while questioning the relationship of fashion with the new, characterizes the tendencies of reuse, recycling, and upcycling as the tools of the slow fashion movement as a revolutionary approach. The cycle of the slow fashion economy, which develops against the social and environmental effects of fast fashion, reveals a structure that slows, repairs, and improves with solidaristic collaborative thinking along with the sharing economy models.

Hazel Clark, who outlines the concept of slow fashion within the framework of three lines, (Clark, 2008)

1) Transparency in the production and consumption cycle,
2) The use and valuing of local resources
3) Defines the ability to create long-lasting and durable designs emotionally and physically with environmentally sensitive materials.

While Clark examines transparent production systems with less intermediation between producer and consumer, she was talking about the hierarchical structure between designer, consumer, and producer (Clark, 2008).

Fashion does not have to follow a market-oriented mindset imposed by the global system. Rather, it should be free of choices and tools to express identity. which, would cause the emergence of a new, emotional, quality, aura (Atalay Onur, 2020) entering the person's self-image and the clothes worn. Therefore, sustainable and sensorial products with a higher added value than typical consumables would have a long service life.

It may be necessary to define a new fashion that covers the market value with the principle of more subtle, foresight, and slowness based on the relations of existing

clothes with individuals. The Emily Spivak collection is an example of this situation (Worn Stories, 2017). In this context, the ways of using clothes shape our relations with them, and our daily use practices with clothes have the authority to initiate change by turning it into a craft (Fletcher, 2012).

While appearance and label determine the fashion value of the brand in the global system, slow fashion is the valuation of daily lives as a part of individual styles. Slowness, which is a qualified and responsible way of life, aims to produce timeless and quality designs rather than short-lived, seasonal, products. In this context, it is aimed to encourage the creativity of the consumer while offering versatility in designs with capsule collections created in a certain style in minimal numbers and limited colors. Despite the destructive effect of irresponsible production, slowness suggests a circular, transparent, fair system, while allowing the creation of more emotional objects in the longer term. Fletcher believes that the creation of emotional objects is under the control of designers, and states that material quality is not equivalent to emotional durability, but a conceptual bridge can be established with fashion-based formatting (Fletcher et al., 2012).

Emphasizing that the way we use clothes is an accidental result, Fletcher states that making a daily garment emotionally durable is a way of embodying its identity, depending on functionality (comfort and warmth) and an emotional value (family roots). In both cases, fashion needs a process to become emotionally stable. (Esculapio, 2020) It could be said that the purpose of emotionally durable design coincides with the goals of slow fashion (Fletcher, 2010).

Otto Von Busch's work "Abstract Accessories" presents an example of an emotionally durable design. The project refers to a textile kit called "Textile Punctum", which encourages bringing out the existing stains by working with the contour. This kit, which includes red thread and a needle, helps the stains become a decorative element while keeping their stories alive. Thus, since the emotional value of a garment that loses its monetary value increases, it becomes a garment with an identity, regardless of the material, as a deep relationship is established between the individual and garment. Therefore, it transforms into an emotionally durable, meritable garment (Busch et al., 2014).

Although handicraft production is more expensive and more labor-intensive than machinery, it makes the product and its designer valuable (as far as the fair wage is paid for the workers). Clark also mentions examples such as Tord Boontie, a product designer who helps re-evaluate and maintain cultural practices by reviving lost handicrafts. In addition, productive communities formed by the combination of local communities and transparent production systems constitute one of the important pillars of sustainability and slow design (Clark, 2008).

One of the brands that can be shown as an example of this situation is Rozenbroek who is a sustainable clothing brand founded by British women, is a brand focused on design and durability. It was founded by Jade Rozenbroek to offer an alternative for conscious consumers who are aware of the environmental effects of fashion. All Rozenbroek garments are designed in London and handcrafted, sustainably and ethically, in their solar-powered factory in East Yorkshire. Using only organic fabrics, the company sources its fabrics locally as much as possible, with the majority of its fabrics from Europe. The company, which obtains its buttons from Corozo or the walnuts of the Tagua Palm of Ecuador in England, offers a 100% natural, ethical, ecological, and sustainable alternative with "vegetable ivory". Using organic materials to reduce the environmental impact on soil and air, the company manufactures its products in small batches or to order. Avoiding overproduction and use of unnecessary materials, the company strives to promote longevity and value with its repair and recycling service. Working to create the change needed in the fashion industry, the firm is giving power back to the consumer to help eliminate fast fashion (Rozenbroek, 2021).

Briefly referring to local cultural practices, the use of hand skills (such as sewing, knitting, eco-printing, deconstruction) brings along a transparent production system. Indicating that the roles of designer, producer and the user may need to be redefined, this slowness reveals information including production location and methods, conditions of workers, to environmental impacts with transparency. This source of income gives rise to the "distributed economy", which is a network of local systems that provides an alternative to the uniform global system and identical products. The sense of responsibility and trust created in craft production, in which there is collaborative production in its nature, increases the commitment to the local

culture. (Clark, 2008) There are fewer intermediaries between producer and consumer in “distributed economies”, which consist of the local community and a global network of local systems. Therefore, it is subject to less interaction than traditional retail (Clark, 2008). While transparent production systems with fewer intermediaries between the product and the consumer create a more ethical system, they increase consciousness and awareness. Therefore, small-scale and ethically inclined companies aim to educate the consumer about the design, production processes, material information and raise awareness while telling the stories of their brands and selling their products. To illustrate this situation, Darwin's Botanicals brand, which uses the ecological dyeing method (Figure 6. Ecological Dyeing) with a production based on experience and creativity, raises awareness with its didactic approach, by saying, “Someone's trash, someone's treasure”. This brand was founded by Tuğay İlyasoğlu Güven in 2017, offering pure and nature-friendly products that are dyed only with colors obtained from flowers, fruits, leaves, seeds, and roots of plants, without using any chemicals for a waste-free and more sustainable world (Darwin’s Botanicals, n.d.).

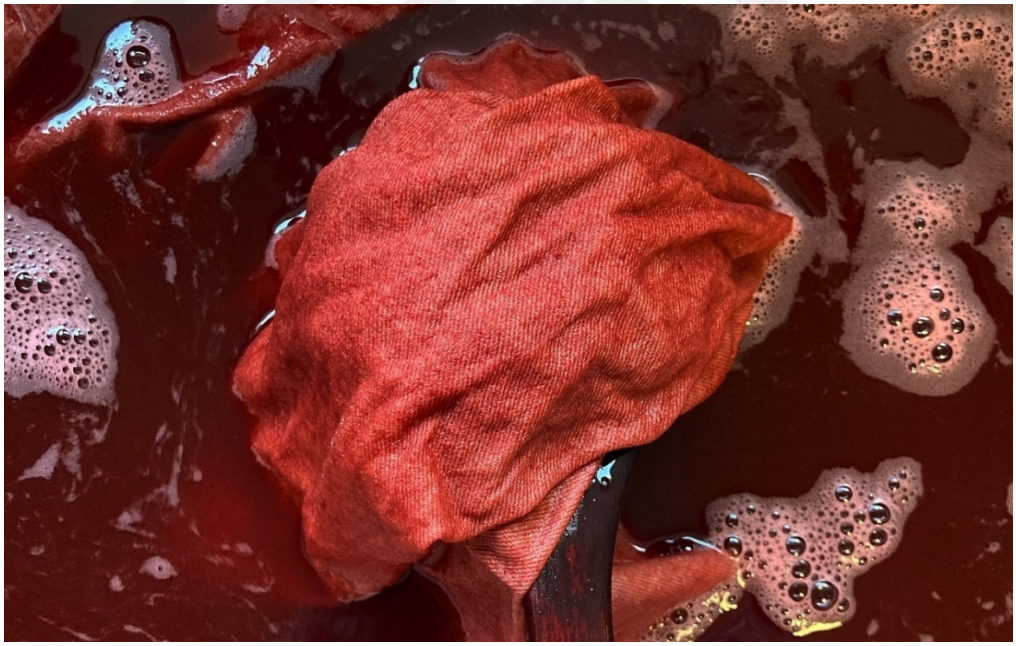

Figure 5. Ecological Dyeing (Source: Darwin’s Botanicals, 2021)

Design-oriented initiatives that have adopted slow strategies, while emphasizing a slower fashion, transparency, and traceability, offer a creative, qualitative, innovative recipe for production. This innovative production recipe is the result of an experimental process based on labor and practice, and what makes it new

is the blending and interpretation of material culture, that is, craft practices from the past to the present, with a highly developed skill (Sennett, 2008). In this context, it is possible to examine slow fashion design practices, which consist of an experience-based process, under 6 headings of slow fashion design methods: "Repairing/Mending, Upcycling and Reconstruction, Multi-functional and Adaptable Design, Natural Dying, Needleworks Techniques, Hand Weaving, Hand Knitting". In addition, the relationship of these seven topics with the participatory design approach and the do-it-yourself movement is important for the widespread use of slow design methods and the creation of emotional sustainability. Thus, the consumer, who realizes that meaning is more important than appearance, turns into a producer who values objects and asks why. According to Sennett, they have now turned into cultural materialists who establish a permanent bond with the object, who have a good eye for emotions, and who desire to design where happiness lies (Sennett, 2008).

2.3.1. Slow Fashion Design Methods

Many design and manufacturing aspects of the fashion industry mainly consist of craft-based practices. Despite advances in presentation and marketing, designers create garments by cutting patterns, using tailoring techniques, sewing, or embellishment at the custom design levels (Black, 2018).

While the fashion design and production processes shaped by the growth of the industry gradually moved away from the craft, it created an army of clothes that are isolated, uniform, and without identity in the design and production processes. In this context, the slow fashion movement acts like a time machine that unearths handcrafted methods.

Slow fashion, which is the bridge between body/memory/clothing, according to Kate Fletcher, arises from the natural characteristics of the individual, experience, culture, relationship with body, and product. When the approaches and methods in the design and production processes are examined within the scope of the principles of the slow fashion movement, a wide range of methods could be found. The slow fashion movement, which encourages more emotional connection between the wearer and the garment, uses traditional methods based on handcraft (such as weaving, needlework,

embroidery), repair, upcycling, restructuring, reuse, DIY, flexible design mathematics with zero-waste strategy. Moreover, it builds a story-intensive and emotionally sustainable structure with multifunctional design strategies and methods such as primitive printing and natural dyeing.

With fashion's "planned obsolescence" strategy and "use-dispose-society" structure, basically, new clothes have been defined as waste. Against this vicious circle that feeds each other, the design methods that developed with the planned recovery strategy instead of the "planned obsolescence" strategy have reshaped the perspective that has developed against the concept of waste.

2.3.1.1. Repairing:

This concept, developed under the umbrella of sustainable fashion, is the definition of a satisfying process based on practice, experience, and time. It is to design a new method that produces a solution to a problem on the basis of recreating existing ones and producing possibilities instead of new consumption. In other words, the repair is the definition of an improvement process; It is a garment care application in which a worn, torn, or damaged piece is restored for reuse and enjoyment (Farrer, 2011).

This process, which may involve techniques such as knitting and patching, reinforcing seams and panels with new material, or replacing missing or faulty elements such as buttons and zippers, should be considered an integral part of the garment's lifespan. The process that encourages the establishment of long-term relationships with the clothing used is the practice of repair itself, and it is a creative journey that does not have to be done with certain principles and there is no right or wrong. Visible repair is a repair technique based on the free-forming technique and handicraft (Caldecott, 2021). This intentionally made visible repair process is the case of making the repaired areas of the garment a feature of the garment by using invisible mending is a repair technique that consists of reconstructing both the warp and weft using a long needle (Jacomet, 2012). After the warp and weft have been reconstructed to fit the original weave exactly and the garment has been pressed, the repaired part will remain behind the fabric. Also at the back, the restored area will be marked with long ropes of weaving. Unlike patchwork, invisible mending consists of a seamless

making process, as dangling threads can deform the fabric. Japanese visible repair techniques called Sashiko or invisible repair practices such as Rafoo art in India can be given as examples of this situation. It is possible to reduce the destructive environmental impact of fashion by re-remembering. In other words, it is possible to reduce it by re-remembering the skill-based practices that define the culture and make the industry forget. Just as Otto Von Busch phrases “Repair Against the Machine” in response to the consumption industry which has forgotten its repair skill in the past (Busch et al., 2014).

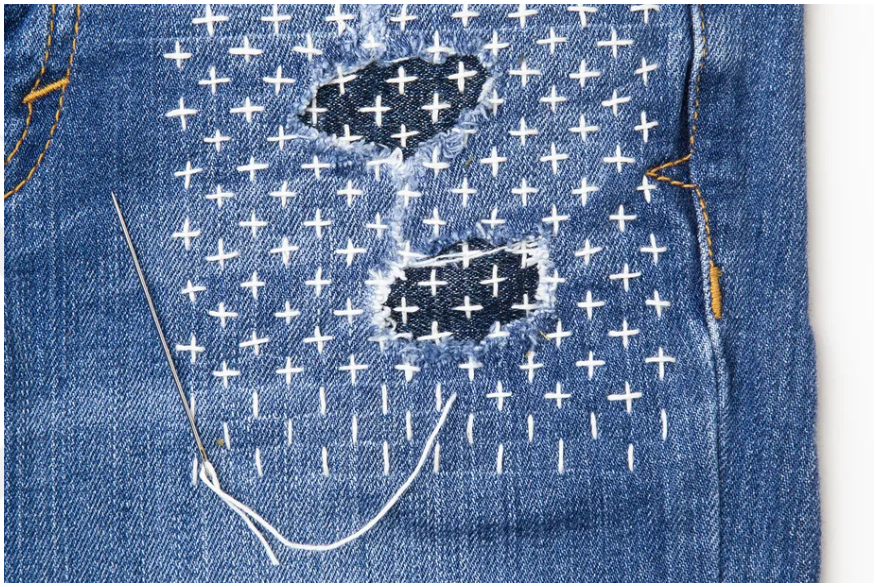

Figure 6. Japanese Art Sashiko (Source: Vox, 2019)

On the other hand, in Papanek’s book, Design for the Real World, he emphasized that normalizing the disposableness of the things we use has detrimental consequences for the environment, social justice, and for our personal relationships and that they become disposable items in their relationships (Papanek, 2019). In this context, he emphasized the importance of taking responsibility and caring for the causes and consequences of actions. Repair, which is a creative practice in which everyone will discover the craftsman within as a responsibility and by designing new ways (Odabaşı, 2021), is a reflection of the user's transformation into a healer for himself, the garment, and the world. Kate Sekules, a writer and producer who is committed to repairing clothes with visible repair, has started a challenge on Instagram with #MendMarch, while repairing all holes and ripped pieces and clothes with great

amateur spirit (Sekules, 2020). Turning into a magnificent visual feast, Instagram has become a gateway for different ways of doing and applying (Visible Mending, 2022).

Figure 7. Visible Mending Techniques (Source: Heartful Stitches, 2019)

For example, Clothes Doctor is a UK-based business that provides sustainable clothing care. It promotes slow fashion and a culture of repair by renovating old leather jackets, while promising new life to garments, restoring holes in old sweaters or restoring function by shortening the sleeves of blouses. Offering online change, customization and repair services, the business raises awareness. Believing that every new garment should be a lifelong friend, the company encourages consumers to join the repair movement, preventing clothes from falling into landfills and encouraging consumers to take steps to adopt a more sustainable wardrobe (Clothes Doctor, n.d.).

Another business example in the UK is Make Nu, the firm that invites people to re-question and redefine ideas about 'waste', by showing consumers a more sustainable way of using their wardrobes, raising awareness and aiming to guide change of consumer habits. Aiming to provide a perfect door-to-door service, the

company only works with local embroiderers, weavers, knitters and tailors during the repair process, which takes 1-3 weeks. In addition to repair and alteration services, they also sell a range of garment care products to add new meaning and value to your garments, as well as cute patches and embellishment services (Make Nu, n.d.).

Another business that offers a range of repair, refitment and tailoring services is Old Flame Mending in Pittsburgh, Pennsylvania. Collaborating with customers to decide on the best repairs and alterations for each garment. The business also offers digital gift cards and repair kits, indicating that their customers have chosen not to participate in an exploitation system through their practice of mending garments. Thus, it contributes to the spread of slow fashion and repair culture from the past with its repair gifts and practices. As long as it's made from fabric, no matter how damaged it is, the business strives to "fix everything but a broken heart", with a small but empowered team dedicated to helping keep clothes out of the landfill, with a history of sewing and design, creative problem solving and collaboration (Old Flame Mending, n.d.).

London's only private, vintage remodeling studio and repair service, Splendid Stitches focuses exclusively on vintage reproductions alongside clothing from the 1920s to 1980s. Splendid Stitches helps with how to use carefully made, decades-old vintage and heirloom pieces with the right care, while allowing for changes to be made (such as shortening and resizing parts). They also offer everything from repairs (like replacing broken zippers, fixing rips and patches) to replacing old linings or redesigning something new from something old (Splendid Stiches, 2017).

The Seam, which provides maintenance and repair services for individuals and brands based in London, offers a platform system that allows you to search for local manufacturers specializing in the type of project, where all kinds of repairs and measurements can be made. In order for the user to find the service they need, it is sufficient to use simple search filters to discover local producers in their location. You can even request manufacturers to visit you for an assembly support at home or at work, so that it is possible to make the process of repairing or changing clothes as smooth as possible. Helping to revive a culture of mending and upcycling, these businesses contribute to making the mending movement more inclusive by

strengthening the skills of artisans and makers who know how to make loved clothes permanent (The Seam, 2021).

As Orsola de Castro, author of Loved Clothes Last said:

> "*We don't redesign and mend clothes because we can't afford to buy something new -we do it because we can't afford to throw something away*." (Castro, 2022).

Because producing waste is part of a process that has devastating effects both financially and environmentally.

2.3.1.2. Upcycling and Restructuring:

Upcycling, which is one of the recycling applications that aims to change the linear process into a cyclical process by transforming the last step of the process into the first step, is a term used to emphasize the products whose value is increased by the conversion or personalization process. This circular design method, which is the equivalent of transforming the material and quality of used products into another form, is a concept that aims to create or replace a new product from outdated, worn or production waste materials, to produce components and original products with the same or higher quality value. This method, which is a form of recycling in which discarded materials or products are transformed into items of higher value from the original input, is the practice of reuse by transforming unused by-products, waste materials, useless or unwanted products into new materials or products that are considered to be of higher quality, such as artistic value or environmental value. For example, it involves using pre-consumer waste materials such as leather, polyester or neoprene scraps from the outerwear industry to make bags and other accessories or turning good quality old clothes into new products (McDonough and Braungart, 2010). This method, which aims to produce with reuse, argues that waste or old materials should be combined with creativity and turned into a qualified product (Zhi, 2022).

Martin Margiela, who graduated from the Royal Academy of Fine Arts in Antwerp in 1979, is a successful craftsman who has created a contemporary art influence in fashion. Known for his post-modern and anti-fashion designs, Margiela has developed a passion for abandoned objects and forgotten places and events, giving

them new honor. Margiela defines the upcycling method as an analytical creation process that reveals a paradoxical relationship, as it creates a new fashion while destroying fashion. Belgian designer Margiela questions the traditional understanding of fashion and the concept of “new” in fashion while rethinking the relationships between fashion forms, functions, and ideology constructed by clothing practice. It is about making the object more valuable, more desirable than it used to be, through the transformation process, which represents much more than just using old materials. Margiela, who adopts the upcycling method has transformed waste materials such as old shoes, clothes, gloves, and wigs into a new contemporary form by shaping them with a design journey that covers an experimental process. Upcycled clothing, which is highly qualified and very fashionable, has also led to the repositioning of clothing at the top of a prestige hierarchy, removing the concept of secondhand from its relations with the poor and working classes. Transforming textile and clothing waste into a desirable object with high commercial value, Margiela has criticized his consumption habits while creating quality and unique fashion. While taking a stance against the system created by the global fashion industry, he has emphasized that what is valuable is not “new” but labor-intensive craftsmanship that brings the craft to the fore. Thus, the waste takes on a useful and qualified identity (Fletcher, 2008).

Another example is Gönül Paksoy, who combines old Turkish fabrics and accessories with new fabrics and creates simple, useful, and timeless designs that can be used at any time (Türkmen, 2009). With her design approach shaped by the feelings of “respecting, protecting and keeping alive the old”, she has given life to the fragile, worn and damaged antique fabrics by repairing them with labor-oriented techniques based on handcraft. Protecting the cultural and material heritage, Paksoy has created the first examples of the Upcycling method. 'Reconstruction', a form of upcycling, represents a more activist stance against fast fashion and consumption culture, while creating a method that focuses on waste materials. It is the process of making new garments from wastes from pre-worn garments or pre-formed finished garments (Zhi, 2022). This process involves first deconstructing the garments and then turning the waste materials into new designs. This multi-layered creation process presents design mathematics, and design engineering, with pathways in the creation process. This practice, which is a rebellion against the culture of mass consumption that transforms the relationship with clothing, is an activist stance (Living Fashion, 2013).

Figure 8. Reconstruction - Clothing Design (Source: Inhabitat, 2016)

Ahimsa fashion (Kipöz, 2015) could be handled in this context while building responsibility, care, and solidarity; it creates a civil resistance ground for the slow fashion movement, which is fed by mistakes, personal touches, and by putting the labor-oriented production understanding on its backbone. In this context, Kipöz, stating that the collaboration of cultural structures in the production of crafts with designers is effective in creating sustainability, has created a platform where different creative identities come together while revealing the conceptual framework of slow fashion with works created with a deconstructive approach. In addition, while aiming to prolong the life of clothes and reuse the old clothes which have stories, the concept aims to reach a deeper understanding of the philosophical and ecological world while examining the emotional relationship of the individual with itself, the collective, and the objects (Kipöz, 2015). With the same design methodology, the "salvaged leather" exhibition held in 2019 provided the recycling of idle leather jackets with a deconstructive approach. Drawing attention to the labor-intensive process in leather production and the toxic chemicals used, this exhibition features the works of different designers and artists. Organized as part of Good Design Izmir and created by Şölen Kipöz, the exhibition highlights craft and calls for the unethical story behind the leather.

Figure 9. Ahimsa Fashion Exhibition (Source: Kipöz, 2015)

Reducing textile waste is one of the main goals in the upcycling method, where the entire discarded garment is used to fix, improve and give a new life to the same garment. There are many brands that develop a sustainable approach by giving new lives to clothes. One of these businesses, Hidden Opulence, is located in Portland, Oregon. Combining inclusiveness, sustainability and uniqueness, it extends the life of well-worn clothes a little longer, while allowing valuable heirloom pieces to be renewed and repaired. While presenting a recipe that prompts the user to think about how clothes should be taken care of, it offers facilitating services that include attentive care (Hidden Opulence, n.d.).

Continuing its activities with the idea that repair is truly an art, Artful Menders is a UK-based business that aims to transform loved pieces into wearable works of art. Using visible and invisible repair techniques, the company continues its practices by following the understanding that "no part is too small or too strange". Aiming to bring clothes back to life and give them a unique edge and elegance, the company makes clothes “better again”. The brand, which writes a new story to be told with each garment, also offers various repair shops and events to convey how to bring a new breath to the garments. Thus, a new and permanent emotional bond is created between the product, the object, the user and the brand (The Artful Menders, 2020).

Another brand that creates new products from worn parts is RE/DONE. Extending the life of the clothes, the company revives childhood memories and

reminds us of the days when family heirloom jeans were re-evaluated. Working with Levis and Hanes, the firm sets a good example of circular fashion with its upcycled denims and sweatshirts that fight fast fashion (RE/DONE, n.d.).

Another brand that can be shown as an example of upcycling clothing brands is Rave Review. The company, which does more than offer a more responsible future with its products called modern careful, thoughtful and luxury fashion, reflects the values of fashion with its environmentally friendly initiatives, while pointing to an increasing awareness in the fashion and luxury sector (LN-CC, n.d.).

While the concept of Upcycling emphasizes the importance of reducing consumption and using resources correctly, it is actually a philosophy that encourages renewal by using existing materials. The rebirth of the product like a phoenix and its taking on a new form is formed by the blending of labor-oriented craft techniques based on handcraft and material culture. In their book "Cradle to Cradle: Remaking the Way We Make Things", McDonough and Braungart, who argue that no resource should be considered as destroyable, stated that efforts should be made to extend the life of the product (McDonough and Braungart, 2010). The "Upcycling" method, which encourages the designer to find solutions by approaching the problems more creatively and transforms the passive consumer into an active producer and user, turns the designer or user into a craftsman who encourages questioning of the role in prolonging the life of the clothes and asks why and how (Sennett, 2008). Although Upcycling is a value-creating process that supports creativity, ethical values, collaboration and divergent thinking, the main problem is overproduction. Therefore, in order to leave a cleaner world for future generations, the rate of rapid consumption should be reduced, it is necessary to focus on sustainable areas and to use upcycled products instead of producing and purchasing new products.

Figure 10. Upcycled Clothes (Source: Forte-Forte)

The culture is transferred by the methods, which also tells stories through the traces on the fabric. With time changing, these stories turn into a wardrobe that covers a life in the material. Therefore, wardrobes become a collage of memories passed down from generation to generation. It is extremely important that the stories that create these objects are in contact with traditional production practices that represent a slow fashion. Therefore, methods that create a friendly environment that allows consumers to trust products that are produced locally in small quantities and within the transparency of the supply chain, using natural ingredients and quality materials, have ensured that the clothes last longer (Fletcher, 2010).

2.3.1.3. Multi-Functional and Adaptable Design:

This method, which is a design strategy developed for the efficient use of resources, also constitutes an important building block of slow fashion design methods. This slow design method, strengthened by smart design strategies, challenges the clothes that repeat each other and serve a single purpose. Garments made with a multi-functional and adaptable design method are garments that can be transformed, that allow variability in terms of use, are self-renewing, and can adapt to changing conditions. Therefore, the fact that a single design can be used in numerous ways makes it possible to use energy, time, and resources effectively. The concept of transformable garments, which is used to describe garments that offer two or more functional and/or aesthetic alternative styles, includes various manipulative methods

such as wrapping, tying, rolling, twisting, tying, folding, and collecting a garment, as well as a transformation that takes place without a change in form and silhouette. includes the process (Çeğindir and Öz, 2020). Thermoregulatory clothes with smart and smart textiles can be given as an example to this situation (Rahman and Gong, 2016).

This design style, which offers many options instead of imposing a certain form, allows the user to be freer in their usage practices. In addition, this design method allows establishing a deep connection with the object by producing an active and democratic application practice by involving the user in the transformation process (Atalay, 2015). The creative participation of the user can bring change and innovation even from an old and used garment. Thus, as the wearer's tendency to wear the garment increases, the service life of the garment increases (Black, 2008). Thanks to this strong bond created, as Fletcher said, the throwing of clothing wastes to the landfills will be postponed as well as the psychological aging of the object (Fletcher, 2008).

Figure 11. Yohji Yamamoto's wedding dress. (Source: Mara Marietta, 2021)

To illustrate; Yohji Yamamoto's wedding dress, which was exhibited in the V&A Museum “Fashion Radical” exhibition in 2001, can be considered the best example of transformable design with its intense skill-based and multifunctional structure. Another example is the garment prototype of Rahman and Gong, which can be combined using a modular and functional design method, which could be considered a successful example that creates a smart and powerful design language (Rahman and Gong, 2016).

Figure 12. Multifunctional Garment Prototypes (Source: Rahman and Gong, 2016)

An example of adaptable design is Petit Pli, which started a sustainable revolution in children's clothing with its “growing clothes”. It was founded in 2017 by aerospace engineer Ryan Mario Yasin. Inventing and implementing breakthrough material technologies that solve problems for individuals, businesses and the planet throughout the textile value chain, the company states that garments must be versatile, comfortable, contain only the essentials and be extremely durable. The company, which develops all innovations within the scope of these criteria and continues its activities in accordance with strict environmental policies, has focused on producing designs that truly meet human needs by reducing their water and carbon footprints and the need to constantly buy new clothes. With a gender-neutral clothing culture, garment life is extended with products versatile enough to adapt to a wide variety of body shapes and sizes, styles, activities and purpose. Thus, it contributes to the

reduction of 20-30% carbon and water use. Petit Pli, a small company with big ambitions, consists of an agile team of interdisciplinary design engineers, fashion designers, neuroscientists and sociologists, obsessed with responsible consumption with its innovation-oriented structure and inspiring future generations to value and use their clothes less (Petit Pli, n.d.).

2.3.1.4. Natural Dyeing:

It is the process of using natural dyes with primitive methods based on practice and experience from materials obtained from natural resources. Plant roots, plants, minerals, insects, leaves, flowers, bark, rocks, fruits, and vegetables are the protagonists of this natural dyeing method. In this magic painting process based on implicit knowledge, effort, practice, and experience, natural materials need to be adapted to their own dynamics. In addition, one-to-one fiber and dye plants are used in natural dyeing processes. This process, in which completely natural fibers are used for the adhesion of the paint, requires both momentary like art and intense labor and practice like craft, Sennett mentions (Sennett, 2008). In order for this method, which represents a labor-intensive, experience-oriented and slow process, to be adapted to the industry, it is necessary to benefit from financial support and systems for reducing the amount of water used. Therefore, a large number of dye plants are needed for industrial production.

Although dyestuff plants such as root dye (Rubia tinctorum) and indigo are produced agriculturally, which means that they are not cheap to afford (Kökboya bitkisi, 2007). Commercial dyeing methods with dyestuffs obtained from plants are very expensive, and it is a difficult method to be applied industrially. Metal salts such as copper, chromium, zinc, and tin, which are known to have negative effects on human and environmental health, are used as binders (mordant) during dyeing (Yeşilist, 2017). The tradition of using these toxic metals as binders continues in many academic studies. While it claims to make ecological dyeing by obtaining the dye from natural sources, the metal salts used as dyeing aids cause more harm to nature and therefore to humans than synthetic dyes. For this reason, when dyeing with natural dyestuffs, it is obligatory to choose all chemicals among those that are harmless for humans and the environment and to use them in the least amount. Natural dyeing methods are divided into two according to their application methods. "Eco dying" is

the process of combining dyes obtained from living things that are offered by the universe and that can renew themselves, with fabrics containing natural fibers. The first step is the mordanting process in order for the dye to adhere to the fabrics containing natural fibers. The process, which continues by applying heat treatment to fabric and paint, that is, by boiling, is an experimental process. In addition, each technique is named differently according to the tying techniques and the plant varieties used. Eco print, which represents a magical reflection of plants, is a process that depends on heat treatment, that is, boiling, by binding the leaves and flowers of the plants after they are wrapped in fabric after mordanting.

It is defined as an eco-print, also known as ecological printing, printing with plants, botanical printing, to remove the dyestuffs in plants directly to the fabric by heat treatment. It is thought that the creator of this method, which is based on ancient techniques, is India Flint. In this technique, where metallic salts or chemical materials are not used, leaves that are ethically collected from nature with rituals are embroidered into the fabric (Flint, n.d.). It also consists of experience-based methods including natural dyeing, organic indigo, and traditional printing methods. Hapa-Zome, which is a direct printing method in which the paint is not removed with a hammer, is one of these methods. In addition, It includes techniques like cooking in the sun, removing paint by cold method, printing with natural dyes, traditional dyeing, and printing, printing with molds made with wood and other materials, etc. (Irwin, 2020).

Figure 13. Natural Dyes from vegetables. (Source: Her Zindagi, 2020)

Also, in Japan, where traditional handicrafts are cherished, Blue Japan, as the name suggests, uses traditional Japanese craft techniques using pure indigo dye. The Kapital brand, founded in 1985, specializes in indigo dyeing using both Batik dyeing (shibori) and resist dyeing (bassen) techniques to create garments, each with its own characteristic finish. The brand, which combines the production of old American workwear with Japanese handicrafts such as Boro technique (patchwork like mozaique), is known for the denim it created. Founded by Toshikiyo Hirata, Kapital combines traditional Japanese techniques like upcycling and natural dyeing with contemporary aesthetics. The silhouettes and production methods, which feature heavily from both ancient Japan and mid-century America, are at the heart of the brand's designs.

Although it is one of the slow fashion methods, the amount of water used during the process is a lot, but it is a more sustainable method compared to the dyeing methods used in the fashion industry since the production quantities are not very high. On the other hand, some craftsmen using this method have carried the process to a more harmless dimension by collecting rainwater or making use of the washing machine. Therefore, with the widespread use of natural dyestuffs, while the world becomes less polluted, people have the opportunity to consume healthier products. The method, which emphasizes the impact of the fashion industry, cheap labor, and fabrics drenched in pesticides on the world and the environment, basically reminds us that the starting point of all these is ecology.

An organic fashion brand that uses traditional Japanese shibori techniques, Modern Shibori uses plant-based dyes to create beautiful, labor-intensive garments. The company, which produces natural fabrics such as GOTS certified organic cotton, GOTS certified linen and hemp grown in the USA, was founded by designer and natural dyer Jenny Fong. For colors, Fong uses non-toxic aluminum salts to create her dyes from plants that are locally harvested or even grown on site, such as rosemary. The company, which produces in small quantities, is a craft-oriented business dedicated to its work to implement more sustainable practices (Modern Shibori, 2020).

Sustainability, a children's initiative, is a business committed to creating the cleanest clothes possible. The business uses 100% organic fibers such as linen and cotton, natural dyes and even organic yarns, and those that use only safe and healthy

dyes in plant areas such as madder, indigo leaves, myrobalan rhubarb, pomegranate peel, oak leaves and logs. It is also produced by artisans in small communities whose practices of thoughtful living are in the same areas, slowly and locally in the US, or in India, where fair wages are growing and working widely (Modern Shibori, 2020).

California Cloth Foundry is a transparent brand that conveys the farm-to-product process using regenerative fibers grown in the USA or even locally grown in California. Using natural dyes such as indigo, madder, chestnut, spring (derived from a flower) and more to color its clothes, the company uses minerals such as calcium carbonate and iron to deepen and expand its color range and apply its dyes to fabrics (Cloth Foundry, n.d.).

Another California-based example is Harvest & Mill, which has a fully localized supply chain. The firm, which supplies US-grown cotton, works with American mills to knit and finish their Fabrics in a cyclic pattern. All designs of the enterprise are produced without paint. However, it also offers options made of naturally colored cotton and colored cotton. Harvest & Mill uses a low-impact fiber reactive dye for its black colors and for its colored parts. It also offers some naturally dyed pieces with indigo and California clay (Harvest & Mill, 2021). Another US brand working with a make-to-order model is Gaia Conceptions. The company manufactures its clothes using sustainable and certified organic fabrics such as hemp, organic cotton (grown in the USA or Fair Trade certified from India) and organic merino wool, for a rich range of colors. Natural plant dyes or fiber-reactive low-impact dyes are used. All products are handcrafted and produced in Gaia's own studio in North Carolina (Gaia Conceptions, 2021).

Ziran, an Asian brand, partners with skilled artisans making Xiang-yun-shã silk in Southern China. The practice of creating this silk, which is the symbol of a century-old tradition, requires a lot of time and expertise. Covered with iron-rich mud, the silk is dyed with vegetable juice before going out into the sun. There is a chemical reaction between the iron and the tannins of the juice that transforms the silk. In its finished form, Xiang-yun-shã silk reflects the magic of nature with its crease resistance, super soft texture (Ziran, n.d.).

The designer of KZ_K Studio, Karolina Zmarlak, who collects the material from Food Textile, a manufacturer that extracts dyes from food waste, uses organic cotton in her knitting, which she colors with rooibos tea, red turnip, blueberry, coffee bean and matcha dyes. The use of organic materials is critical to the natural dyeing method for the dye to adhere to the fabric. Using indigo dyes from Mexico, India and Indonesia to color many of the cotton, silk and linen items in her collections, designer Sheena Sood has prepared a dyebath using fresh indigo leaves found in Indonesia, fermented and reused continuously for several years. It creates sustainable value that Sood will work with a cooperative in India called Oshadi, which grows organic cotton and dyes these services using local flowers and bark rather than procuring them separately (Kz_k Studio, n.d.; Abacaxi, n.d.; Prokos, 2019).

In addition, providing a DIY kit, which transforms the consumer into a producer with plant dyeing kits, clothes and second-hand items finds the opportunity to start a new story. Fibershed offers a range of locally and regeneratively sourced plant dyes. There is also a wide selection of natural dyes available on Etsy.

Today, there are many joint workshops organized in this context. In these workshop practices where tacit knowledge and experience are shared, Beste Bonnard allows writing a story that the user can produce instead of consuming, and thus establish a bond with the product (Yeşilist, 2017). When the object is not seen as a consumable and the object's story is focused on, it goes beyond being a throwaway thing. Therefore, the natural dyeing method, which is an extremely slow practice, emphasizes the importance of integrating with nature and reminds us of the ancient, tacit knowledge that the industry has forgotten.

2.3.1.5. Needlework Techniques:

Defining the difference between craft and art as time, Sennett defines art as instantaneous, and the concept of craft as the product and application of a long-term effort (Sennett, 2008). In this context, Handicrafts is one of the branches of art that meets the basic needs of human beings in order to convey their feelings and thoughts, and it is one of the artistic activities for production that reflects the taste and skill of the person who makes it. This mode of production, which is based on the knowledge and skills of the individual, is generally made by using natural raw materials and

reflects the culture, customs, and traditions of the societies and their folkloric characteristics (Öztürk, 1994). It includes rich methods such as "Embroidery, Punch, point lace, Wire Break Embroidery Technique" based on handwork among the "needle techniques", one of the methods used under the name of traditional handicrafts and forming the building blocks of material culture. Embroidery, one of the richest methods, is made of cotton or silk, white or colored, thick or thin fabrics. Sometimes it could be done on leather or felt, silk, wool, linen, cotton, metal, etc. Embroidery is classified under the name of needle techniques, considering the application forms, techniques, tools used, embroidery characteristics, appearance, the region where it is processed, and various features of the thread formed by guiding the thread on the top and bottom of the weaving (Yetim and Kayabaşı, 2007). "Punch", is basically a type of embroidery technique that creates a 3D effect. In this technique, instead of sewing on the fabric, the piercing needle pushes the thread into the fabric while keeping the needle on the surface. The result of embroidery with a punch needle creates a highly textured look made of loops as if embroidering a carpet.

Figure 14. Traditional Goldwork Technique. (Source: Hawthorne and Heaney, 2015)

One of the most important examples of traditional culture and handicrafts is lace. The "point lace" method is a type of lace whose technique is basically knitting, and it was born from the combination of flower and knitting art. Embroidery can be done using all kinds of techniques. According to the technique used; They are classified under names such as crochet lace, needle lace, etc. This technique, which was produced for the purpose of embellishing, was also used as a communication tool

with the messages they carry. When examined ethnographically, it is seen that laces are named with names that carry meaning. These naming's are of significant importance in terms of keeping folkloric values alive. It is also known that needle lace, which is three-dimensional and has a unique place in knitting arts, is not used as an ornament on its own. "Wire Breaking" is a technique known for its patterns inspired by lace and used since the 18th century, is a beautiful type of embroidery. It consists of motifs formed by the repetition of the "+" or "×" shape (Barışta, 1998). The craft, which is created by arranging a shape on the fabric according to the pattern or interspersing it at certain intervals, has taken this name because it is broken by bending the wire up and down without using scissors while embroidering.

This technique, which is applied with a special needle, is generally applied on fabrics with countable threads such as tulle, grepdemur, and domestic weaving (Erdoğan, 2021).

It is difficult to accept it as a very common method, since it involves a labor-intensive process based on handwork. However, it should be noted that sustainable fashion brands from different countries are trying to keep unique, local and original talents alive. In this context, the Sindiso Khumalo brand, located in South Africa, a country with a rich textile heritage, focuses on sustainability and ethical values, and textile and craftsmanship are at the center of its collections. Working closely with NGOs and small workshops in South Africa and Burkina Faso, the brand produces unique hand-woven and hand-embroidered textiles for its collections. Working with fabrics containing organic cotton, linen and hemp, the designer also uses embroidery technique in her designs. A Cape Town-based sustainable textile designer and social activist, Khumalo's impeccable garments are known for his signature hand-drawn and dyed motifs created by him. Used to tell the stories of extraordinary Black women excluded from the history books, these motifs took a slightly different approach to conscious production. Working on a make-to-order model, the business emphasizes the importance of embracing local production and celebrating local producers (Sindiso Khumalo, n.d.).

In response to the extreme industrialization of luxury fashion, the number of handmade items produced by independent artisans has increased. Another example that highlights the importance of dedication to craftsmanship is Chloé Craft, a new

label with a spiral logo that states it's made by global artisans introduced at the Chloé show in Paris, emphasizing that every culture has a craft history and tradition. Ceramic earrings and necklaces made of precious stones, braided leather sandals and clothes made of tiny crochet combs are some of the garments in this collection. This craft-oriented production method, which is not imitated by machines and made using quality materials and techniques dominated by only human hands, is an appreciation of craft-oriented practices, culture and manual labor, beyond providing transparency. It serves to draw attention to the handiwork of global artisans, as do the "Made in France" and "Made in Italy" labels.

Another brand that connects with people around the world to make a product, interprets international aesthetics using local materials and skills inspired by the things that surround us, is Péro. The company, which carries the Indian handcraft tradition forward with the unique pieces it creates and evokes a sense of culture, was founded by Aneeth Arora, who calls herself a 'textile and dress manufacturer'. Influenced by local people's clothing and dressing styles, the designer emphasizes that culture is a true trendsetter (Chopra, 2020). The brand, which makes crochet decorations in collaboration with Afghan refugee women. Another handicraft-oriented project is Locked in Love. The Péro brand has created a wide variety of handmade crochet collars for spring-summer 2021. Working closely with a group of talented Afghan refugees during this process, the brand used centuries-old traditional Afghan crochet designs in every collar it prepared. The pieces that are meticulously prepared according to the size are appreciated, the uniqueness of each piece is examined, and the infinity of the perfection of handmade is emphasized. Therefore, this technique, which is used for more special pieces beyond being a part of daily wear, represents a part of a deep story (Dangor, 2021).

2.3.1.6. Hand Weaving:

Weaving is a material that is produced from all kinds of raw materials that can be turned into yarn by spinning or other means, that is woven, knitted, or obtained by forming a whole by attaching the fibers to each other with different methods, apart from these systems (Cloth, fabric, knitwear, upholstery, carpet, rug, cicim, zili, sumac, blanket, felt, etc.) (Güleş, 2020).

Products created by interlocking two or more yarn groups in various patterns (under, over) with each other in various handlooms are called hand-woven. Handweaving is a method that should be studied under slow design methods as it requires intensive handwork and labor. It is the difference in the skill of each manufacturer, that is, each craftsman, which beautifies hand-woven weaving versus industrial production. Despite the imperfect perfection of mass production, hand-woven offers an imperfect beauty.

Hand Weaving is divided into four as Girth, Locked weavings, Shuttleless, and Shuttle weavings.

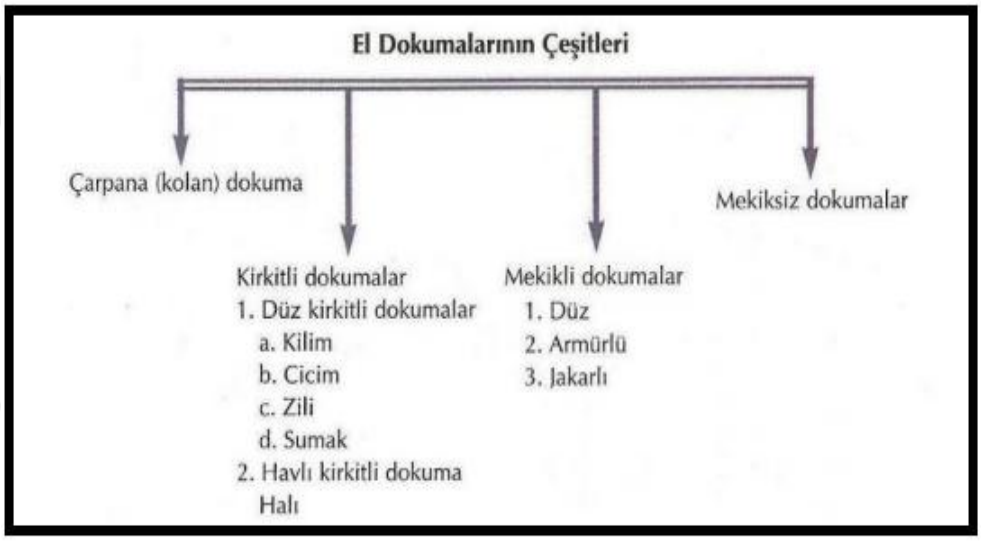

Figure 15. Traditional Turkish Hand Weaving Types (Source: Tekstil Bilgi, 2018)

This creation process, based on intense skill and craftsmanship, continues with the sharing of material culture, experience, and knowledge. Today, this craft, which is kept alive in small workshops, cooperatives, villages, and maturation institutes, is produced slowly and with natural materials. Some brands, which adopt slow design principles, produce in small craft-based production units based on the knowledge, skills, and experience of individually working weaving masters. There are many local brands that have created a hybrid design language by showing their respect for craftsmanship by using them at an advanced level in their designs (Turkmen, 2019). Representing the slow care that reveals the craftsman's hands from start to finish, weaving is an experiential manufacturing practice in which horizontal and vertical threads are combined to patch loose threads to form a whole. This practice of creation,

which covers many actions and processes, actions such as washing, warping, threading, tying, weaving, combing, knotting, mending, also has a meditative effect that creates space for the mind to wander.

The first step in the weaving process, which starts with a single piece of yarn, is to prepare it with vertical yarns (warp). It is necessary to measure precisely so that each warp thread is exactly the same length. All the threads being wound from a single thread create an endless wave of threads that stretch back and forth for meters.

Then the warp threads fed by the loom are rolled to the rear end of the warp loom. In weaving, which is the result of a loving craft practice, each warp thread must then be passed separately to the loom. In the action that takes place when the threads pass over and under the warp of the horizontal thread (weft), the careful touch of each thread by the hands of the producer represents an act of love, while it is a praise and appreciation for slowing down. Each production process encompasses a process that represents hours of repetitive labor-intensive actions. It allows the weft to pass back and forth horizontally as the warp threads are lifted and lowered. The slow combination of warp and weft interlocking to form a single fabric creates a magical power.

Bronwen Jones, the founder of Woven Slow, a project born out of a love for the slow nature of weaving, produces bandanas using Dead-stock natural yarns (such as silk, wool, cotton). Yarns consist of dead stock industrial yarns that were collected when many weaving mills in the Netherlands closed between the 1970s and 90s. The products of the enterprise, which gives new life and meaning to these yarns, which are in good condition but have not been used since then, are made to be passed on for generations. The productions made by Bronwen Jones in Amsterdam are woven with a slow philosophy, in minimal quantities and in a unique way, entirely by hand on looms. In every piece woven by hand on a table loom from the same yarn collection there are minor differences. Guided by careful selection of colors and materials, the process is highly experimental. Then it is finished slowly by hand by tying the ends of the weavings coming out of the loom or by weaving each yarn separately (Bronwenjones, n.d.). Crafted by a pair of hands, each piece has unique details and imperfections. Therefore, every part of the business, which sets out with the goal of making seasonal products that live with the user, which is immortal and softer and

stretches over time, is sustainable. Designer jones, who has products at two different sales points, Komok in Amsterdam and Kiku.Shop in Switzerland, which conducts workshops on repairing practices and transferring the craft (Kiku Kiku, n.d.). Trying to maintain a sincere and loving warmth with her products, Jones calls for slow consumption with every piece she creates (Jones and Perdeck, 2021).

The weaver, who feels every line that passes back and forth during weaving practices, also feels the right tension. The weaver, who seeks a balance in color and material, repairs a single thread when it breaks, and becomes a dialogue between the craftsman and the material. The artisan who listens and feels, uses all his/her senses to develop the fabric. Similarly, weaving listens and assimilates the feelings of the weaver. Therefore, between the touched product and the craftsman, in other words, between the one who produces, repairs, paints and transforms, there is a spiritual language, a magical bond beyond a material language.

Another brand that tries to bring a slowness to daily life with the weaving method is Slow and Woven. Leslee Fiorella, weaver and textile designer, develops modern designs. After working in the textile industry in New York for many years, Fiorella returns to hand weaving, which she sees as the essence of the creative spirit, by following a slow routine, creating space to heal the fast and dirty world (Slow and Woven, n.d.).

Working with Filipino artisans who weave their own stories and transform their own lives for the better, R2R brand started its journey by transforming unwanted waste fabrics into rugs and bags with the weaving technique. R2R, a fashion and design house empowering Filipino community artisans, now produces a wider range of products. (such as bags, clothes, home accessories) Working with a sustainable principle, the brand blends upcycling and weaving methods. The company, which actively seeks and supplies materials that consider sustainability throughout the entire supply chain, continues its activities with the principle of ethics and less waste. Utilizing surplus fabrics and local textiles in their production, the company establishes a fully integrated, inclusive supply chain in partnership with artisans, becoming the life and livelihood partner of strong and dignified artisans who seek to weave better futures for their families and communities. Co-founded by Reese Fernandez-Ruiz, Rags2Riches is inclusive and empowers women to create wearable artworks that

showcase their talents, craftsmanship and potential. Starting to partner with local designers to create high fashion pieces from women's wovens, the firm has also trained more than 1,000 community artisans. Upcycling thousands of kilograms of textile waste, the business continues to reinvest in communities through impact programs. The enterprise that creates social, economic and environmental value can also be considered as a good example for the weaving method (R2R, n.d.).

Brands such as Mah-Roc, Kaivrosi, El-Doku, Büruz in Turkey can be examined as examples of slow design in terms of design approaches and production styles. In addition, it is necessary to mention Fırat Neziroğlu, who successfully uses hand weaving techniques, which is one of our cultural heritages, in the design of clothes with abstract content and expressions and leads in the transfer of the craft with his collaborations and workshops with a unique perspective.

Figure 16. How to weave with wool. (Source: The Woolmark Company, 2017)

Neziroğlu, who designs forms as cloth and uses different materials with an upcycling approach to this “Tapestry weaving technique”, which is based on the act of creating pictures with the weaving technique, is defined as magnificent and illustrated wall weaving (Özay, 2001).

2.3.1.7. Hand Knitting:

Work such as spinning, weaving and sewing began in BC. Although it has been done for 5000-6000 years, hand knitting has been done in M.S. It was discovered in Egypt in the 600s. The first knitting processes were carried out with simple needles, spindles, and crochet hooks, which are still used today, until 1589.

Knitting is the technique of creating a surface, which is formed by twisting and twisting a single yarn on itself, fastening with various loops, reducing, combining, passing between, under, over, knotting, or entangling with simple tools used by hand. (Sissons, 2018; Türkyılmaz, 2008). Hand-knitted, which has been a part of cultures throughout the ages, has appealed to personal tastes with colors and patterns, along with its durability feature. Knitting practice, which is also used in clothing, home textiles, and decoration products, has been produced by using industrial materials as well as natural and synthetic fibers. Thick knits, socks, gloves, knee braces, dents, etc. Among these knits made with natural wool or wool threads dyed with natural dyes, there are those made with cotton thread. While the production of knitted fabrics has increased in order to meet the increasing demand with the acceleration of the textile industry, the interest in the way of producing hand-knit products with quality, natural materials has decreased. However, this method, the use of which increased with the emergence of environmentalist social movements that were effective throughout the world in the 1980s, has now become a practice made with Gots certified yarns and natural materials.

Figure 17. How to Hand Knit a Chunky Blanket (Source: Simply Maggie, 2019)

In addition, the fact that the production practice removes the consumer from passivity and creates a state of durability in the object, thanks to the bond established with the product, ensures that this method is under the slow fashion methods (Cooper, 2012).

The Knotty Ones brand, founded by three close friends who set out with the goal of changing the industry by knitting one at a time, offers a sustainable alternative to fast fashion with its quality and timeless products. Working only with natural and sustainable fabrics, the company focuses on contemporary aesthetics and minimal designs, inspired by old-style Nordic crafts such as knitting. The company, which produces with fair, ethical production conditions, works with craftswomen, mostly stay-at-home mothers, around Lithuania. The majority lives in villages and small towns where jobs are extremely scarce. Therefore, the fact that women earn fair wages and provide for themselves, and their families creates a socially sustainable value. Driven by the goal of creating something that feels good, the business pays for each piece of work made by independent artisans and works with each knitter separately. Taking a stance against fast fashion, the brand has built a flawless structure with its structure that values both clothes, people and crafts (The Knotty Ones, n.d.).

Another Lithuanian brand that keeps the past alive today with a modern touch and makes a difference with its timeless designs is Salanida. Led by Gabriele Kerpyte since 2012, the firm follows a slow and responsible fashion. Located in a small town called Nida on the Lithuanian coast, the brand reminds of a life where time slows down and the little things in life are appreciated. The brand, which has simplicity and sustainability at its core, offers handmade and soft to touch products made from quality natural yarns. Working with a bespoke production model, the company sews its products by hand on artisanal knitting machines and in a small workshop in Lithuania (Salanida, n.d.).

Wool House, a mature, modern and responsible knitwear brand that creates high-quality products, in essence creates high-quality products that can be worn for many years. The history of the firm dates to the interwar period, based in Lithuania, where there are many skilled artisans. Reborn in 1988, the business remains a legacy. Appreciating tradition by focusing on excellence and quality, the company blends

handcrafts and inherited cultural knitting practices with modern production solutions. The clothes produced under fair working conditions and within the company are produced with love and positive energy. The company, which produces in small quantities, does not keep any products in its warehouses and does not produce waste. The company, which produces according to various body types, knits sweaters according to individual orders and the unique needs of customers. In addition, at the request of the user the company, which also offers repair services (such as shortening the sleeves, pushing the buttons forward or sewing the torn places.) creates a sustainable, timeless bond between the brand and the user (Wool House, n.d.).

Another slow knitwear brand offering thoughtful clothing for modern lifestyles is &Daughter, created by specialist manufacturers in the UK and Ireland. Made in Scotland using natural yarns, the focus is on minimal, simple designs, quality and usability. In the production processes of the company, which values the approach, purpose, human and material more than consumption, each piece of clothing is knitted separately and then tied together by handwork. It can be considered as a qualified brand that serves the slow fashion with its timeless and quality products (And-daughter, n.d.).

Another brand that creates a transparent and sincere bond by eliminating the distanced relationship between the garment and the user is Forte-Forte. The story of the brand, which focuses on emotions and feelings, started with a small handmade t-shirt collection. With the spirit created by the harmony of the past and the present with timeless designs, it creates pieces that do not have an expiration date. The company, which creates original designs with a slow principle and close to style, emphasizes a business model where quality comes from products with real and tangible value and production is carefully controlled. The business, which has an arts and crafts-oriented approach, uses many of the slow design methods such as the Upcycling method, crochet, knitting, and basic sewing techniques in its production practices (Forte-Forte, n.d.).

In addition, with the spread of sustainability-based approaches such as upcycling, resale, and repair, which grew after the pandemic, craft practices are experienced more than in the past, with the effect of technology and increasing awareness. Hand knitting together with all these methods such as Crochet, Cross-

stitch, Patchwork (patch), Embroidery, Applique, and Quilting which act as a time machine, creates a craft-oriented fashion aesthetic under the name of "Craftcore" in the mechanized world in which we live. Basically, all these intertwined practices cohand-kniter under the roof of the slow fashion movement to protect the material culture and for a better, more meaningful way of production (Bir Ters Bir Düz: Craftcore, 2022). The Tonlé brand, which successfully uses all its slow and sustainable design practices, takes action with a production strategy that contributes to circular fashion and uses recycled materials. The company, which uses dead-stock fabrics to reduce waste, successfully diverts the produced waste and tries to evaluate each textile waste. Operating with an inclusive, honest and purposeful production principle, the business is procured from the Cambodian markets, where pre-consumer textile waste from large garment factories is collected and resold. In contrast to the hierarchical structure in the global fashion industry, a more friendly and transparent system has been created in the business, where productive artisans and designers work together to create designs from larger pieces of recycled fabric. Small wastes from the production of clothes are cut and sewn into yarn one by one. Then, the hand-woven threads are knitted into new pieces. The fabric pieces, which are the result of the two-time recycling process, are the product of a company that has fully adopted the zero-waste strategy. Thus, the business demonstrates that waste is truly wasted only when it is wasted (The Tonlé brand, n.d.).

The resources created by a combination of dead stock, waste and textiles, which although of high quality are not considered suitable for use in industrial production, represent the beginning of the design process. Resembling a treasure hunt, choosing the right fabric is an important part of the design process as it guides what can be done. In addition, the brand's designs are produced in minimal quantities due to the limited amount of fabric supplied. Therefore, each piece consists of more special, unique and original products. Decisions on how to process each piece of fabric are made by the team, ensuring the integrity and purpose of each garment, and establishing partnerships with the design and quality assurance teams, aiming to use the material efficiently. For its weaving method it has partnered with Weaves of Cambodia, a weaving collective with fair wages and ethical working conditions in Preah Vihear state of Cambodia.

Fabric threads, sweaters, scarves, bags and home accents made from small scraps left over from the making of other hand-cut and sewn garments are used for hand knitting and crocheting. There are slight differences in nature in all production practices based on handcraft. Handicraft embroidery technique, which is a reminder of skill and love, makes the product meaningful and valuable. Patch work, which is one of the repair techniques used to increase or revive the value of the product, which is valuable in its essence, is used to save and reuse textile residues. Inspired by historical quilt designs, Patchwork designs add a modern touch to the products and ensure that no piece used within the company is wasted (The Tonlé brand, n.d.).

In addition, water-based paints that do not contain toxic chemicals are used in the company, which makes use of basic printing and natural dyeing methods. However, some natural dye paste inks are also applied to the garments by hand. The designs, created one by one by the members of the Tonlé printing team, form a part of a meaningful story by meeting the accent colors with the screen-printing method that includes fun prints (The Tonlé brand, n.d.). Making use of the natural dyeing method, 80% of which consists of edible ingredients such as soy milk and lemon, the brand creates the beginning of an experimental, magical and meaningful story with every product it creates.

2.3.1.8. "DIY" Movement and Participatory Design Approach

Suggested strategies for sustainability could be listed as reuse of waste materials, upcycling, repair, and remodeling of clothes, re-creation, reduction (resource use and waste generation), use of ecological materials, use of one type of material, long-lasting product creation, multifunctional clothing design. Strategic methods such as sustainable design practices for the evaluation of textile wastes also form the basis of slow design methods.

Reuse and re-design practices of transforming old materials into new products could be defined as upcycling methods. These methods transform passive consumers into active consumers which connect with the product, while an invisible and permanent bond is established with the object, which becomes a means of personal expression based on practice. This method creates an activist and independent space where the person who applies it freely expresses his or her aesthetic understanding

without being bound by certain patterns. This trend comes from the punk subculture is basically the individual's being a part of production for different purposes. This situation, which is a reflection of existence, progresses in parallel with the consumer identity and is a free form of fearlessness, carelessness, and expressiveness that somehow chooses to do the production itself (Fogg, 2014). In general, the concept of "DIY" represents a process, action, and practice that covers all kinds of work done with the use of materials at hand, without any craftsman or guide. This movement, which is an action against the consumption culture, takes a stance against sameness to the system imposed by different expressions and unique modes of production (Atalay, 2013).

While "Do it Yourself" (DIY) is the situation in which individuals construct, arrange, repair, etc. objects on their own, scientific studies refer to this action as:

> *"Manufacturing, transforming or transforming assets, including materials taken from the natural environment defined as behaviors in which raw and semi-raw materials and parts are used to reconstruct them"* (Wolf and McQuitty, 2011).

This trend, which has been primarily associated with home maintenance and repair work since the early 1900s, has been used to highlight the prominent behavioral tendencies in small craft and building activities (Enes, 2022). This behavioral trend, which is considered a creative, low-cost, and fun practice, is now emerging as a marketing practice and culture in the form of skill sets under the umbrella of slow fashion. Thanks to this cultural structure, DIY also refers to a cultural structure in which individuals create social impact by sharing the objects they design, repair, and transform with alternative methods and exploratory approaches. Otto Von Busch uses the terms craftivist, and maker to describe structures that work within the framework of DIY and defines the individual as a participant in the collaborative, making process that leads to new attitudes (Busch, 2008).

In this context, when the participatory design approach is examined, this concept, which is also referred to as Cooperative Design or Co-Design, can be explained as a design approach in which all stakeholders are actively included in the design processes and procedures. This concept, which emerged in the 1960s, is

accepted as a shareholder in the design process and even includes users, employers, and customers. But on the other hand, in Janet Wolff's terms, social institutions are the authorities that determine who will become an artist or designer, how they will carry out their acts of art or design, and how they will ensure their work is made available to the public (Barnard, 1998; Barnard, 2002). Therefore, the systems have introduced an approach that makes the artist and designer dependent by restricting their freedom of creation. At this point, it should be examined who the participant in this approach is, what kind of process he participates in, and what purpose it serves. The concept of User-Centered Design, introduced by Donald Norman, is an ergonomics-oriented product development approach that determines how the design should be in line with the needs of the users (Akay and Kurt, 2008). Therefore, the concept of User-Centered Design is also especially important in design and research practices where users play an active role by sharing their knowledge and experience in design processes or decision-making processes. As a collective instrument of social change, craft has been instrumental in fusing community members through the meanings and symbols it communicates, allowing non-designers to participate actively in the creative process (Atalay, 2015).

Evaluation of craft culture in design becomes a symbolic, emotional force that increases commitment to local culture and family while allowing the use of local, tacit knowledge connected to a local system. Thus, it provides a source of income to the local people by creating a socially responsive design process (Manzini, 2010). Contributing to the development of a common language and the creation of a more democratic design environment and covering a process, designer craft associations enable the use of “tacit knowledge” that can only be sustained in close-knit communities and represents much more than we can express (Polanyi and Sen, 2009). In associations where there is a bilateral flow of information, thanks to the educational atmosphere created, the maintenance and survival of craft types were ensured (Kipöz and Atalay 2019).

In this context, it is could be seen that material culture is kept alive by sharing tacit knowledge, thanks to workshops organized with design and craft-oriented approaches of slow fashion design methods developed under the umbrella of sustainability. Even though natural painting kits, which appear as a marketing practice

and culture in the form of skill sets, have moved away from the starting point of the concept of DIY and turned into a tool that serves the consumption culture, they also have a didactic structure that awakens and transforms the passive consumer. Founded by Alberto Bravo and Pepita Marin, We Are Knitters represents the DIY brand with sets covering practices such as knitting, crochet, embroidery, weaving, Punch Needle, Petit Point. Following an environmentally conscious approach, We Are Knitters is a "slow fashion" brand that encourages less and better consumption by producing its own accessories and durable clothing. Users who create their own clothes with DIY kits go beyond being a passive consumer and become a knitter who takes an active part in the production process. Considering this situation as a fantastic way to help the planet without wasting anything, the company has developed a sustainable approach from production to packaging. In fact, the company, which offers all the patterns digitally, aims to reduce the amount of paper used (Weareknitters, n.d.).

Heena Agrima, one of the businesses that popularizes the natural dyeing method with DIY kits, which focuses on the magical beauty of the process, not the result, started in 2010 as an idea for two young children who dream of working together as best friends. Focusing on producing projects together since then, the duo put forward an eclectic vision and tries to develop different perspectives for the same purpose. The company, which produces every product by hand, manages the entire process together, relying on the experience of the past and the vision of the future. Aiming to design beautiful heirlooms that will live in your closet forever, the company continues its work with the idea that everything is art. The company, which produces with the vision of creating a wardrobe full of magic, creates imperfect perfection with what comes from nature. In addition, the company, which allows users to create an emotional work with the workshops it organizes, invites consumers to be a part of a beautiful process while experiencing crafts and co-creation (Salanida, n.d.).

Following in the footsteps of Mahatma Gandhi, the business aims to keep the industry's forgotten values, while emphasizing the importance of hand-spinning, farming and weaving skills, traditional artisan communities and traditions that have been passed down through generations. Aiming to benefit women, who make up the majority of global textile workers and artisans, the business uses organic fibers. Supporting a craft-oriented, fair, restorative, and sustainable industry, the firm

effectively uses all slow design methods. Khadi transforms users into producers and serves to convey the craft, with six types of hand-woven and hand-woven textiles, five dyes for a world of natural colors, and natural dyeing kits that offer the necessary mordants (Fabric of Humanity, n.d.).

Therefore, workshops and collaborations that reveal the production, repair, and construction practices based on manual dexterity, which exists in the essence of the individual but are forgotten by the industry and the modern consumer society, are especially important. Thanks to the designer craftsman associations and workshops that combine the traditional and the contemporary; Like the way we design changes, production workshops become educational spaces. Production becomes transparent and a common language develops. While the phenomenon of storytelling was revived, it is also the human relations that are produced (Atalay Onur, 2020). There are many examples of workshops organized with the blending of participatory design approach and slow design methods. One of these workshops that will breathe new life into wardrobes is the upcycling workshop organized by Junk in Manchester. The workshop, led by Charlotte, shows users how to make wardrobes live through creative tailoring and alteration techniques (Junkshop, n.d.).

Another company that continues its activities with the same principle in England is Stitched Up. The business, which creates a community by building an inclusive and transforming structure, creates awareness and value with the events it organizes to build a sustainable fashion (Stitchedup, n.d.).

The individual's production reasons, and production styles were shaped according to the cultural structure and living conditions. Instead of being a person who does something but usually does not understand what he is doing, it is important to be a person who brings together the questions of how and why, gives importance to meaning rather than appearance for more human material life, and is curious about themselves. Because people who are curious about themselves desire to understand how they can produce religious, social, or political values. Accordingly, instead of a system that devalues objects, a system that can better understand how to manufacture things could be created (Sennett, 2008).

2.4. Slow Fashion Movement in Turkey

The fashion industry, that is, "fast fashion", which represents a large market and economy in the global sense, is a concept that dates to the 1930s. The craft-oriented, traditional, and cultural forms of production, which are the basis of the concept of slow fashion, have been with the concept of Haute Couture, which was born in France in the 17th century and is based on high tailoring skills (Arnold, 2009). British designer Charles Frederick Worth, who is considered to be the founder of this concept, has contributed to the formation of a structure that emphasizes more sophisticated and superior qualities and covers areas such as economy, trade, communication and marketing (Fogg, 2014). In the 20th century, with the development of consumption concepts in line with people's needs, mass production methods have developed, and competition has increased. With the access of fashion products made for specific people to large masses, the foundations were laid for fashion to evolve from being an area that only the elite could have, to an accessible, unqualified, fast, and cheap fashion that appeals to everyone and is uniform. While globalization urbanizes markets, it confines craftsmanship to the countryside (Unesco, 2005).

Craftsmanship, which represents an internal resistance to the capitalist system, the development of the garment industry, the increasing rate of local migration from villages to metropolitan cities, the general lack of workers with appropriate craft knowledge, and craft practices that cannot be combined with creative design have delayed the formation of a sustainable culture.

In the pre-industrial era, artisans were individuals who could assume the roles of designing, producing, and marketing. Craft activity and design practice, which was separated in the post-industrial period, has created a garbage dump that separates from each other, becomes isolated and becomes identical with a fragmented production process. The designer, acting as a bridge, prevents this separation (Kipöz and Atalay, 2019). At the end of the 80s, with the spread of ready-to-wear in Turkish fashion became visible and cheaper in the global market, habits began to change. First of all, in big cities, practical habits and daily actions based on skills such as meeting our daily needs, sewing clothes at home, and repairing objects have begun to be forgotten (Ovacık, 2019). At this point, designers have developed a cultural stance by

incorporating Anatolian motifs into contemporary clothing designs as a reaction to the negative consequences of the global economy and stereotyped design identity. This situation has led to the formation of a cultural design identity with high added value, supporting local design and supporting national strategies (Kipöz and Atalay 2019).

In this context, it could be said that the basis of the concept of slow fashion in Turkey appeared as small fashion houses and design workshops working with a craft-oriented principle. These workshops, which operate on a principle that is completely opposite to the Fordist understanding, which was the dominant business understanding of the 20th century, where a few generic products were marketed to everyone, create a strong relationship between the consumer and the producer (Türkmen, 2019). Although this relationship has not turned yet into what Fletcher calls a relationship that supports skill, creativity, personalization, and individual participation, there is a connection between personalized production and slow fashion (Fletcher, 2008). In this context, it can be said that there are designers such as Vural Gökçaylı, Dilek Hanif, Yıldırım Mayruk, Gönül Paksoy who set the first examples of slow fashion in Turkey.

In addition, The Fashion Designers Association (MTD), which was established in 2006 with the aim of positioning Istanbul as a "Fashion Design District", has led to the start of a collective Turkish fashion movement. In Turkey, where a craft-centered design approach toward sustainability has been developed, two main roles have been established for designers. (Kipöz and Atalay, 2019); At first, designers act as craftsmen, emphasizing the quality of designs, traditions, and craftsmanship. Secondly, they collaborate with artisans to strengthen communities and local cultures by playing a facilitating role (Kipöz and Atalay, 2019).

The slow fashion movement adopted a craft-oriented and ethical production approach that resists high-volume production which could be described as slow and fair fashion. Slow fashion is the advocate of a more human, ethical future that is long-lasting, sustainable, sensitive to the environment, and mostly crafted locally. According to Fletcher, the slow fashion concept that emerged as opposed to the time phenomenon of fast fashion (Fletcher, 2008) brings together the quality feature and the essence of fashion with appreciation, innovation, aesthetic valuable social awareness, and responsibility.

While the slow fashion movement makes the design process more ethical, it underlines that doing things together is a more humane and sustainable method. In this context, both roles attributed to the designer can be gathered under the roof of slow fashion, but it is possible to strengthen this framework with the ethical production network created and the social value created by the designers.

Clark states that the brand, which provides a sense of belonging to a local culture due to its collaborative nature, creates a sense of responsibility and trust (Clark, 2008). In this context, the Argande brand, which is one of the important examples with its social value and ethical production conditions, should be mentioned. Thus, the Argande brand, which is one of the best examples of this cooperation, is a unique fashion brand associated with a social responsibility project in Turkey. Argande, which was established within the scope of the "Innovations for Women's Empowerment in Southeast Anatolia Project (SAP) Region" in cooperation with the United Nations Development, launched its first collection in 2009 (Argande, 2021). With the support of the Swedish International Cooperation Development Agency, Argande promotes fair work and production by employing approximately 145 disadvantaged local women under the design coordination of Hatice Gökçe with Turkey's top 30 fashion designers. Gökçe is one of the founding members of the Fashion Designers Association voluntarily supported the ARGANDE project with Özlem Süer, Arzu Kaprol, Ümit Ünal, Bahar Korçan and Hakan Yıldırım. Another goal for Argande is bringing the values specific to the region to the fore again and to include the values of the region as an element of the brand. Within the scope of the project, in which cooperative-based micro-scale design and production workshops/facilities were improved, inclusive business models were created, and equipment and material support were provided to existing workshops/facilities (Kipöz and Atalay 2019).

Figure 18. Women's Empowerment in Southeast Anatolia Project (Source: Al Jazeera Turk, 2017)

Aiming to contribute to the local economy by using fabrics unique to Southeastern Turkey, the brand offers products from Şırnak and Gaziantep regions such as Şelşepik and Kutnu. Fabrics that have sunk into oblivion and whose production is limited to one atelier were used. The cultural and quality values that came back to life with this project have also become an income-generating element for the local community due to the demand created by Argande's new collections. The Argande brand, which represents an initiative to revive regional traditional handicrafts, shows how social capital can be accumulated through fashion and how this capital can be transformed into a potential source of social welfare (Kipöz and Atalay 2019). As a social sustainability model, Argande creates a transparent and cyclical relationship between fair production, and supply chain processes in the fashion industry, and enables a fair exchange between the producer and the consumer (Kipöz and Atalay 2019).

Another designer who successfully uses slow design methods is Gönül Paksoy. With her unique design understanding and aesthetic sense based on the feelings of respecting, protecting, keeping alive, she has created a unique and simple language in the years when the concept of sustainability was not discussed (Türkmen, 2009).

Paksoy, who has an academic background, has transformed these materials into new products with an innovative style based on the use of hand-woven natural fibers

and dyes. Paksoy reuses precious materials such as worn, raw silk crepe from the past, sensitive to their fragility, and transforms them into new products. Bringing material culture to light and keeping it alive with her own designs, Paksoy creates a new, original, and timeless language that is representative of timeless designs, and meaningful and valuable products created with a fully qualified and sustainable process.

Using slow design practices with a sustainable approach, re-evaluating discarded or worn fabrics with respect to the material and trying to ensure their survival creates a design that has an aura and is emotionally durable. Other designers who combine their expertise by applying local handicrafts to contemporary designs are names such as Zeynep Tosun and Aslı Jackson.

Zeynep Tosun, who presents quality designs by synthesizing the motifs and craft techniques she uses in her collections and cultural identities in a modern way, provides cultural sustainability with her unique and timeless designs. While keeping the material culture alive with its innovative, functional, and meaningful designs, the designer also contributes to the local economy, and there are also projects that he realized using the up-cycling method. Her cooperation with Bego jeans, a sustainable denim brand, could be given as an example (Tosun, 2020).

Aslı Jackson, who proposes targets to change the balance of power in fashion and clothing production, presents flamboyant and distinctive designs with the zero-waste principle and up-cycling approach. Focusing on the reuse and meaning of the material rather than its content, the designer maintains the material culture with its multi-layered designs and emphasizes the importance of upcycling.

Figure 19. Wool and hand combs (Source: Hernevi İğ)

Another brand that emphasizes the importance of sustainable design strategies and the concept of craft is Hernevi İğ. It is the brand of Seda Sargın, who brings to light a traditional method with her activist and instructive identity and introduces herself as a yarn artist, describing yarn spinning, natural materials, and the destructive effects of the textile industry. Sargın, who tries to raise awareness with the effect of the social square and to guide the way with video shares and the content she prepares, sells natural wool and produces it on order so that individuals can produce it themselves.

On the other hand, there are many local brands that generally use natural ingredients with their unique patterns and minimal production quantities, displaying a craft-oriented production principle and an ethically sustainable stance. Brands such as Rumisu, Matla, Satsuma, Laika, Rewaken, Ferah, Huner the brand are some of them.

In addition to these names, it is necessary to mention Başak Cankeş and Fırat Neziroğlu, who make a difference with the designs they create under the name of qualified, original, timeless, wearable art with their craft-oriented production structure, although they do not fully implement slow design methods and principles.

Adopting a production style just like Argande, Rumisu is a brand founded in 2013 by two sisters, Deniz and Pınar Yeğin. The brand, which was born with the linear

expression of their passion for illustration and design, and the excitement they always feel dynamic, consists of colorful stories and original designs. They tell colorful stories with their designs consisting of silk and cotton scarves, handkerchiefs, and now capsule clothes, with their own drawings. They complete their designs, which consist of childlike yet exotic and original patterns, with a tiny three-dimensional figure that reflects their passion for handicraft, depending on the story of the pattern. The production of these figures, which make a small reference to the 'needlework' tradition, which is an important part of the Anatolian textile culture, is carried out by women employed in different cities of the Southeast Anatolia Region. Working with women who are independent producers, the brand creates both social and cultural value and contributes to the local economy (Rumisu, 2020).

Another brand that tells mythological stories with its unique patterns and ethnic lines is Matla. The brand, founded by Duygu Özdemir Kibar in 2016, was inspired by nature and women. The brand, which advocates that people belong to nature and that nature should be itself, can be considered as one of the brands that can be positioned under the roof of slow fashion with its qualified pattern designs, materials used, low-volume production, and fair production conditions (Matla, 2020).

Workshops were organized with a participatory fashion approach that involves the user in the production and experience process, actions that activate the passive consumer shaped under the DIY method, and targets to change the power balance of fashion and clothing production. These practices, which involve the collaboration of designers and craftsmen at various stages of the user's design and production process, are in a way a daring challenge to the hegemony of high fashion that fuels consumption (Türkmen, 2019). Within this framework, it is necessary to mention the Satsuma brand, which creates collections and organizes workshops using a bespoke production model using primitive painting methods and a comfortable and simple design language. Founded in Datça by Özge Horasan in 2014, the brand operates with an extremely organic and slow philosophy. Working only with natural fibers, Horasan is an organic brand that does not establish an atomic money-service-product relationship but creates a transparent and sincere bond at every stage, uses fabrics woven by the local people, and acts with an ethical, fair, and craft-oriented production method.

The Participatory Design approach proposes targets to change the balance of power of fashion and clothing production; It involves collaboration with designers at various stages of the user's design and production process. In a sense, Participatory Fashion is a daring challenge to the hegemony of high fashion that fuels consumption. With these slow design practices based on experience, individuals who transform from an inert consumer form to an active consumer form create an immortal, emotional bond based on the story and expression between the object and the object (Chapman, 2012).

Another brand that blends its original patterns with its plain and simple line is Laika. Representing wearable art with its products, the brand presents quality and qualified designs with its craft-oriented production method, natural ingredients, and low production capacity. Founded in 2019 by Işıl Kurt, the brand creates a timeless bond between the designs it creates and the user. Collaborating with local manufacturers in its production, the brand writes an original story between craft, design, and art. The collections are not only limited to clothes but also carries their story to all areas of life with scarves, paintings, and hand-woven rugs (Laika, 2021).

Another brand inspired by nature and making production focused on craft is Rewaken (Rewaken, 2021). The brand, which exhibits a unique and sustainable stance with handcrafted details of natural ingredients, consists of products designed by Merve Kırşan and Tuba Albustanoğlu. Blending the traditional art of embroidery with materials such as Linen, Cotton, Tencel, Lyocell, and Bamboo, the brand aims to improve the life cycle of garments with its timeless design line and ethical production processes.

Considering that today is the future, and the world is our home, it is necessary to know and realize what is done or what is done in the houses today. In Sennett's words, people who are aware of this, that is, people who are aware of what they are doing can have an idea about themselves thanks to the things they do (Sennett, 2008). Meaningful material culture and more human material life can be created by asking why and how questions together. In this context, it is necessary to mention Hüner Aldemir, the designer and founder of the brands "Ferah" and "Huner the Brand", who has a better understanding of manufacturing goods. Aldemir, a fashion designer, produces accessories from sailing materials, which are called waste, using the upcycle

method (Aldemir, n.d.). Waste that is reborn with the material taking on a new identity creates a sustainable value. The brand, which instills sustainable fashion to its users with its collaborations and some organized workshops, exhibits an activist stance. Although "Huner the Brand", which was established in 2017, creates a socially and economically sustainable value with its production method and ethical production conditions since the materials used are not natural and cannot be dissolved in nature. Therefore, in Aldemir's own words during the interview, "*For a better production*", she established the "Ferah" brand in 2021. The designs produced from raw Şile cloth, which has a natural and spacious structure like the name of the brand, were created with a genderless, plain, simple and timeless line. Working with a bespoke production model, the brand calls for craft-oriented production methods, traditional production methods, the uniqueness of hand-woven fabric and its biodegradability. Aldemir, which attaches importance to the works carried out with the zero-waste principle, has cooperated with "This is Mana" for the "Ferah" brand. The brand, which produces buckles from waste fabrics within the scope of cooperation, has built all the legs (social, economic and environmental) of the chair, as Farrer says.

Working with ethical working conditions and cooperating with cooperatives, "This is Mana" is a Project Leader in the evaluation of waste fabrics. Adopting the 17 principles of sustainability (SDG), the initiative basically tries to serve two main problems. The first one is to raise awareness about the impact of the environmental problems created by the textile industry on the climate crisis, and the second one is the prevention of violence against women and gender inequality. This social structure, which carries out projects with the forward recycling method and zero waste strategies, cooperates with women's cooperatives and contributes to the independence of women. The initiative, which develops advanced transformation designs by procuring textile waste and waste materials from textile retailer brands, produces models developed with women's cooperatives and delivers them to the company. This initiative, which also contributes to the waste management of enterprises, could be considered as one of the good steps that create awareness and impact on the slowdown of the textile industry.

Another collaboration that lifts the Anatolian stalls and awakens feminine wisdom is the Fırat Neziroğlu and Nevruz Village Women Project. Within the scope

of this project, which was exhibited in April 2022, the workshops organized by the weaving artist Neziroğlu with the Nevruz Village Women's cooperative with a participatory design approach should be examined. It constitutes one of the important steps taken for the creation of a sustainable textile network where tacit knowledge is shared and by this way traditional handicrafts are revived. This structure, where women from different regions who do not know each other come together and reveal the existing feminine wisdom, creates a slowly sustainable, fair transparent textile network with a craft-oriented production structure. ("*Anatolian textile network*" with his own words during the interview.) Bringing the unique spirit and creative energy of village women together with natural fabrics, the art of weaving, and Fırat Neziroğlu, the project creates a timeless value that "*brings those who take good care of their world together*" in cultural, social, environmental and economic terms. Fırat Neziroğlu, who is both a craftsman and an artist, who dedicates himself to doing a decent job, spends material effort and practice, has successfully asked how and why questions and has accomplished many works that make a difference and show direction. His collaboration with Başak Cankeş is also one of the works that make a difference.

Figure 20. Anatolian Feel at New York Fashion Week (Source: Habertürk, 2019)

Başak Cankeş, the founder of Bashaques brand, who works with a conceptual design approach for the sake of "Wearable Art", combines art and fashion in her collections while collaborating with artists and craftsmen. The 2016 collection titled "The Door" reflected her inspiration from traveling in Catalonia and particularly from the patterns in Gaudi's works. Collaborating with the internationally renowned Turkish

textile artist Fırat Neziroğlu, Cankeş has transformed these inspirations into intricate decorative appliqués, knits, crochet, and prints infused with a variety of materials such as silk, leather, knitwear, wool, and cotton. By incorporating handicrafts into the design, Cankeş has succeeded in balancing wearability with unique artistic quality, creating clothes that appeal to the street and a young audience (Kipöz and Atalay 2019).

Figure 21. The Door Collection (Source: Bashaques, 2016)

Another collection that blends miniature art with Salvador Dali's surrealism is the 2017 collection titled "Entrada de Gala de en Haren". Cankeş, who generally conveys her designs in a theatrical language, has developed an extraordinary approach by using performance art to involve the audience in that process and experience. The 2017 collection named "Ballerina's Hidden Dream" and the 2019 collection "The Truth", in which she describes the fashion world in a critical language, could be shown as the most striking examples of this situation. With "in the footsteps of wearable art", project in Peru region of South America. The designer has prepared Anatolian motifs for her last collection by working with local craftsmen (Bashaques, n.d.).

In summary, concepts such as "diversity", "innovation", "speed" that entered human life with the Industrial Revolution have changed a sustainable lifestyle that formed the basis of fashion. Therefore, with the transformation of the craft-oriented, handcraft-based production form into a mass production form, it has taken a form that isolates the concept of design, that is, separates it from the production process and glorifies it, by going beyond the traditional tailor's understanding.

The new ready-made clothing, which emerged in the late 1960s, offered an alternative to "haute couture" fashion for people, especially in the life that started to accelerate after the war and created the opportunity to reach fashionable clothes

quickly (Turgut, 2010). Although this situation has created a fashion accessible to all segments, with the ever-increasing product variety, while capitalism has begun to dominate, consumption has come to a point where it is highly encouraged. Custom-made products have begun to be replaced by mass-produced clothes with certain standard sizes. Fast fashion, a cheap imitation of luxury fashion items, has created a hierarchical structure in which the worker is alienated from the product and the consumer is alienated from production.

According to Loschek (2009), the thing that makes fashion visible, which is an invisible system, is the clothing itself. What makes slow fashion visible is the production and meaning behind the look. Therefore, today, where the necessity of sustainable systems against the destructive effects of fashion is mentioned, steps have been taken to develop sustainable strategies. Thanks to the increased awareness with the effect of the pandemic and technology, an increase is observed in designers and local businesses trying to exist in this regard.

Table 1. Global Factors (Source: TGSD, 2016)

Population and demography	The world population is 8.5 billion, the population is aging, lifespan is extending, birth rates are lowering, 90 percent of the youth population (15-24 years old) in developing countries, households shrink.
Urbanization	Sixty percent of the world's population will live in cities (5,3 billion people), urban life will create a new consumption and demand effect, the need for infrastructure-resources-energy will rise, urban population increase in Asia (2014-2030) 80' (in developing countries)
New middle class	The middle class is expanding fast, 60 percent of the world's population will enter the middle class, 5.3 billion middle class populations, 80 percent of the middle class will live in developing countries.
Economic power shift **Economic flows** **Global dependence** **Regional dependence**	The shift of economic activities and power from west to east, north to south, developing countries will have 57 percent of global income, multipolar world order, increasing economic fluctuations. Interregional new generation cooperation agreements, interregional integration and dependence, trans pacific, trans atlantic, eurasia, asean, rcep (asean+china+india+japan+korea+australia)

Table 1 Continued. Global Factors (Source: TGSD, 2016)

Climate change Sustainability	Paris Climate Agreement with all countries with large commitments, carbon emission limited, renewable can be limited, renewable, renewable, industry, new production, newborns, cyclets, new productions, ardanortak standards and regulations, proximity will stand out, proximity to the transparency demand, renewable-transformable production in processes.
Stress in natural resources	Increasing population, income, and consumption will grow a deficit between needs and resources, 40 percent increase in energy demand, 40 percent water supply and demand will give a deficit, competition for metal and minerals, need for agricultural areas.
Communication and digital technologies	Unlimited communication between people-objects-machines, big data, communities and inter-system networks, cyberthreats
Industry 4.0 technology and innovation	Fully automation and digitalization in production, robotic unmanned manufacturing, 3d individualized manufacturing, miniature manufacturing, new materials, interactivity (interactive production), smart products.
Changing consumption trends	From multiple trends to individual trends, special product request, increased environmental and social responsibility sensitivity, multiple markets/segments, localization and individualization, digital consumption-payment tools, shops.

"UFUK 2030" study prepared by the Turkish Clothing Manufacturers Association mentions ten different and crucial precautions and actions to be taken in order to save our planet.

Table 2. Slow Fashion Against Fast Fashion (Source: TGSD, 2016)

FACE OFF: FAST FASHION & SLOW FASHION
Increasing regulations and standards with sustainability
Production with renewable recycled durable fiber
Recyclable clothes are extending the usage time of the clothes
Clothes that need minimum washing (water)
Shopping in small stores, second hand is expanding
Production in fast-interactive-full automation
Personalized production with 3d (maker movement)

Table 2 Continued. Slow Fashion Against Fast Fashion (Source: TGSD, 2016)

Effective waste management and recycling
Permanent local - personal designs
Shared collections instead of frequent and new collections (Sharing economy)

In this context, there is a high probability of an increase in transformation-oriented services in slow fashion brands that build a sustainable structure with their craft-oriented and ethical production structure. Fashion is a collective activity in production and design, just as it is in consumption. Sustainability requirements will be more effective if they are carried out jointly with the designer, consumer, producer staff, and company officials. The designer figure, who is more aware of the production and meaning behind the appearance and has an active role in the consumer, needs to make decisions by considering both the present and the future. Users and designers will act together to create an impact against important responsibilities in ensuring a sustainable life.

2.4.1. Small Design Enterprises in Turkey

In response to the global system that divides the design and production processes, designer craft associations create a common language with a holistic, circular, and qualified approach to the design and production processes of garments. It shows that the waste created by separating these steps in the production process has created conspicuous unnecessary waste (McQuillan, 2011).

Emphasizing pleasurable, engaging togetherness, the slow fashion movement takes a stance against the standardized destructive process focused on consumption, with designers focusing on the traditional experience of production and co-creation, and re-evaluating local art. The slow fashion movement, which is a part of sustainable fashion culture, is fed by the craft traditions of Anatolia (Kipöz and Atalay, 2019). Therefore, there are many current examples in this context in Turkey.

Being able to develop a craft-based design approach towards sustainability due to its location, it is possible to talk about designers in Turkey who emphasize labor-intensive production and quality, blend cultural diversity integrated with nature with

the use of local materials and crafts, and emphasize the importance of using local expertise to create a fairer production process.

In the collections designed with this understanding, the clothes produced in the simplest forms with the highest quality fabrics are examples where knowledge and skills of traditional weaving, embroidery or handwork are used. The clothes that make up the collection are pieces that are not influenced by seasonal fashion trends, parallel to fashion but independent of fashion shows or large advertising budgets, fed by an evolutionary design sensitivity that develops slowly rather than radical changes. With their collections, such designers express their desire to take advantage of these traditional skills and details and bring them back to the fashion arena. Designers produce in small craft-based production units based on the knowledge, skills and experience of individually working weaving, dyeing and embroidery masters.

Instead of the concept of “range planning” representing fast fashion, slow fashion consists of local brands that offer a minimal, pure capsule collection of mathematics. As Margolin emphasizes with the role of the designer in the creation of sustainable design culture, the role of slow fashion brands goes beyond the structuring of clothes and creates a social and environmental awareness as “communicators, educators, activists and entrepreneurs” (Fletcher et al., 2012) highlights the transformative power of identities (Margolin, 1998). In this context, there are many small design businesses working with this principle in Turkey.

One of the first examples of the slow fashion brand was founded by Zeynep Özar Berksu and Çağrı Berksu in 2015: One square meter brand. (One Square Meter, n.d.) The brand, which transparently shares all its production processes in order to emphasize that another way of production and consumption is possible, acts with the principles of slow, responsible, and sustainable fashion. In addition, the company, which carefully selects its fabric suppliers and partners, uses the fabrics of Yünsa and Çalık Denim, which makes sustainable production, work on recycling, consumes minimum water in production, and weaves meticulous and quality fabrics. The firm, which receives sustainable consultancy support, has been working with Sinem Çelik, known by the brand name "Blue Project". Simple, comfortable designs without accessories, created from fabrics with natural ingredients (such as linen, organic cotton), are produced to order with a zero-waste strategy. Contrary to the hierarchical

structure created by fast fashion, it creates an ethically friendly laboratory environment where the whole team can work together. Emphasizing that slowing down is valuable and will be good for everyone, the brand refers to the transformative, remediate, non-destructive nature of slow fashion principles.

There are many concepts that are considered as waste depending on the excessive production and consumption amounts created by fast fashion. It is considered a type of pre-consumer waste called “deadstock”, (Mowbray, 2016) which is basically new and unworn clothing that is not sold or returned after an online purchase and is expressed as waste. In the same context, "deadstock" fabrics that have various defects after fabric production in the textile industry or are defined as waste due to excess production are called "deadstock" fabrics.

There are a few slow fashion brands that evaluate these fabrics with a sustainable consciousness. One of them, OhSevenDays, is an Istanbul-based women's clothing brand that creates sustainable pieces.

"*We build slow fashion from fast fashion's leftovers!*" (FWI, 2021)

The brand was founded by Megan Mummery. The brand creates small capsule collections produced under ethical working conditions with fabrics obtained from sustainable sources. Designed in harmony with functional and capsule wardrobes, collections with minimal pieces consist of a simple line. Trying to create a transparent stance by sharing the design and production processes of clothes, the brand allows its customers to know the life cycle of its products.

Another brand working with the same design strategy is Atölye REN, founded by Gözde Karatekin (Karatekin, 2021). Adhering to ethical, sustainable, and slow fashion principles, the brand is produced inclusive, minimal, comfortable, and functional clothing with a clean, fair production model, while making use of fabrics made from natural fibers that are "deadstock" in warehouses. For this reason, Atölye Ren, which develops a collaborative relationship with all its stakeholders in the production process by utilizing the unifying power of the craft, eliminates the hierarchical structure in fashion industry production and builds a socially sustainable structure. Combining minimal silhouettes with well-thought-out, original details,

Atelier Ren aims to prevent excessive waste with its on-demand production model. It creates an inclusive structure with body alternatives developed with innovative methods and a neutral approach that does not differentiate. Examining the fashion-beauty-innovation-body-trend relationship imposed by the forms it creates, Atelier Ren emphasizes that all imperfections are unique and therefore should be celebrated rather than concealed. Trying to create a sincere and positive experience of togetherness, Atelier Ren aims to create a structure where everyone sees each other as friends. Stating that getting to know the people behind the production process connects people more, the brand emphasizes that a society that understands, recognizes, and cares about each other can be created in this way. Therefore, it is a beautiful example that emphasizes the transformative power of acting together.

Another local business that makes waste a valuable part of a circular production process is the Máh-Roc brand, founded in 2016 by Roksan Sarfat (Máh-Roc, 2019). Emphasizing that it aims to protect the environment, Roksan Sarfat aims to bring the past to the present by replacing and repairing discarded fabrics.

Figure 22. Upcycled bag designs (Source: Máh-Roc, 2019)

The brand, which collects waste and unwanted fabrics from all over the world during their travels, transforms the textile wastes resulting from overproduction into original bags by enabling them to be reborn for a second life. The brand, which carries out its productions in a transparent manner in its workshops in Balat / Istanbul, cooperates with artisans from the Black Sea and Sri Lanka to preserve its handcraft traditions. Within the scope of this cooperation, an old weaving technique, “Kolan”,

was brought back to life with the help of women. Defining its designs as an expression of the lifestyle of nomadic people, the brand offers unique products with limited models and minimal production capacity. Adopting the local production style, the brand contributes to the circular economy while creating a social value with the production process it carries out with independent women craftsmen in the Black Sea.

Darwin's Botanicals is another brand that contributes to the circular economy with the forward recycling method and shows the value that should be given to handcraft with the natural dyeing method. Based on the absence of waste in the life cycle of nature, it continues its work to green this waste-free cycle (Darwin's Botanicals, n.d.). While revealing the primitive dyeing methods, the brand, which shares the experimental, slow, and labor-intensive process with its users with all its clarity, takes its source from nature, plants, fruit, and vegetable wastes in the dyeing process. Instead of throwing away the flowers, fruits, and leaves of plants that have reached the end of their life stage, original and unique results are obtained with an experimental process full of magic by turning waste into a resource and dyeing natural fabrics. Taking a stance against synthetic dyes that contain chemical, non-renewable, and non-recyclable materials, the brand contributes to upcycling and circular fashion with these natural dyeing processes.

There are many local brands working in a labor-intensive and experimental process in Turkey. Another successful brand using the same primitive painting methods is Urba Studio. The brand, founded by Gizem Dündar in Muğla, is a slow clothing and accessory brand that uses waste fabrics made from natural fibers such as linen and Ödemiş silk as local hand-woven and designs with a method that attaches importance to sustainability in its production processes.

Clark points out that handmade products, including those from haute couture lines, not only offer a personalized fit and look but also provide customers with a sense of connection due to stories and origins that heighten their emotional value (Clark, 2008). Clark also highlights that only small-scale businesses can create this transparent mode of production by providing more cultural and material value (Clark, 2008).

Using what nature offers as a resource, the brand presents comfortable, minimal style and functional designs. The collections developed with experimental

methods aim to create a qualified value that does not harm the environment. Taking a stance against synthetic paints, it creates a transparent network between it and its customers with the DIY kits and workshops offered by the brand. Therefore, it reveals that manual labor is valuable in raising consumer awareness with a participatory design approach. The designer, who progresses by creating color palettes with a personalized design method and bespoke model, works with many organizations on a voluntary basis and undertakes the transfer of the craft with her educational identity through workshops held by different groups and children. Designer-integrated craft communities can prevent the disappearance of traditional craft techniques, thereby creating new bonds and strengthening existing ones. The most important practice in the collaboration of the designer and the craftsman is the transformation of production spaces into educational spaces at the same time. Thanks to the educational atmosphere created by the transfer of knowledge, the maintenance, and survival of craft types are ensured.

Many slow production natural dyeing brands continue to work with the same design discipline and design principle. Satsuma, Studio Fern, Atolyee. M, Slow Nest Studio, Raw Fabrics, D'or. Scarf and More, Slw Company, and finally Silk Soie, which defines itself as a natural dyeing kitchen. Therefore, it can be stated that these small businesses in separate locations have become more known thanks to digital technologies, and a network that feeds each other and raises awareness has been created.

Another accessory brand that produces with the upcycling production method is Huner the Brand. Huner, a sustainable fashion brand that focuses on providing material-oriented designs, was founded in 2017 by Hüner Aldemir in Istanbul (Aldemir, n.d.). While creating one-of-a-kind products with a sustainable, transparent design and production process, it aims to bring raw materials to the fore. The brand, which transforms the sailboats into durable bags and accessories by using waterproof and "deadstock" fabrics, carries out handmade production under ethical and fair conditions. The company, which adopts the make-to-order model by producing in small, limited numbers, works with the principle of zero-waste design. They also released a collection of sailing fabrics in collaboration with WWF in 2020. By using

the already existing resources which are evaluated as waste on the system, the brand that gives them the right to a second life creates a sustainable value.

In addition to the upcycling method, there are also local brands that embrace the cultural heritage with production and design methods such as embroidery, knitting, and weaving that emphasize crafts and craftsmanship, and that produce in an ethical environment with a slow and labor-intensive process.

Mandalina Rossa, one of these brands, is a textile artist brand founded by Nazlı Çetiner Serinkaya, which uses many of the slow design methods with a colorful and creative language. Creating classic handmade knitwear for adults and children with a sustainable approach, the brand takes a stance against mass production with its DIY design guidelines and collaborative workshops and invites individuals to be producers and transformations rather than consumers. Coordinating social projects to encourage consumer participation, Çetiner assumes various roles as a designer, craftsman, facilitator, and instructor. Çetiner stated that plastic bags are an eternal threat to nature, when recycled, they can be shaped and become suitable for a wide range of products. Çetinkaya and Mehmetcan Serinkaya have experienced practical ways to recycle plastic bags and to produce thick plastic to produce unique and stylish accessories. Çetinkaya and Serinkaya, who started the project while volunteering at the Warm Heart Foundation in Thailand made a call stating that they are open to sharing how to recycle, design, and market plastic waste. Aiming to reduce plastic waste while helping people become economically dependent on themselves, Çetinkaya and Serinkaya emphasize that adopting recycling as a business model is a situation that will initiate change (Mandalinarossa n.d.).

Apart from their common traits to craft culture and skill in traditional craft techniques, these designers all work in small-scale ateliers accessible to their consumers. In this context, small businesses are challenging the two biggest negative aspects of the traditional fashion design system. The alienation of consumers from products and the alienation of designers from consumers. For consumers, this direct contact creates an emotional connection, making the products more meaningful (Kipöz and Atalay 2019).

Thus, brands that adopt a stance that complies with all of the basic design principles specified by Clark, transform the concept of “new”, emphasizing that the real value comes from handcraft techniques based on different cultures, hence from the labor-intensive process. It has been understood that the point of view towards the concept of waste has been transformed, and that waste is a treasure with the increasing workshops and the advanced recycling process becoming more known and applied. Therefore, to create a circular production structure instead of a linear production model, consumption habits should be questioned, and dressing practices should be shaped in this direction by becoming individuals who transform and repair, not consume.

2.4.2. Use of Technology in Textile and Fashion Design Practice

All the technological conditions experienced throughout history have been effective on the concepts of textile and fashion. In the textile industry, which gained momentum with the Industrial Revolution, there was almost a revolution with the adoption of innovations in daily life, especially in the military field, space suits, and sports fields. The world, tired of the wars, started to apply the innovations found in the technological field towards the end of the 1950s. After the 60's, in the process of obtaining new synthetic fibers and changing the structure of the fibers - even though a significant part of smart textiles are at the prototype stage - they have begun to enter our lives with their functionality (Alpan, 2010).

In the 2000s, with the development of weaving techniques, fabrics became lighter, production was made in micro sizes with nano technology, and it became possible to change the structure of the fibers. Thanks to the nano technology, waterproof, stain-proof and wrinkle-free fabrics could be developed. Although fabrics that could change color with factors such as heat, light, pressure, chemicals, clothes that regulate body temperature according to cold and heat, control blood sugar, charge phones with solar energy are limited and used in certain areas, it is aimed to appeal to a large part of the society over time. The use of natural products such as bamboo, stinging nettle, and spider silk constitutes the trend of returning to nature at the beginning of this century (Turgut, 2010).

In the 21st century, technology significantly affects the ready-made clothing industry, despite the repetitive fashion. Although the technologies used for the development of sustainable systems are systems that include the development of alternative materials, recycling, functional design strategies and processes such as zero waste, Re-birth strategies, Life cycle analysis, reducing the number of productions, and stopping unnecessary production can be considered as the most crucial step of environmental sustainability (Lee and DeLong, 2016).

As a result of increasing awareness of the devastating effects created by the textile industry to the point where it cannot be overlooked, small businesses, collectives, and platforms have emerged that resist this issue and want to take a stance against it with the urge to change. Since the concept of slow fashion first emerged, the collectives and platforms that feed each other and benefit from the power of unity have created a transparent, sincere, instructive, hacktivist network. (Like Fashion Revolution founded by Carry Somers and Orsola de Castro). Therefore, the slow fashion movement, which has become a concept that has become more widespread with the effect of technology and social media, has caused the formation of more small businesses at the point reached today, as well as questioning the production methods made by small businesses. Still, the small design studios, which take a stance against fast fashion with their slow production methods, consciously convey the environmental and social impacts caused by the global textile industry, while sharing their story and production process with all openness, including their design and production methods. In this context, when the relationship between technology and small design workshops or independent designers is examined, it is observed that the brands that form part of the global fashion industry collaborate with small design workshops in terms of design and materials. Although the technology used to develop innovative materials within the scope of such collaborations is a start for the slowdown of fast fashion, it also raises the question of whether it makes this process sustainable with its high production numbers and intense energy use. Nevertheless, Gözen Institute could be shown as a good example of material innovation.

Gözen Institute, which was established with the awareness that fashion can only have a meaningful future if it is sustainable, has created a new sustainable model by focusing on design, biotechnology, and art to combat the pollution created by

fashion and textile industry in the world (Gözen Institute, 2021). Ece Gözen, a female entrepreneur and bio-designer, develops design and material prototypes with global brands and manufacturers. Continuing to work with the philosophy that every living thing in the world is interconnected, Gözen has supported this situation with the projects it has carried out with many global brands such as Samsung and Nike. Gözen Institute, Nike's sustainability brand ambassador, produces sustainable biomaterials for the textile industry, such as vegan leather and bioplastics, with her team. Gözen defines her design style in three words: circular, holistic and futuristic (Studio Mercado, 2021).

Figure 23. Ece Gözen – Gözen Institute (Source: Sabah, 2019)

Gözen, who works with a design philosophy that includes the need to repair the ties we have broken with nature, continues to work with a multidisciplinary approach so that other sectors adopt this sustainable, ethical and environmentalist movement, which started at the heart of textile and fashion.

Technology, which is basically the product of intense dedication and effort, is a kind of craft, as Sennett puts it. He states that technology is based on a skill and progress increases as skill develops. Technology historian Henry Petroski emphasizes the importance of skill and experience while stating that technology develops by analyzing small pieces that come out when a simple piece like pottery is destroyed (Sennett, 2008). At this point, it should be mentioned about a connection between intensive practice and skill-based craft-oriented production and the concept of technology. However, the point that distinguishes technology is the purposes for which it is used. According to Arendt, if technology is defined as Pandora's box, technology

is a god of invention, so what comes out of the box can be considered as unconsciously caused by evil. Just like the unconscious and destructive vicious circle created by the fashion industry (Sennett, 2008).

In this context, although the technologies used today are used to contribute to the circular economy and to improve the fashion industry, it does not seem possible to fully improve this situation with high production volumes. On the other hand, technological innovations that require large financial investments constitute today's inaccessible technologies such as Haute Couture, which was once an inaccessible fashion. In this context, when we examine the link between Local Design Ateliers and technology, there are short-term show-oriented and advertising-smelling collaborations rather than projects that produce long-term solutions. On the other hand, there are also practices that contribute to the spread of slow design methods, slow production methods, local brands and sustainable strategies.

To illustrate, there is a design language shaped by the ties established between digital and traditional methods by designers like Hussein Chalayan who use special production methods in the creation process. Using technology extensively to revolutionize the form and function of clothing, Çağlayan describes himself as a "*weaver of different worlds*". Hüseyin Çağlayan, who combines technology and fashion the most, could also be described as a man who is inspired by design, science, and art. It is observed that the collections which Hüseyin Çağlayan created with his innovative spirit and extraordinary approach have turned into impressive showpieces. Emphasizing that technique and mentality are important and interesting, Çağlayan is a successful artist and designer who connects seemingly unrelated things in different fields and cultures.

Created with a very functional design language, the "One Hundred and Eleven" S/S 2007 is a collection created by utilizing technology. The designer, who conveys the historical evolution of fashion with changing clothing forms, offers a versatile design with a single piece of clothing, thanks to microchips that allow the form and details of the dress to change. Therefore, it can be considered as a good example of slow fashion and technology development. In addition to this subject, the A/W 2013 "Rise" collection prepared by Çağlayan in 2012 consists of clothes that can transform more quickly with the support of technology. These examples, which draw attention

to the importance of technological developments and interdisciplinary work, create a sustainable value with their multi-functional clothing structure. In addition, the versatile design that combines the concepts of technology and craft, combined with the slow design principle and methods, can create a transformative effect that creates value.

Futuristic fashion designer Anouk Wipprecht transforms fashion into a communication tool between people and the environment with designs based on user experience that communicates with people's emotions (Anouk Wipprecht, n.d.).

Figure 24. Design of Anouk Wipprecht (Source: Wipprecht, 2017)

The clothes with artificial intelligence developed with the combination of engineering, science, and experience have a feature that reacts to the environment while moving.

In the Smoke Dress design, in which microcontrollers and proximity sensors are placed, the suit has the ability to perceive the stress level of the person and the threats in the environment and to emit smoke in case of danger. Spider Dress, a similar design, is simulated using robotic arms and transferred to the dress by simulating a spider's instincts. This design, which can be an example of biomimicry, has a feature that reacts according to the data collected from the wearer of the suit via motion and respiratory sensors, and the arms can activate when they detect danger (Anouk Wipprect-1, n.d.).

Another name that perfectly blends Creativity, Craft, and Technology is Iris Van Herpen, who creates an original, qualified, and timeless language with sculptural design forms. She reflects that art and craft, technique and science, hand and thoughts are intertwined concepts with her original design language. The designer, who creates experimental material innovation, is a visionary clothing architect who combines technologies such as 3D printers and laser cutting with cultural skills and interdisciplinary collaborations. According to Kipöz, Chalayan's conceptual and Herpen's wearable technological works, which reflects that strange and mysterious representation of inanimate beings, are like a meaningful key to the door opening to a fantastic parallel universe (Moda Personası, 2020).

In this thesis, in which this transformative effect is investigated, the relationship of small and medium-sized enterprises in Turkey with technology and their approaches to the use of technology in the design and production stages are evaluated.

CHAPTER 3: THE RELATIONSHIP OF TECHNOLOGY WITH SUSTAINABLE FASHION

Throughout history, all technological achievements that ensure world development and global growth have been accomplished by human intelligence. The innate creative spirit that learns, dreams, and inspires to explore, forms the basis of the "Homo Faber" human. Technological developments are the products of a captive dedication that pushes the limits of the possible and transforms the individual into a craftsman (Sennett, 2008).

The concept of technology, which could be seen as the source of power today, is a definition of developing and producing a new product, or method, by making use of existing scientific knowledge or by processing raw information in order to provide a better service (Yörükoğulları, 2013). The concept of technology, which determines our production and consumption relationship, essentially means a lot of change in a short time. The concept of technology, shaped by industrial revolutions, consists of systematic designs developed to facilitate processes, save time and energy, develop products and services with high added values, and provides maximum efficiency with minimum error. While these systemic designs formed the building blocks of industrialization, they also have created an unqualified mass production area.

As a result of the First Industrial Revolution, of the transition from labor-intensive production to production with machinery, it changed form from art and craft to the emergence of the concept of design, while building a hierarchical structure that feeds the linear production model. The unceasing development of technology, which carries the fashion industry to a more productive and creative dimension, has created a production cycle for consumption, while also serving to the realization of the constant change in the nature of fashion. Therefore, the changes experienced after the Industrial Revolution paved the way for the formation of the global fashion system. The fashion industry, shaped by the combination of technology and craft, has also changed the understanding of design and production.

As mentioned in the previous sections, a consumption-oriented system has always offered more options with a system based on design and production. This

vicious circle, which feeds itself with an uninterrupted production structure, has caused a significant amount of waste. Therefore, the main problem became the production quantities that offer excessively abundant consumption products (Fletcher, 2008). 87% of textile materials used in clothing production processes are taken to landfills or incinerated. While this situation creates severe environmental pollution, it causes the whole industry 100 billion dollars annually (C40 Cities, 2021). The system, which makes use of the possibilities of technology for just-in-time production, has revealed the necessity of a cyclical production model instead of a linear production model due to the environmental and economic problems experienced at the point reached today. The building blocks of this production model are recycling, DIY, zero-waste, and functional design methods. The methods that form the basis of this production model also constitute the methods of a sustainable fashion system.

In other words, it could be clearly seen that technology and industrialization have created an unqualified mass production area dominated by a mechanical order devoid of design, aesthetics, and creativity by separating the concepts of craft and design from society. Therefore, technology, which provides the cultural beauty of the traditional and the destruction of the craft with mechanization, plays an active role in the socially and environmentally destructive fast fashion system.

The technology used to slow down the global fashion system is in an effective position to slow down the system and raise awareness with innovative tools, methods, and forms of communication. In the light of all this information, technology, which plays an active role in the formation and growth of the global fashion system, has changed the working and production methods of designers with the innovations it has created and is a part of the design processes by encouraging the use of digital techniques. Technological innovations and digital revolutions have completely changed the relationship between body and clothing, the creative evolution of fashion, but also transformed the way of design and marketing. To conclude, in this study, current applications for technologies used for a sustainable future scenario and possible potential of the technologies used for sustainable fashion design in the fashion industry under the headings of production, design, materials and user relation were

investigated in detail and the possible relationship between the concept of slow fashion and these topics with cognitive information technologies was examined.

3.1. Design, Craftsmanship and Technology

Although the First Industrial Revolution caused the concept of design to change from art and craft as a result of the mass production brought about by the transition from labor-intensive production to machine production, the concepts of design, craft and technology are fundamentally intertwined. According to Sennett:

> "*Advances in high technology reflects an ancient model of craftsmanship.*" (Sennett, 2008).

By this, he refers to the innovation arising from an accumulation based on intense time and experience. Also, in 1971 Victor Papanek claimed that:

> "*All people are designers. Because design is a fundamental human trait, everything we do is almost always design.*" (Papanek, 1971).

In this context, it could be said that design is a phenomenon that progresses simultaneously with the human existence process. The person who maintains his/her ability to design in response to all kinds of vital developments and changes is the "manufacturer", who produces and is the ruler of material labor and practice. In other words, the craftsman is human. The important thing is to be able to ask the question of how and why together, without making the work and design itself the goal, without turning into "Animal laborens" in Arendt's words. In other words, it is to be able to ask the result of production or design, without focusing only on production practice or design action, by establishing a cause-effect relationship. Only in this way we can create a production model by protecting the material culture (Sennett, 2008).

Design, defined as an act of human consciousness, is an impulsive reflection of the needs of the material and spiritual world. While developments in science and industry allowed new machines to be designed, those machines enabled new techniques and those techniques enabled new materials to be designed. Thus, new

materials made it possible to create new needs. It is necessary to have sufficient knowledge in order to reveal designs that can meet these requirements.

Today, it could be said that design is the link between creativity and innovation. Creativity, which is the intellectual activity of looking at existing problems from a unique perspective, makes it possible to produce new ideas and approaches by recognizing opportunities in developing technology or the market. Innovation is the successful use of innovative ideas and approaches to transform them into new products, services, and even new ways of doing business. Alvin Tofler defines the third wave as the age of technology and describes the world as a "global village" with shortening distances as a result of the increase in information and new technologies (Tofler, 2008).

Therefore, in today's world, known as the information age, in an environment where technology affects every point that interests the individual, it is not possible for fashion to stay out of this sphere of influence. The unceasing development of technology, which carries the fashion industry to a more productive dimension, also serves to realize the constant change in the nature of fashion. However, making this service more efficient is about asking how and why questions.

In this context, it is necessary to evaluate the relations of technologies used for a better production model, therefore, with sustainable design methods, material development processes, recycling, production, and service concepts.

3.1.1. Craft and Production

Craft and Production are intertwined concepts that feed each other. Craft is the base of production, and production is the base of the craft. However, production accelerated with the development of technology turning it into a purpose and craft into a habit-based skill. (Sennett, 2008) Today, in a world where sustainability has become a necessity, production has become a tool rather than an end, these two concepts have moved to a dimension that supports each other in many respects. Sustainable design strategies developed with the increasing importance of factors such as the protection of cultural elements, economic justice, protection of local production methods, reduction of chemical use, and reduction of waste constitute the first stage of this dimension.

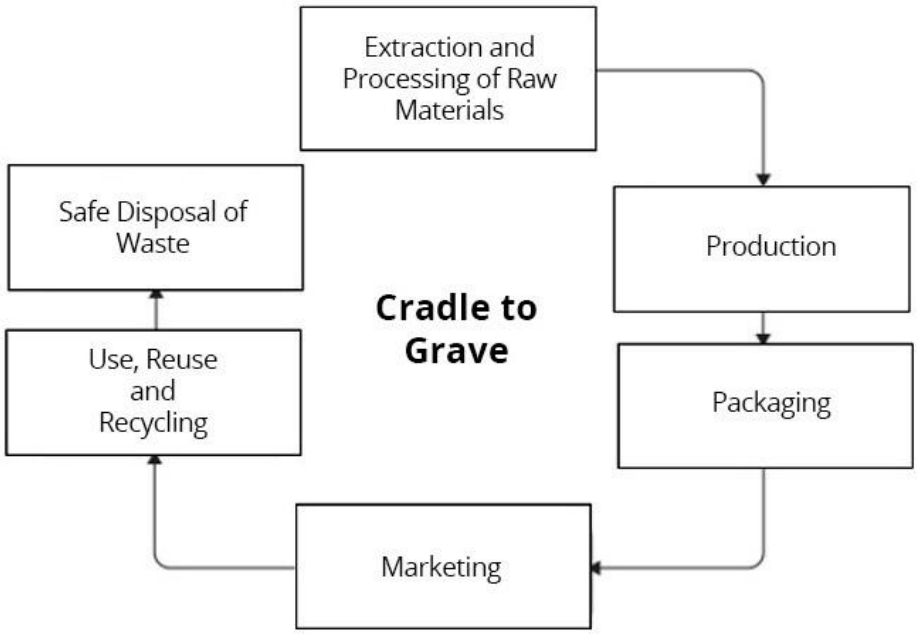

Figure 25. Concept of "Cradle to Grave" (Source: McDonough and Braungart, 2010)

Since the relationship between the concepts of craft and production is examined within the scope of sustainable design strategies, it is necessary to define the circular design strategies well first of all. Circular design strategies covering a global fashion industry also form the basis of slow design methods. Therefore, in order to examine the relationship between craft and production concepts with technology and sustainability, sustainable production and design strategies should be clearly defined.

According to Niinimaki, sustainable fashion should include life cycle thinking that takes into account all phases of design, production, logistics, retail, use, and waste. On the other hand, according to William McDonough and Michael Braungart, considering the speed and destructiveness of modern industry, the effort to make the system "less bad" with sustainable strategies will remain a very limited goal (McDonough and Braungart, 2010).

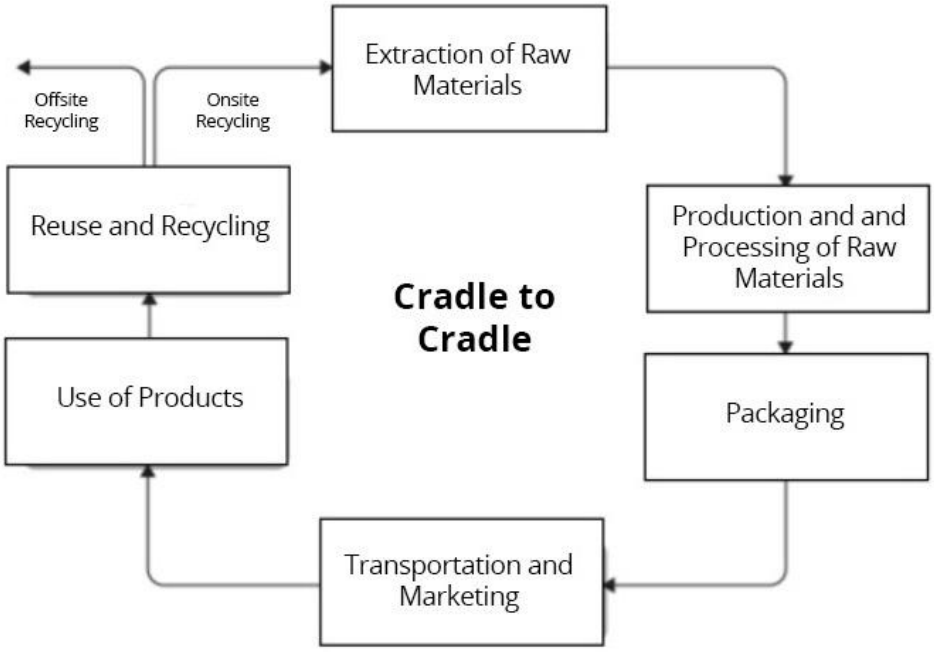

Figure 26. Concept of "Cradle to Cradle" (Source: McDonough and Braungart, 2010)

Therefore, instead of a design strategy that serves the conventional system and focuses on "what not to do" and focuses on reducing the bad consequences of wrong design strategies, a more limitless and meaningful goal can be created to eliminate the concept of "Waste", which is a product of the modern world, by designing products and systems from the very beginning. Instead of the concept of "Cradle to Grave", which is the definition of a linear system defined by William McDonough and Michael Braungart, they defined the concept of Cradle to Cradle, which is a representation of a cyclical movement process (McDonough and Braungart, 2010). This definition can be divided into two cycles according to the material properties used: the biological cycle and the industrial cycle. This entire process should include a lifecycle idea that takes all phases into account, including design, manufacturing, logistics, retail, use, and post-use disposal.

In this context, if we consider the issue of recycling, which is one of the sustainable strategies (3R), this concept, which is defined as a new culture of accumulation by Şentürk, is a recycling process that includes a series of industrial applications that are collected, sorted, recycled and made ready for reuse (Şentürk, 2013).

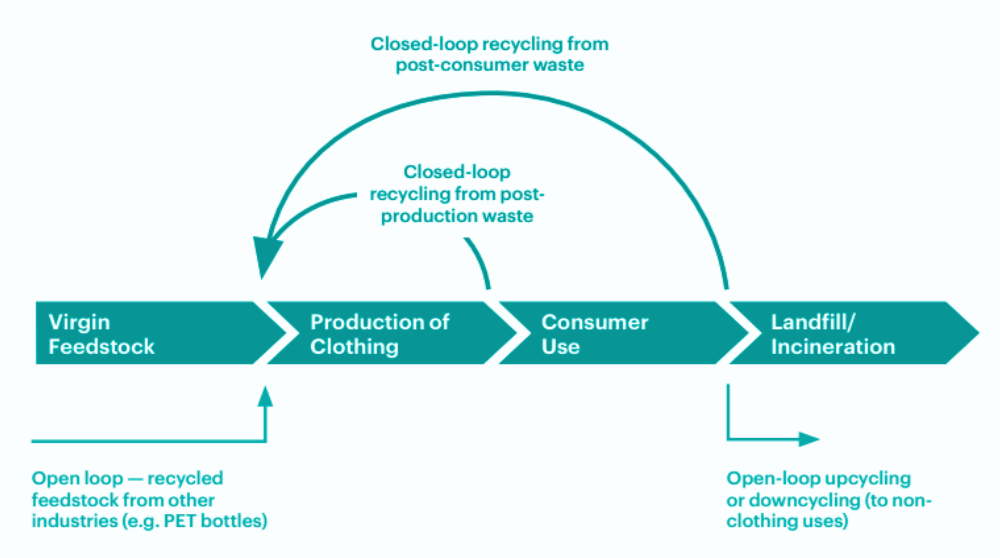

Figure 27. Closed-Loop of Recycling Waste (Source: Mckinsey,2021)

As the material that loses its value at the end of each recycling process takes on a lower quality form, it turns into a material that can be recycled in a limited number of times. During the recycling process, sometimes various chemicals need to be added in order to complete the process and reuse the material (Türkmen, 2009). This transformation process, in which the material loses its value, is called "Downcycling". A material designed with recycling in mind can be considered ecologically harmless. However, recycling that is not thoughtfully designed is ecologically harmful. Combining organic fibers with industrial raw materials is extremely harmful to nature and human health. Industrial raw materials called technosphere can maintain their continuity in a closed-ended technological cycle, but it is very important that they are not contaminated with biodegradable substances called biosphere due to the damage they cause to the environment (Türkmen, 2009). The concept of 'monster hybrids' is used for the case of becoming a non-transformable composite material (Earley et al., 2010).

It is aimed to slow down the consumption rate with sustainable fashion, and to adapt ‘cradle to cradle' strategy to the life cycle of products rather than 'cradle to grave' strategy. For the recycling process, which includes a number of industrial applications, to be effective, this complex and dependent system must be well designed. In response to the negative effects of this process, which is a long and complex life cycle consisting of many stages such as ready-made clothing, fiber and yarn production, assembly and

transportation, on the planet, Life Cycle Assessment (LCA) has become a tool that can play an important role in providing critical information on how fashion can improve current environmental sustainability challenges. Technologies used in this context are essential to the textile industry.

Fine-tuning by changing different steps to be taken at all steps of the value chain, such as resource selection, form, material, production techniques, and even alternatives, thanks to software that can perform Life Cycle Assessment. Thanks to methods whose impact on nature can be more or less predicted while products are still in the development stage. Over time, Product Life Valuation has become an indispensable tool for designers and manufacturers to create more environmentally friendly products. Developing technologies also play an active role in facilitating recycling processes.

DeNature, a physical coding system, can be considered as a successful project where science and design meet, developed for faster and more accurate identification of invisible material information. This project, which has a closed-loop chemical recycling system that transforms waste textiles into new fibers, contributes to the correct and fast execution of chemical processes in recycling. Dr. Hanna de la Motte and Miriam Ribul, who developed innovative methods for the chemical recycling of materials, including regenerated wood-based cellulose fibers, in the DeNature project that could be given as an example of design-science collaboration (Textile Toolbox, nd.).

Figure 28. Design of DeNature (Source: Ceylan and Tunç, 2021)

The formation of closed loops by connecting material and energy flows is considered a measurable and definable goal for sustainable design. With a system designed in this way, it will be easier to put forward a sustainable design strategy, and it could be foreseen that more effective results could be obtained.

At this point, the concept of Re-Birth, which is one of the sustainable design strategies, should be examined (Gürcüm and Tanyer, 2021). This method, which can be considered as a strategy that serves mass production, is actually a birth story based on the re-presentation of an existing product with minor changes, rather than a new production or recycling process. This strategy, which can be classified under the reuse approach, is a method based on the analysis and re-development of stocked products for sale by designers (Lee and DeLong, 2018). The technology could support how the product is chosen by the help of data-based systems.

It is possible to evaluate the rebirth application as a more advantageous option compared to recycling processes that require intensive labor and energy (Niinimaki, 2013). At this point, the possible relationship between skill-based and labor-oriented practices and technology should be examined. "Repairing/Mending, Upcycling and Reconstruction, Multi-functional and Adaptable Design, Natural Dying, Needleworks Techniques, Hand Weaving, Hand Knitting", which are the basis of the craft and slow design methods. All these methods, which are related, are intertwined when they meet the concept of technology. When the repair process meets technology as a skill-based practice from the past, alternative repair methods can be developed. At this point, the technology that facilitates the repair process could turn into a service-based software, service or a way of doing. For example, the Houston, Texas-based MendIt App, developed as software aimed at providing a market for extending the life of garments, is available on the Apple Store or Google Play. Aiming to offer customization services by connecting its users with local artisans and artists who can decorate and redesign their clothes, the business is designed to facilitate the development and preservation of textiles. In addition, the goal of the company, which does not deduct the service fee of small businesses in order to support local businesses, is to contribute to the spread of the repair culture by making sustainable consumption easy and enjoyable. Making it quick and easy to recover clothes from landfills, the software allows users to easily find help. Founded by Kaitlyn Allen, inspired by her grandmother, the business came

to life in 2020 in line with the agreement with Dave Silverstein and Chris Biddle to establish a technology company (Mendit, n.d.).

Fix That Shirt, another Parisian fashion tech startup, helps to repair and transform garments with ease. Accessible from the Apple Store and Google Play, the app offers users a service to connect with local artisans and manufacturers to breathe new life into garments, depending on the service needed. Job opportunities were created for people with sewing skills in the application, which could set prices for each service and allows easy connection with people who wants to do their own business. The practice, which transforms the individual with repair practice into a repairman, contributes to conscious consumption and sustainable fashion (Fix That Shirt, n.d.).

Apart from these technological advances in traditional clothing, a group of designers has taken the business one step further, using digital scanning, simulation, and 3D printing machines to create a revolutionary example of traditional garment production (Conti and Vacca, 2008). To illustrate, Ganit Goldstein, a London-based fashion and textile designer, is a craftsman specializing in the development of 3D fashion and smart textiles. Working on the intersection between craft and technology, Goldstein uses 3D printing and 3D scanning technology, to produce 3D Textiles. In addition, Goldstein, which blends primitive handcrafted sewing methods with traditional Japanese weaving techniques (IKAT), to create a timeless, original and qualified design language with her labor and skill-based practice. Designing an innovative project that challenges the current fashion industry production methods, Goldstein took advantage of polyjet technology. She created a new design language by combining the fascinating special looks that she created with multicolored embroidery. She named her 3D printed clothing collection 'WeAreAble'. Collaborating with other technology partners such as Haratech for Stratasys 3D multi-color printing and 3D body scanning, Goldstein used 'veroclear' transparent material in her designs to create a crystal-like appearance. Starting with measurements taken from a body scanner with a 360-degree "depth" camera, the project enables the creation of bespoke products that fit perfectly to one's form (Ganit Goldstein, n.d.).

Figure 29. WeAreAble' 3D printing Kimono collection by Ganit Goldstein (Source: Re-Fream, 2020)

It sets an example of a structure that moves away from the mass production of 'fast fashion' technology, with a sustainable production process that produces no waste and is processed from 3D to 2D CAD manipulations that create a single, definitive piece of fabric for each garment. These designs, which are a hybrid result of embroidery and 3D printing technology, reveal a time machine method that combines the past and the future, a product of the combination of traditional craft methods with innovative techniques. At this point, it is necessary to mention the technology and craft-oriented Maker Movement. Within the scope of this movement, learning by doing is encouraged, while creating ideas using digital production tools, prototyping, encouraging collaboration and mentoring, and open exchange of knowledge within digital and physical communities constitute the common features of the movement. The basis of the maker movement, which is formed by the blending of digital and traditional skills, is digital production, new material technologies and the availability of accessible knowledge and skills from communities related to these technologies (Martin, 2015). The basis of the maker movement, which is a social phenomenon, is based on the science of physics, which studies how data turns into objects and objects into data. It is based on MIT's Bits to Atoms program (Voigt, Montero and Menichinelli, 2016) organized in 2001, which defines itself as an interdisciplinary initiative that explores the boundary in computer science.

At the core of the Maker movement, which aims to create a production culture instead of a world where everything is consumed rapidly, lies an education strategy that gives importance to the process rather than the result, which also includes mistakes. This movement, which represents a world where the culture of production is lived by learning, teaching and experience, encourages the transformation of ideas into production and their activation. This trend, which also includes designing solutions to problems with production awareness, represents a learning strategy for experience and practice, and contributes to the development and entrepreneurship of the individual. Communities such as sewing circles, knitting clubs and quilting bees, where craft-oriented design practices such as knitting, sewing and upcycling are made, socialize and share their knowledge and skills about their projects, form the basis of this movement. Today, in parallel with the worldwide maker movement, new maker communities and maker spaces have emerged, using digital fabrication tools and technologies in fashion. Dedicated to innovation in fashion and textile production, maker communities and maker spaces provide alternative learning environments for self-taught designers with skills beyond traditional clothing development.

The communities that develop with the increase of these producing areas and laboratories are constantly researching how technology, materials and products are in many ways, so they directly affect the future of fashion in terms of education. Emphasizing the importance of learning by doing, rather than passive theoretical education, this movement aims at active learning that is included in the process, emphasizing sharing while creating something through personal digital fabrication. (Hatch, 2014) Digital fabrication is defined as a process that combines design with production using computer aided design (CAD), 3D modeling software, and additive and subtractive manufacturing processes. (Millard et al., 2018) Being able to connect to digital production devices through open source, low-cost hardware and software strengthens the spread of this movement into different creative fields (Nascimento and Pólvora, 2018). Technologies that formulate digital production are widely used in fashion design practices (Schumacher, 2017).

In fashion, these technologies are mostly associated with wearable technologies and tools such as e-textiles, biotextiles, 3D printed textiles and clothing, soft robotics and laser cutting, digital printing and CAD embroidery and knitting.

Other slow design practices that represent material culture such as "Needleworks Techniques, Hand Weaving, Hand Knitting", which reveal beauty based on imperfection, are combined with facilitating technologies such as 3D printing, integrating with a couture approach and a qualified and timeless language, creating a slow and magical reality focused on craftsmanship. To illustrate; Manus x Machina, an exhibition held in 2016; While exhibiting 170 costumes from the 1900s to the present, examines the relationship of fashion with handicrafts, machinery, artifacts, and human beings in the age of technology, and reveals the inevitable bond of our age with striking examples. Underlining talent, skill, and workmanship, the exhibition emphasizes that technology has become an element that supports these processes (Bolton, 2016). Sculptural structures, which are formed by blending technology and hand labor, set an example for new generation haute couture works. New generation technologies such as 3D printing, laser cutting, software-produced printing and patterns, knitting, and weaving techniques used in this context also transform designs into more special and meaningful objects (Smelik, 2020).

Figure 30. 'Manus x Machina: Fashion in an Age of Technology' Exhibition (Source: New Europe, 2016)

3D printers serve the maker movement and accessible design as a technology that allows people to design and produce clothes from scratch. There are advantages and disadvantages of 3D printing technology, which has a transformative effect on design. This technology, which can be used with biodegradable or recyclable materials, offers a high level of detailing ability, allowing complex designs to be

created. More commonly used to create accessories, shoes, jewelry and buttons, 3D printing technology allows products to be produced and prototyped more quickly locally.

In order to use time more efficiently, 3D printing technology allows the use of more sustainable and safer methods by adopting biodegradable printing filaments. Most of the filaments used consist of glucose-based bioplastics and petroleum-based plastics. One of the main problems with 3D printing is that the plastic used is sometimes unsustainable and non-biodegradable. Therefore, the filaments used and the amount of production are also important in order to avoid the destructive environmental problems created by the global textile industry. When the filaments developed in this context are examined, the most used plastic type in 3D printing is PLA (Poly Lactic Acid), which is made from corn and other biomaterials, and is preferred more because it is easy to print as well as being biodegradable.

The material, which has an organic structure, is obtained from sugar cane and corn starch. So, when degraded, completely non-toxic products have a decomposition cycle of under 3 months in a composting facility and 6-12 months in a domestic compost bin. Another problem with PLA is that it usually requires a lot of water to grow compared to other crops and must be made from sugarcane. PLA is less preferred and sometimes not preferred in structural models, as it has lower impact strength than other common plastics and is less resistant to high temperatures. Another type of plastic commonly used for 3D printing is ABS (Acrylonitrile Butadiene Styrene), a petroleum-based plastic.

Just like normal plastics, the light-decaying material breaks down into smaller and smaller pieces until it breaks down into individual molecules after hundreds of years. This material, which does not serve much sustainability, produces ultrafine particles and volatile organic compounds that can cause adverse health problems if inhaled during its production. For this reason, it is important to use ventilation systems when 3D printing with plastic and to realize that fine particles are released into the atmosphere during the process. Despite these problems, ABS is still a preferred filament by manufacturers due to its lightweight and easy processing properties. Therefore, it is important that these technologies, which are also used within the scope

of the maker movement, are produced using which materials and for what purpose (Cuomo, 2020).

It is important to build a production culture against a consumption culture, but it should be questioned what purpose it serves and how it is applied. In this printing technology, in which biotechnology is actively involved in the materials used, sustainable organic, plant-based filaments produced with an innovative approach are also used. For example, ALGA, a plant-based filament, becomes fully biodegradable when combined with PLA made from algae (Cuomo, 2020).

Creating the ALGA Filament, which collects microalgae to create a variety of products, including 3D filaments, the company ALGIX removes algae from lakes without harming fish and plant life. The collected algae are dried and processed before being combined with plastic resins for filament production. Therefore, the company also contributes to the conservation of biological diversity. Another filament made using recycled litter, 3D Fuel- Landfillament- Trash Filament is produced from non-metallic litter that undergoes a thermochemical decomposition of organic material at high temperatures in the absence of oxygen. It produces the equivalent amount of CO2 to the greenhouse gas emitted by a car traveling at 1.1 mph.

New materials such as FilaFlex and Enviro Filament created for 3D printed clothing have many advantages. A direct recycling filament, Refilament is a fully recycled 3D printer filament made from old car dashboards and PET bottles. Making anything printed instantly recyclable, this filament is thoroughly cleaned and shredded into tiny plastic flakes before being filtered, melted and extruded into thin strips. The threads are then woven together to form the filament (Miller, 2019).

Professor Neri Oxman, who conducts scientific research at the MIT Media Lab, is one of the leading designers using 3D printing to create wearable technologies for the future. The 2014 “Wanderers” collection created a 58-meter system of inner fluid channels filled with living organisms, created using synthetic biology to sustain life on the planet, within a 3D-printed glass. The wearables in the collection are designed to interact with a specific environment and produce the necessary amount of biomass, water, air and light to sustain life; Among the basic functions of each part are functions such as converting daylight into energy with photosynthesis, strengthening human

bone with bio-minerals, lighting in the dark with fluorescence (Oxman, nd.). The 2014 “Wanderers” collection, which is the intersection of technology, biology and design, can be given as an example of how various disciplines can collaborate to find solutions to environmental problems on our planet.

Iris Van Herpen, one of the important designers working in this context, with her innovative and interdisciplinary approach, creates collections that combine technology with traditional craftsmanship methods. In 2016, she used 3D printers to form complex designs that aesthetically push the boundaries of the fashion world in the “Lucid” collection which she prepared with Architect Niccolo Casas (Lucid-1, n.d.).

Figure 31. The “Lucid” Collection (Source: Van Herpen, 2016)

The Dutch designer, who knows the material very well, reveals the transformation of fashion with the fluid-structure of clothes with her choice of hard but flexible materials (Hemmings, 2019). Explaining how the 3D printing method would affect fashion, Herpen said:

> "*Fashion evolution will occur not only in the evolution of digital design techniques and material experimentation but also in the integration of traditional craftsmanship*." (Çakmak, 2017).

She reveals the transformative link between technology and craft concepts with her successful designs.

Multifunctional garments, one of the sustainable strategic practices stated by Sandy Black, is a design principle that represents comfort and functionality for craftsmen and designers who have adopted the philosophy of slow fashion. For the textile industry, this is one of the elements that represents sustainable collection mathematics. This method, in which the concept of design takes on a stronger form, is one of the most effective ways to use resources efficiently. It can be done with primitive methods based on practice and skill, with pattern games, or it can be done with the support of technology. This process, which can also be shaped by the user's creative approach, builds an emotionally durable bond between the user and the object.

For example, designs of Hüseyin Çağlayan, which successfully blend technology with slow design methods, could be given as an example of this situation. “One Hundred and Eleven” S/S 2007 collection is one of the best examples of transforming and adaptable design method and technology meeting, pushing the limits of creativity. The transformation of smart textiles and thermoregulatory clothes with smart textiles instead of form, form transformation also includes examples that put the user in the center and serve transformable purposes or transformable aesthetic appearance. Therefore, smart textiles, which have the ability to detect and react to any effect or impact change, are considered under two groups in terms of their usage features and functionality. If it perceives the effect of change, the “passive smart” textile product is defined as the “active smart” textile product if it also responds to the perceived effect or change (Mattila, 2006). It can be stated that both definitions are examples of the Multi-Functional and Adaptable Design method.

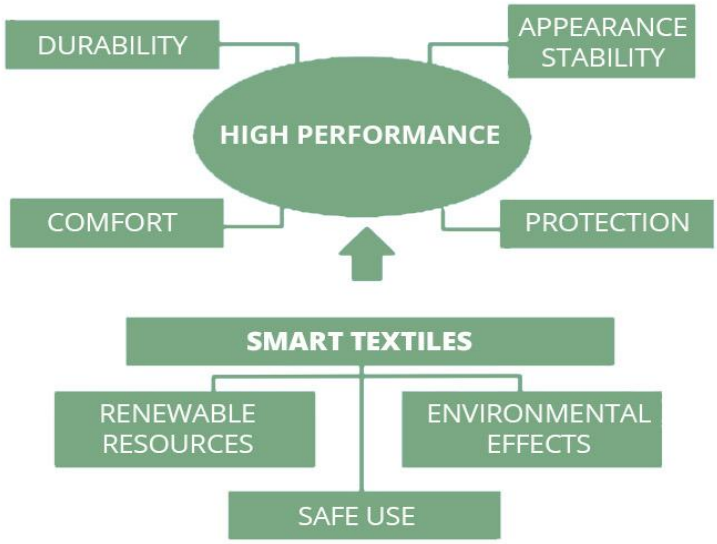

Figure 32. Establishing the evaluation criteria of smart textile components (Source: Jose, 2005).

An example is The Mirror Handbag, which is produced by CuteCircuit company, which aims to develop all kinds of clothes that allow self-expression and offers aesthetic functionality. Constructed from ultra-light aerospace aluminum and a laser-etched acrylic mirror that allows light from white LEDs to shine through and produce gorgeous animations as on-screen messages and Tweets, the product is a reflection of the purposeful fusion of craft and technology (CuteCircuit, nd.).

Figure 33. The Mirror Handbag (Source: Cute Circuit, n.d.)

Another example working in the field of wearable technologies is the special t-shirt designed by CuteCircuit brand for hearing-impaired people, and this technology enables people to feel the music on their skin with vibrations of different frequencies with it is smart fabric technology. Thanks to the microchips placed on the t-shirt, each separate instrument creates an effect similar to the sense of touch in various parts of the body in a live concert performance. There are no cables inside the garment, and the transmitters are completely embedded in the fabric (About Cutecircuit, 2020).

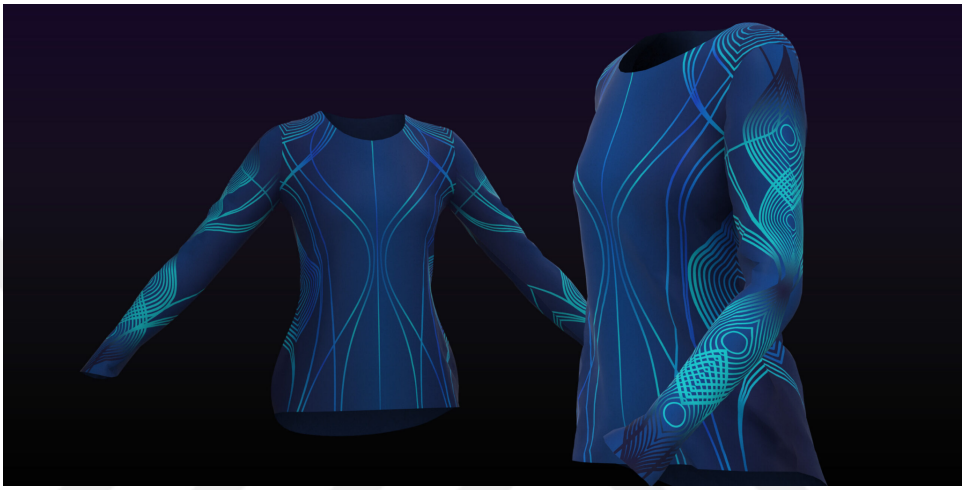

Figure 34. The SoundShirt (Source: Cute Circuit, n.d.)

The Smart Heated Jacket Mercury could be given as an example about functionality for needs and use. This product, which adjusts the ideal temperature in real time, offers a comfortable and functional product prepared with lightweight heating elements and innovative stretch insulation (About Cutecircuit, 2020).

Figure 35. Mercury Collection (Source: Ministry of Supply, 2021)

Another example about functionality based on aesthetics is the innovative and technological product of Neffa, the Chameleon Scarf. Chameleon Scarf was inspired by nature, changes color depending on mood, heat and light, it also constitutes an example that brings together the concepts of nature and technology (Chameleon Scarf, nd.).

Figure 36. Chameleon Mood Scarf (Source: Neffa, 2017)

These robust design examples, which are generally the result of interdisciplinary studies, reveal better ways of production or transformation can be achieved, where the concepts of technology, user, craft, design and production are intertwined. What makes slow design methods powerful is due to a labor-oriented, slow production process, as well as a magical bond created between the user and the object. The most effective concept in creating the magic bond is the workshops organized with the "Participatory Design Approach" and the "DIY" practices. All these user-oriented practices are an effective way to challenge the systemic passivity and hierarchy created by the fashion industry. In expanding this path, the contribution of technology is rather significant. All these practices, in which the production space is transformed into the education space, have turned into black mirror workshops with the effect of developing technologies and the Covid 19 pandemic process. Therefore, black mirrors have turned into a training space, and the place where the user's hands are turned into a workshop space. In this context, technology has an undeniable contribution in the transfer of the craft and the sharing of tacit knowledge. On the other hand, these workshops, which lead to the formation of a community, also represent a part of the maker movement, which aims to learn by experimenting and producing rather than consumption.

These communities, which are divided into two as Digital and Physical Maker Communities, are building a game and experiment-based structure where new learning opportunities are offered (Cuomo, 2020).

Websites hosting open-source visual, or video tutorials also function as alternative learning environments for individuals interested in online fashion-related productions. For example, It covers everything from recycling old clothes, creating waterproof textiles and improving leatherwork, to tutorials on hand sewing and designing e-textiles, with images and videos with step-by-step instructions. Instructables also provides an educational model with free online video lessons on 3D printing, sewing, embroidery, wearable technologies, and more. Burda, the German patternmaking and fashion magazine, launched the Burdastyle project to promote open fashion design and to bring together user communities to exchange ideas on designing and sewing clothes.

The online design community, Thingeverse, is an open platform dedicated to creating and sharing 3D printable files where anyone can use or modify any design, along with a recipe for how to do it. It offers 3D printable files of jewelry and accessories as well as flexible textile structures that can be downloaded and experimented with 3D printed fashion. Through the Creative Commons license platform, users can easily access all kinds of information required for their production practice, sewing encyclopedia, equipment, design, pattern collection, and tips on how to produce on their own (Thingeverse, nd.).

Since the activities organized within the scope of the maker movement in the field of fashion and textiles require expertise and skills in significantly different fields, communities are formed in a collaborative manner with various trainers and using different digital fabrication tools. Extending the courses beyond the classroom to exhibitions, maker fairs and workshops to increase the sense of belonging are also alternative ways of incorporating the maker mindset into fashion design education.

The destructive effects of the global fashion industry became more visible with the COVID-19 pandemic process that have led to further questioning of the concept of "need" and ethical concerns. In the textile industry, where the real problem is the increasing production amount without any need and order, the fact that "orphan

clothes" (Atalay Onur, 2020) waiting in the warehouses could be defined as waste represents a reflection of a damaged nature and a corrupt society structure. The textile industry, which produces waste at every stage, pollutes the world with the increasing amount of production and the inability to manage effectively. At this point, the “Zero Waste” strategy that serves to eliminate cutting and sewing waste and the concept of Zero Warehouse to prevent the formation of "orphan clothes" waiting in warehouses should be examined.

Zero waste strategy, based on the complete prevention of waste, represents a costly process to separate the waste generated due to its mixed content. For this reason, the necessity of developing methods based on waste prevention is required. This strategy, which mimics sustainable natural cycles by changing people's lifestyles and practices, represents an ethical, economic, efficient and visionary goal. It represents a circular economy where all discarded material is designed to become a resource for others to use. (The Zero Waste International Alliance, 2009).

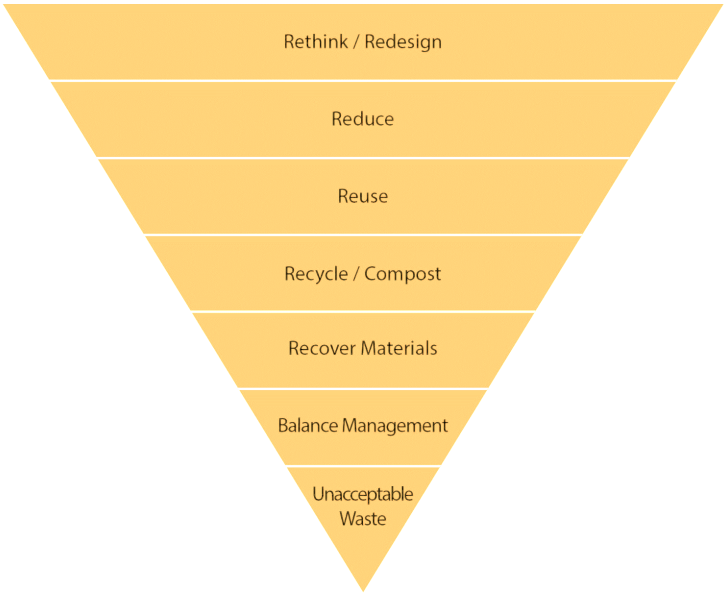

Figure 37. Zero waste model based on hierarchy (Source: Yücel and Kurnaz, 2021)

According to Yücel and Kurnaz (2021), who argue that the main problem is the "Cradle to Grave" system as William McDonough and Michael Braungart said, stopping waste production is possible with a circular economy model. Yücel and Kurnaz explained this situation with a zero-waste model based on a hierarchy created by the classification of “3R” processes.

Fletcher, who collects her strategies on waste evaluation under three headlines (3Rs: reduce-reduce, reuse-reuse, recycle-recycle), defines all these methods as strategies that aim to provide maximum benefit from products such as fiber or fabric before they are discarded (Fletcher, 2008). Therefore, the aim of the zero-waste design strategy is to destroy the textile wastes that take their roots from the unplanned design and production process (Atalay, 2013). Waste in the textile industry could be divided into three groups:

Raw material wastes, textile production wastes and textile consumer wastes. (Yıldıran, 2021)

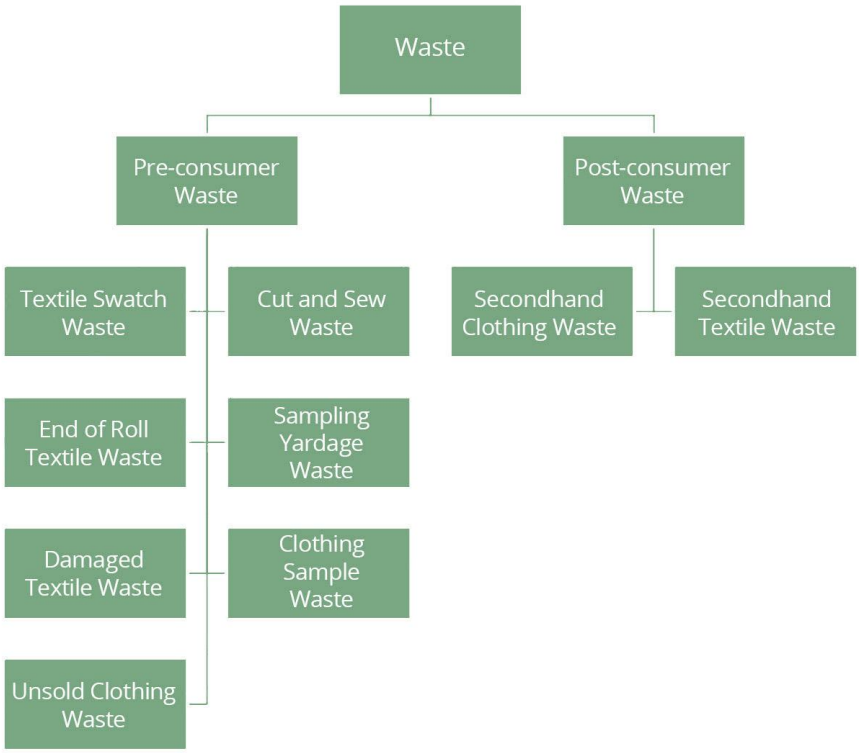

Figure 38. Classification of Waste in Fashion Industry (Source: Ecochic Design Award, 2015)

It is important to note that 10-20% fabric waste is generated during the cutting phase of the fabric, which plays a leading role in the garment production process. This wasted prodigality is a kind of pre-consumer waste that occurs as an unused fabric in a finished garment, appearing in various sizes and shapes (Kipöz and Atalay, 2015). The hierarchical production process created by the fashion industry has resulted in the extraordinarily wasteful cut and sew fashion system (McQuillan, 2011). For this reason, Rissanen (2008), who forms the basis of various approaches, discussed the

reduction of fabric waste created in pattern making, fashion design and production processes in his work called creating fashion without creating fabric waste, and stated that one of the primary goals of sustainable fashion design is to reduce fabric waste (Rissanen, 2008).

Therefore, it is expected that the zero-waste approach, which is at a critical point, for a sustainable fashion design, the zero-waste-oriented design idea, the effective use of fabric at the design stage and the use of fabric with original approaches even on a micro scale. For this purpose, especially starting from the design process, the clothing designs that focus on the prevention of waste and resource wastage in the sector and carried out within this scope could be defined as 'Zero Waste Fashion Design' (Yıldıran, 2021).

McQuillan (2011) identifies four approaches for the zero-waste clothing design strategy and classified them as tessellation, jigsaw, embedded jigsaw, and multiple fabric methods. In addition to these four approaches, Carrico and Kim (2014) proposed a fifth design practice called the "minimal cut". Zero waste fashion design practices that can be classified in two main axes; It can be classified as Zero Waste Fashion Design Methods before the user and zero waste fashion design methods after use (McQuillan, 2019).

Zero-waste fashion design practices before use is a material-oriented design process and includes a craft-oriented creation process in which old clothes are transformed, the leftovers are evaluated, redesign processes are started from small waste pieces, and alternative zero-residue methods are developed. To briefly summarize these methods, which could also be mentioned under the umbrella of slow design methods;

1) The method of adding or joining: This method, which has many examples in traditional clothing culture, consists of pieces of fabric added to the sides as triangles, straight or in different geometric cuts, mostly straight or triangular from under the arm to the hem. Chiton, one of the ancient and Roman garments, obtained by wrapping without cutting or by fastening flat fabrics at certain points. Sari, which is an Indian clothing, and kimono, which is Japanese clothing, could be given as examples (Koç and Koca, 2012).

2) Puzzle approach: The jigsaw puzzle method, which is based on the principle of constructing clothing patterns on the fabric, is a clothing design method in which all the pieces placed on the fabric during the molding stage are created by bringing them side by side so that there are no waste pieces left. This process, in which the pattern, clothing and design are prepared simultaneously, requires intense knowledge and skill in order to design a three-dimensional clothing form on a two-dimensional pattern (Carrico and Kim, 2014). This method, which emerged as a method that focuses on the effective use of fabric in the molding stage, creates a "jigsaw puzzle" appearance, in Rissanen's words, in which the pieces of fabric are interlocked. In this context, the example of a dress with zero fabric waste, which was designed by Mark Liu in 2007 and offers a series of designs related to zero-waste, could be given as an example (Rissanen, 2008). In addition, using the jigsaw method used by McQuillan in his research, Enes made experiments to reduce the amount of fabric consumption and waste with various alternatives on a summer dress model. As a result of these trials, in the study where the dress developed a zero-waste prototype, it could be mentioned that it does not produce waste and saves on fabric (Enes, 2019).

3) Minimalist: This method, which represents a process that progresses in an integrated manner with the jigsaw method, aims to benefit from the entire area of the fabric. It represents an innovative approach that aims to save on fabric usage by reducing elements such as excessive abundance, drape and long length, which constitute the basic features of zero waste designs.

4) Mosaic: This method, which represents the situation that there is no space between the shapes, creates the floors obtained by laying the shapes that overlap each other in harmony.

5) Patchwork: This technique, also known as 'kirkpare' in traditional Turkish crafts, involves cutting waste fabric pieces of various colors and patterns in various geometric shapes (square, triangle, etc.) and sewing them side by side according to a certain order is a method of combining, as mentioned under slow design methods. It has become a more widespread method with the effect of sustainable fashion concept and DIY practices.

In this context, repair and upcycling practices specified under slow fashion design methods are also an effective way to give "soul" to waste. Thanks to all these methods, while the qualities and values of waste are also scrutinized, it turns into a commodified economic value rather than something that needs to be saved or destroyed, and it evolves into a form in which one's trash turns into another's treasure (Kipöz, 2020).

The trend towards this zero-waste strategy, which is used by many fashion brands and designers, has increased. Although products continue to be tried and developed, moving the process to different dimensions in terms of molding and reducing excess fabric used in clothing will make the process more efficient in terms of reducing waste generation (Carrico and Kim, 2014). Therefore, at the point reached today, it is especially important to get support from software programs in order to facilitate the sample processes and manage the waste problem in the production processes.

3D design programs that work like a jigsaw puzzle offer a system design in which clothing and pattern are designed simultaneously. It is difficult to predict with primitive methods how the design created on a 2D surface like a jigsaw will stand on the human body, as well as prolonging the design process and causing fabric loss. However, with 3D virtual clothing design programs, 3D views can be seen in clothing simulations. Therefore, the visual integration of the 2D design made by means of molds or drawings with the 3D view is considered as a crucial step for sustainability. Stating that it can provide a new workspace for waste reduction applications, McQuillan emphasizes that 2D model and 3D digital design tools can provide a more holistic approach to clothing design in her study:

> *"Digital 3D design as a tool for augmenting zero-waste fashion design practice"* (McQuillan, 2020).

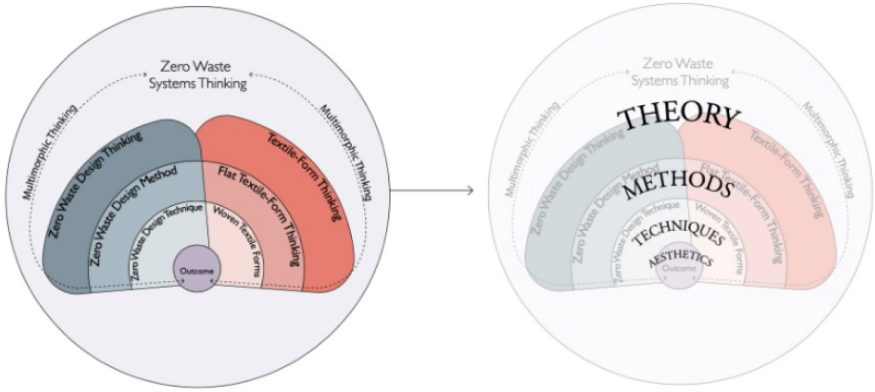

Figure 39. Zero waste strategy (Source: McQuillan, 2020)

To illustrate this situation for the textile industry Daniel Grieder said:

"*The potential of 3D designs is limitless, so we can meet consumer demands faster, more efficiently, and more sustainable*," (Tafreschi, 2019).

CEO Tommy Hilfiger Global and PVH Europe. The technology, which has replaced traditional product photography, transforms the design processes and sample production steps into virtual processes, making it possible to gain speed and seamlessly integrate with Digital Showrooms (Tafreschi, 2019).

In addition, it cooperates with companies such as The Fabricant Studio, Soorty and Tommy Hilfiger, which cooperate with many companies that invest in technology. Accelerating the transition to digital design, joined forces with Tommy Hilfiger earlier this year. Together with STITCH, Tommy Hilfiger's in-house incubator center dedicated to digitizing design processes, The Fabricant leveraged the Tommy Hilfiger 3D design foundation to create a digital hoodie, proof that digital design has reduced timelines so dramatically. It can be stated that the project, which radically changed the approach of the brand and paved the way for it to become a production on-demand business model, is a good example of how technology can be used to slow down fashion (Tommy Hilfiger, n.d.; Digital Denim, n.d.).

Figure 40. Designing with 3D Software (Source: Yıldıran, 2021)

In Mine Yıldıran's (2021) doctorate thesis “Zero-Waste Designs with Innovative Design Technologies in The Context of Sustainable Fashion”, it is possible to combine the patchwork and puzzle method under the zero waste strategy with software programs and bring them together under mass production conditions. examined whether it is possible and how production practice can be improved in ready-made clothing assembly lines. For this reason, technology usage which could also be described as a transparent bridge between craft and production plays a significant role in the sustainable industry.

In addition, although the methods developed under the zero-waste strategy are approaches that serve sustainability and create value in emotional and cultural sense, the main problem for the textile industry is excessive production amounts, as stated before. In this context, the concept of “on demand production”, which causes the concept of zero warehouse, could also be considered. This concept, which is one of the promising shoots of new forms of production, is a production model in which products are produced only when and as needed.

The basis of this form of production comes from the concept of “Houte Couture” and “Boutique”, which represent tailor-made and bespoke production. These concepts, which represent a production process that is tailor-made according to the dimensions of the user, have been replaced by the concept of 'mass customization' used by Davis, with the mass production and the increasing demands of users for uniqueness

and innovation in the products they buy (Davis, 1987; Rahman, 2016). This concept, which is used to create customized styles at a reasonable price and with mass scale, aims to create a bond between the product, object and brand by involving the user in the personalization process. Anderson and Pine (1997) define this approach as a consumer-oriented approach and business strategy that; uses information technology to efficiently produce customized goods and services with maximum differentiation through low-cost production. (An example of this is the case where the Nike brand offers various options with an interface design, designing a special model for the user and producing it specifically for the user.) Pine (1993) defines it as a business competition that makes it most important to identify and fulfill the wishes and needs of the individual customer without sacrificing efficiency, effectiveness and low cost. Therefore, this approach does not only offer customized goods and services to the user, but also creates a deep bond between the object and the user by including them in an unforgettable consumption experience, even though the underlying ambition is competition, more market share.

On demand production could be divided into three according to the relationship between technology, user, and producer:

- While the contact between the user, the manufacturer and the designer is realized with technology support, the form of production made to order with standard dimensions depending on an interface

- The way of production is made to order without technology or with personalized measurements between the user, the manufacturer and the designer.

- The form of production made to order with standard dimensions, where the user is involved in the design process with the support of an interface, and the contact between the manufacturer and the designer is realized with the support of technology.

To illustrate this situation for the textile industry; Analyzing Unmade and Miximaliste companies, Black emphasizes Design / Make / Sell to Design / Sell / Make

by changing the fashion business model of both case studies (Black, 2019). Leveraging existing digital systems, which developed new digital processes through which they could connect more with the customer, from the online experience, interaction to production information communication. It can be shown as an example of slow responsible consumption.

To exemplify this; Unspun, a custom-made jean ordering startup, both as a consumer brand and through collaborations with larger brands and retailers, announced a partnership in April 2020 to present Body Scan Jeans in Stockholm under the H&M-owned Weekday brand (Velasquez, 2020).

Another example is Stitch Fix, a firm that calls its users consultants. Style consultants choose clothes for each client in line with the information obtained by filtering the preferences and tendencies of the users such as personal taste, style, brand views before they start shopping with cognitive information systems (Stitch Fix, nd.).

While sending back the clothes that are not preferred by the user, the characteristics of the clothes received or not received by the client after each shipment are also recorded in the data pool. This strategy, which the company has developed by utilizing cognitive information technologies, can be considered as a strategy that prevents excess production amounts.

On demand production, which defines a make-to-order process, also serves the same goal as Black's defined business model (Design / Sell / Make). (Black, 2019) The pile of unqualified clothing created by the concept of "just in time production" is the result of the inadequate quality of wholesale production created by the rushed production lines to meet seasonal quotas. Contrary to this type of production, which causes a large amount of dead stock and product wastage, “On demand production” prevents waste (Mckinsey, 2021) and means that it can be produced with higher quality, since orders are not delivered on a seasonal basis. In this production model, which does not require the storage of products while waiting for users to place an order, all products are produced according to user demand. Therefore, when the product is not yet produced by the manufacturer at the order stage, this situation leads to longer waiting times for users, but offers a higher quality and qualified product option (Mckinsey, 2019).

To summarize the advantages of the "on-demand production" production model, which can be defined as an effective way to slow down the fashion industry.

1. Offers a more ethical alternative for designers and businesses; It reduces the energy and pollution of unsold and therefore unused shipping stock, while 'slowing down' fashion and reducing the danger of products being manufactured in uncontrolled factories to save time.

2. Ensures less waste; It not only saves the cost of producing the stock, but also reduces the waste problem caused by excess production quantities.

3. Allows for better relations with producers; By providing more consistent opportunities for producers, it creates an ethical, transparent, strong and fair working environment and also reduces economic anxiety.

4. Lays the groundwork for the production of higher quality products; Products produced with a longer production process but of higher quality are offered. By notifying the user in advance of production times, manufacturers and designers get the time they need to ensure their products are of the best possible quality.

5. More control over the business; By giving designers control over products, they can ensure that they are produced in the right quantity by fully understanding which products are in high demand without having to wait for seasonal stock changes.

6. Allows for greater opportunities for producers; Faced with less seasonal time pressure, manufacturers can have more flexible working hours and lead times by scheduling themselves to make products. This allows the creation of a more ethical, sustainable and craftsman-oriented work environment, rather than seasonal work (Davies, 2021).

To illustrate, it is not possible to win the fight by only cutting the costs of production and shipping as well as using only sustainable materials since the production is more than demand. A company called Teemill has a different yet effective approach to this issue. Teemil mentions that their items are produced in real-time and on-demand in their factory in order to overcome the unsold stocks. Teemill uses dozens of robotic devices and artificial intelligence in their production line.

Anyone with an internet connection can simply go on their website and design and sell shirts (Lewis and Burnell, 2019).

Figure 41. Factory of Teemill Brand (Source: Ecotextile, 2019)

A number of technology platforms are used to further facilitate on-demand production;

Sharecloth, a retail software company, uses cloud-based technology to help promote the on-demand model. This technology provides easy access to 3D models of products and allows businesses to take special orders directly from their websites (Sharecloth, nd.).

Alternative software, UnmadeOS, 'serves as an operating platform that enables fashion and sportswear brands to connect demand to product and production. The software allows products to be designed and then produced through all operating systems (UnmadeOS, nd.).

Techpacker is the other facilitator who states that the starting point of all production is the technology package. The system, which offers an interface design for brands to create their orders on demand, has created a transparent and reliable system that can clarify the needs of the order with the manufacturer, with the library system that includes information such as the definition, quantity, color, cost of the fabric and the supplier's contact information, and the structure where explanations, comments and pictures can be added (Techpacker, nd.).

Therefore, this system, which is vastly different from the traditional wholesale production and option system that designers and brands hope the user will buy, usually based on seasonal bulk orders, does not allow the formation of "orphan clothes" in the warehouses, and does not create wastage with this production method, instead of the concept of "Dead Stock". It can be said that it built a zero-stock system.

3.1.2. Design Softwares

Today, the concept of technology, which is not only used in the production of clothes, has turned into creating recycled technology for sustainable fashion is defined as an interdisciplinary and innovative field at the intersection of design, science, and fashion, which includes engineers and scientists as well as designers. Textile products, developed in cooperation with different disciplines for today's changing demands, seek the new in functionality as well as aesthetics. Since innovations in fashion design shaped by technology and crafts emerge non-stop and in interaction, computer-aided design should be examined in the context of contemporary craftsmanship with zero waste under the headings of softwares, applications and technological appliances.

From the past to the present, Technology and Science is the trigger of productive power. Production capability represents science, which means craft; science and technology represents the ability to produce which means the skill that comes with experience. (Sennett, 2008)

For this reason, following and analyzing current science and technology activities and integrating them effectively into creative industries such as fashion will make production efficient, while improving production methods. When approached from this point of view, 3D design programs, which is one of the current design technology trends, should be considered.

3.1.2.1. Stitch Hub software

Stitch Hub software, which is planned to be sold to brands that want to make 3D designs, creates a digital asset library by automatically scanning all items used for fabrics, ornaments, and completed designs in companies. In addition, it is emphasized that this software technology, which allows companies to design, present, and review their collections in a visually appealing environment, reduces the collection

development process by two weeks, according to Anne-Christine Polet, the head of software technology (Tafreschi, 2019).

Figure 42. Renders from Stitch 3D (Source: Vogue Business, 2021)

In addition, Stitch 3D, a startup project of Moda holding PVH, was offered to foreign brands in 2021. The technology used by brands within PHV such as Tommy Hilfiger and Calvin Klein provides tools that help brands scale their 3D design capabilities. Moreover, the software developed to scale 3D design capabilities, improve workflow and assist in the training of talents creates an environmentally sustainable value. Emphasizing that the purpose of the software is to facilitate digitalization and to create a rapid and sustainable change in the industrial age, Polet stated that digital design can reduce the resources required to develop collections.

3.1.2.2. Vizoo; 3D fabric scanning device

Founded in 2013, Vizoo is a fabric and tissue scanning device used to digitize fabrics. Vizoo works with a scanning device and accompanying xTex software. This technology, which enables detailed scanning of fabrics, focuses on detailed material visualization for use in 3D studies. In order to report in the most accurate way in the xTex program, it offers the opportunity to report from any part of the scanned fabric. Direct links are available for the following programs:

Autodesk VRED, Blender, Clo3D (by importing), Browzwear V-Stitcher (by importing), Assyst Vidya (by importing)

Figure 43. Fabric Management with VIZOO (Source: Optitex, 2020)

3.1.2.3. Vidya; 3D Virtual Fitting Software

Vidya is a 3D dressing simulation system that includes an advanced CAD system and enables the effective use of time and fabrics. Working integrated with the Assyst program, Vidya also allows revisions on ready-made patterns. Vidya, which is a 3D virtual proofing software, prepares digital samples thanks to the advanced parameters in it and provides remarkably close to reality views (About Assyst, n.d.).

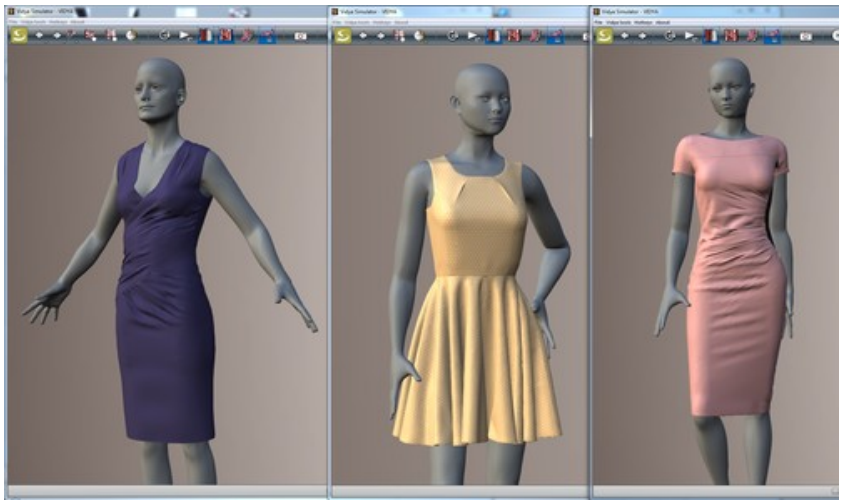

Figure 44. Vidya 3D - Virtual Fitting Software (Source: Assyst, 2020)

3.1.2.4. CLO-3D Fashion Design Program

CLO 3D design program, which creates lifelike clothing visualization with the latest simulation technologies in the field of design: It provides the opportunity to use from a single screen by providing the integrated work of the 2D mold window and 3D simulation window (CLO Virtual Fashion, n.d.). CLO 3D Design Program allows simultaneous viewing on the avatar while making mold revisions at the same time due to the 2D mold window and 3D simulation window. In the applications made, the sample prepared in the CLO 3D design program and the production sample are 95% matched to each other. Since the fabrics used in the production sample can be integrated into the CLO 3D Program, it offers the opportunity to get the most realistic image (CLO-SET, 2020).

Figure 45. CLO-3D - Fashion Design Software (Source: CLO-SET, 2020)

3.1.2.5. Accumark Gerber 3D

This software technology, which speeds up the traditional sample creation process and limits the use of resources, includes manual assemblies and relocations. Accumark 3D software technology is an integrated technological solution system that enables sample departments to create more styles in less time (AccuMark 3D, n.d.).

Figure 46. AccuMark 3D version 12.1 (Source: Lectra, 2020)

3.1.2.6. Vstitcher Browzwear

VStitcher is the industry's leading 3D fashion design and development software. With Vstitcher, designers have the ability to design garments through size ranges, leveraging graphics, fabrics, embellishments, colorways, styling, and photorealistic 3D rendering. Its comprehensive set of features enables designers, technical experts, and mold makers to create designs and take them to the next level with true motion fit, mold modification, grading, technology suite, and more (Browzwear, 2021).

More successful results could be achieved when technology initiatives are made by forming interdisciplinary functional teams. The capabilities of the designer and an engineer could develop an innovative perspective that complements each other. Fashion designers' expertise, design understanding, human experience; its cultural and economic importance, and its development in digital technologies could play an extremely significant role in shaping the consumer society of the future.

> "*If selectively and rationally embraced, technology can continue to serve the sustainable and ethical requirements of modern society, enabling ever sophisticated methods of clothing creation, consumption, and disposal.*" (Sarah Scatturo, 2008)

3.1.3. Biotechnology and Textile Innovation

“Biotechnology and Textile innovations”, the result of the blending of the concepts of craft, technology, production and nature, represent a systematic process combined with the aim of creating sustainable materials.

Biotechnology is a science-driven industry sector that uses living organisms and molecular biology to produce healthcare-related products. However, biotechnology is also applied in other areas such as Fashion. Modern biotechnology is the opposite of ancient forms of "biotechnology" that arose thousands of years ago when humans began domesticating plants and animals (Kagan, 2021). In today's world, where sustainability-oriented approaches and solutions have become a necessity, materials constitute one of the most important points to focus on. Therefore, using the science of biology inspired by nature to make textiles better and more sustainable has been instrumental in the creation of revolutionary new materials.

According to the report of BioFabricate, biomaterial; is “a term used to denote materials with a non-specific biological relationship”. Biomaterials can include many materials, from traditional and non-animal hides to a pure cotton fabric or a polyester cotton blend, containing fruit or vegetable waste combined with “bio-based” synthetic polymers (Understanding Bio Material Innovations, 2020).

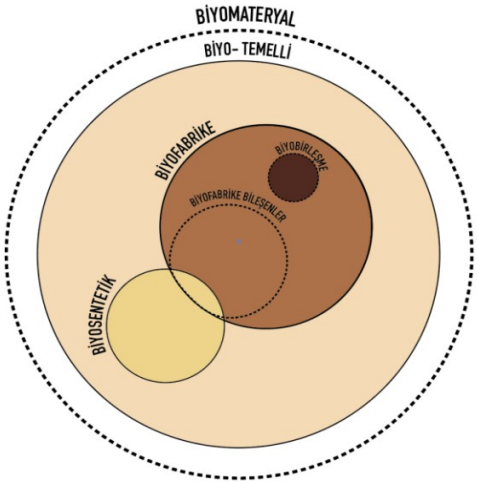

Figure 47. BioMaterial Explained (Source: Meriç, 2019)

Inventions and developing technologies in the field of biology have stimulated material research, developments in production methods and material structures, and many application areas have emerged for many types of biobased plastics, namely "biodegradable" materials (Meriç, 2019). The combination of biomaterials (such as starch, sugar, corn, vegetable oils) found in nature with synthetic polymers obtained from petroleum constitutes some of the biodegradable materials. In order to categorize a material as bio-based, the material must contain at least 20% renewable carbon. This

renewable carbon content is derived from plants or organic matter such as specially grown energy crops (Fulgar, n.d.).

In general, biodegradable materials that serve mass production with a sustainable approach that creates "Biosynthetic Textiles" which serves the ready-made clothing industry, in other words, the "fast fashion" system. Emerging as a potential alternative to traditional synthetic products, Biosynthetic Textiles consist of polymers made wholly or partially from renewable resources. Biosynthetic materials are divided into three generations depending on the development stages and the biological source from which they are derived:

1) Materials such as corn, sugar cane, sugar beet and wheat, which are referred to as first generation biopolymers, are commercially available and more common in use.

2) Biomass resources from agricultural and forestry wastes, which are classified as second generation biological raw materials, require further technical development and are not used commercially on a large scale.

3) Raw materials such as algae and bacteria grown as a third generation biological resource are at the concept and pilot stage, and their commercial prevalence is still considered insufficient. Textile Exchange (2018a)

To illustrate this situation for the textile industry;

Materials used in clothing are often not sustainable or recyclable. A significant amount of resources and effort is needed to recycle those products. While creating a cotton shirt requires the same amount of water as 2.5 years of water consumption for a human. On the other hand, synthetic materials use less water in the production process however they produce dangerous greenhouse gasses (Beall, 2020).

It is possible to save water, effort, and as well as reductions on emissions of greenhouse gasses by using alternative materials in production. Eco-Friendly textiles such as hemp, bamboo, banana fibers can be used as alternatives.

ECOPEL mentions that they are willing to reduce the environmental impact of faux fur. With their latest invention, KOBA faux fur (%37 Plant-based) the company claims %30 energy and %63 Greenhouse gas emission reduction (KOBA - First Bio-Based Faux Fur, n.d.).

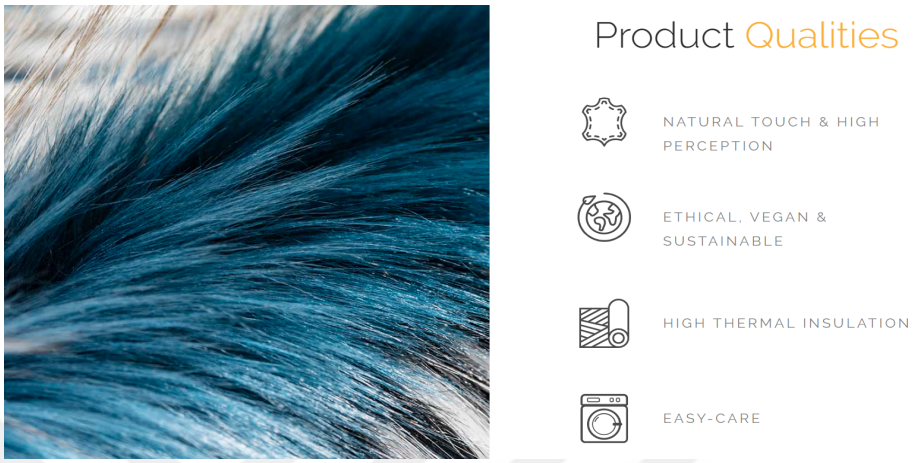

Figure 48. KOBA - First Bio-based Faux Fur (Source: ECOPEL, 2019)

While the companies are trying their best to overcome this huge problem, development in the technology department could also mean a huge help. In 2020, so far there were few developments that could tackle our problem;

Launched in November 2021, the Co-Exist Story collection, created with a sustainable approach, has been described as a nature-oriented collection focused on sharing the planet with animals. PETA-approved "FLWRDWN", an innovative and sustainable source, produced using a combination of wildflowers biopolymer and airgel, an alternative to animal materials, an alternative to animal hair filling, and 100% natural, is used once a year to provide the highest quality with pesticides or It is grown without artificial irrigation and is harvested by hand (Econyl, nd.).

Agraloop and hemp bio fiber, which are used from the harvest wastes of cannabis seeds, can be considered as steps taken to protect nature. (Ann-Sofie Johansson, creative advisor, H&M). In recent years, H&M has discovered plant-based alternatives and innovative fabrics instead of genuine leather, this time aiming to create a collection that does not contain animal fibers. (Ann-Sofie Johansson, creative advisor, H&M). (Hm example, 2021).

The use of biosynthetics consisting of fibers made of polymers derived from renewable resources known as biopolymers is becoming widespread. Some of the most common commercially available biopolymers come from renewable sugars, starches, and raw materials such as sugar cane, corn, and vegetable oils. Today, various technologies are being developed and regular testing is carried out to produce commercially available biosynthetic fibers. Synthetic biology can be characterized as a new compostable and promising technological achievement to produce bio textiles in the fashion industry. Although sustainable fashion initiatives are more prominent; more ecological processes are needed due to the current use of natural resources caused by the fast fashion system (Ug, 2020).

Biofabricated material, which is defined as an area designed by growing living things in nature (living materials such as bacteria, fungi, algae, culture and mammalian cells) through methods such as fermentation, yeast and yeast engineering, constitutes the other part of biodegradable materials (Healthy Materials Lab, 2020). Bio Fabricated materials, which generally serve for slow production under the umbrella of sustainability, are used by designers and artists who make more boutique production, creating "Biofabricated Textiles' that can serve couture clothing and experimental works.

Biofabrication, which covers a wide range of practical applications such as biofuel production from algae, animal-free meat production, animal-free skin and fur production, tissue and organ production for human implantation, tissue modeling, drug toxicity and drug discovery experiments, biosensors used in space exploration, and bioart. It means “bio-production” (biofacture), which is widely used in bioengineering terminology (Mironov et al., 2009; Baydemir and Bıyıklı, 2021)

“Bio Fabricated components”, defined as “macroscale structures grown by living microorganisms such as bacteria or mammalian cells”, encompass microbially produced building blocks for both “natural” and “synthetic” polymers that can be exemplified by complex proteins such as silk or collagen (Understanding Bio Material Innovations, 2020).

Mycelium, which is among the “Bio-Combined” materials; Chitin is a polymeric composite material naturally formed from cellulose and proteins. With its

rapid growth, “mycelium leather”, which does not require intensive processing methods, is a very suitable alternative to traditional leather in terms of environmental impact. The mycelium, which has visual features that mimic cowhide, can be cut and shaped, pressed or textured, colored or tanned, similar to cowhide. Thanks to the proteins in its structure, it forms an outer "skin" that behaves very similarly to the skin formed by collagen in animal skins. The properties of this leather, which has a flexible and soft structure, such as surface homogeneity, abrasion resistance and water repellency vary according to the type of cork used. This material, which can be used in clothing design, is the product of a labor-intensive process (Material Innovation Initiative, 2020).

In this context, “MYLO” produced by Bolt Threads company with a mycelium design called a fungal species formed by a bacterial colony, can be shown as an example of the “Bio-Assembled” material class under the roof of Biofabrication. Bolt Threads Soft leather-like material MyloTM, which was licensed by the partnership of Patagonia and Stella McCartney for vegan mushroom skin developed by the American company Ecovative Design, was produced from the bacterial roots of fungi, Mycelium. Mycelium, which is a more practical and environmentally friendly alternative to genuine leather, has been grown in a laboratory environment and under observation. This material, which has a hard form in the beginning, then grows into a soft and bendable form after intense work. This material, which has an animal skin-like appearance but is completely plant-based, eliminates the damage caused by polyester-based artificial leather, while offering an innovative option with a completely natural and biodegradable new generation leather (Bolt Threads, nd.)

Piñatex, developed by Dr. Carmen Hijosa, is a cellulose obtained by mixing PLA and resin produced from pineapple leaves, is a natural leather alternative. In the production of Piñatex, waste leaves from the pineapple harvest are used as raw material (Ananas Anam, 2021). The fibers obtained from the leaves are transformed into non-woven surface textiles and a leather appearance is obtained by various processes. Thus, it can be used as a sustainable alternative to leather for a wide range of products.

Silk Pavilion exhibition was an outcome of a case study led by designers, engineers, artists and scientists, which was organized by the MIT Media Lab in 2013. In this work, where a silkworm dome was created using robot-knitted threads, unique

technologically manipulated cocoon weaves, digital and biological fabricated material were the first to come to life in architectural proportions. The aim here is to increase the flexibility and durability of the potential material obtained. It was to highlight architecture and a remarkable structure.

Continuing to research to use biosilk for fashion purposes, Bolt Threads announced MicrosilkTM in 2017 in collaboration with Stella McCartney. Designed with spider DNA, yeast and water, MicrosilkTM has an elastic, soft structure and is defined as a synthetic spider silk. Bolt Threads, as a biomimetic adaptation of spider silk, has properties such as high tensile strength, elasticity, durability and softness (Bolt Threads, n.d.).

Japanese biotechnology startup Spiber, which has developed a material equivalent to spider silk, an exceptionally durable material, has fed proteins created by genetically modifying the DNA of microbes with sugar and other nutritional salts. The fed microbes were dried until the resulting substance was purified and powdered by a fermentation process similar to that of beer. The fiber called “Qmonos”, which is produced as a kind of protein by the combination of bioengineered bacteria and recombinant DNA, got its name from “kumonosuna”, which means spider web in Japanese (Spiber, 2020). With this synthetic revolutionary protein developed, Spiber launched the "Moon Parka" in 2019 in cooperation with the North Face brand (Spiber, 2019). The product constitutes the first outerwear prototype produced with synthetic spider silk “QMONOS” fiber within current industrial production technology (Bhanushali, 2021).

Supporting the integration of the design process with scientific fields in order to develop the products of the sustainable future, Collet investigated the potential of synthetic biology and living technology for the textile products of the future with the project named BioLace. Designed to explore the potential of a biological manufacturing future by exploring the cellular programming of plant systems, the project aimed to integrate synthetic biology with scientific fields by transforming it into accessible design scenarios (Collet, 2012).

Biofabrication creates a space where the designer can work on bees, fungi, bacteria, algae or plants and develop new techniques to grow and produce products,

like a farmer, in the production process, which has begun to make sense for designers as its use in applied design disciplines increases. (Chieza and Ward, 2015). The new generation designers in the fashion industry, shaped by technological developments, while designing the forms, looks and materials of the future, transforms clothes from passive appearances to active technological tools (Quinn, 2012).

Designer Suzanne Lee, who is considered as one of the pioneers in researching the subject of biodesign in textile and fashion fields, was one of the first researchers to write in this field in her book "Fashioning the Future". By questioning the concept of "growing" clothes and the "ready-made" product-ready garment strategy created by the fashion industry, Lee creates a slow process in which the material turns into a meaningful actor (Smelik, 2018).

Setting out with the question of how we can create other materials for a sustainable future, researcher Suzanne Lee transforms engineered materials consisting of biologically engineered living organisms directly into finished, biodegradable products. Demonstrating that eco-chic clothing can be produced from the microbes used in fermented green tea, Lee worked with scientists and biologists. They produced layers of cellulose that could be molded onto a wearable fiber by throwing yeast, sweetened tea, and bacteria into tubs at a certain temperature (Lee, 2005).

Bio couture is an innovative fashion concept used mainly to describe the use of bacteria in the production of textile materials to make high-quality garments. It develops materials through compostable materials that can be produced with minimum raw materials, toxins, and water. It is produced using raw materials such as wood, starch, sugar, etc. It is named Biocouture as a result of combining the old-time classic haute couture term with a more ecological term, which is handcrafted and one-of-a-kind designed by French high fashion houses with truly distinguished clients. In the Biocouture concept, garments are made only from raw, natural resources and materials grown from different types of organisms. The term was first introduced by Suzanne Lee, a researcher working on future technologies in the fashion manufacturing industry at the Central Saint Martin’s School of Art and Design in London (Ha, 2016).

Figure 49. BioCouture: The new future of growing garments with bacteria (Source: Lee, 2012)

The adventure of Bio couture, which started with microbial cellulose, covers a labor-intensive process in which the material must be grown. In this context, in the first stage, the material can be harvested by lifting it from the liquid in a period of about ten days. When the moisture turns into steam, the combined fibers are dyed with vegetable or fruit dyes in the next step. The result of bacteria and yeast, as is often claimed, is somewhat like a thin leather fabric. Following a labor-intensive production process, these garments are examples of qualified and unique designs. Moreover, they are also compostable clothing designs (Dezeen, 2014). Within the scope of all these examples, it could be stated that the connection between creativity and innovation is material design. Creativity, which is the intellectual action of looking at existing problems with a new eye, draws its inspiration from natural science and creates a labor-oriented world of possibilities that combines developing technologies with experience. This field, which is part of a labor-intensive process, can enable the creation of new tools and the development of new materials for the design and modeling of more sophisticated products that do not exist in nature.

Therefore, considering the speed of the system and its production capacity, even if slowness cannot be mentioned in this example, it can be defined as examples that show themselves as alternative materials based on innovation created by giant ready-made clothing companies to ensure sustainability by using technology. On the other hand, the technology used today also tries to limit the use of resources, develop

new materials, create alternative and functional design methods, and create a better structure against destructive effects. Since the second half of the 20th century, with the continuous development and widespread use of computer technologies, and innovations; many systemic designs have emerged. Artificial intelligence technology is the one that stands apart from the other designs

3.1.4. The Future: Artificial Intelligence

The concepts of fashion and technology, which frequently meet at the middle point from the past to the present, have pushed the boundaries of each other and led to the emergence of the most advanced products and systems. The fashion and textile industry, which cannot stay away from using new technologies created to serve different areas for its own benefit, has started to be used for different purposes in the fashion industry today. With the continuous development and widespread use of computer technologies, it is possible to examine artificial intelligence technology, which is one of the innovations covering many systemic designs, within the scope of four headings for the fashion industry (Nadasbaş, 2020).

3.1.4.1. Demand Planning and Trend Forecasting

It is very difficult to develop an accurate trend prediction for the future in the fashion industry, which is based on individual and variable tastes. Especially in recent years, developments in communication technologies have made it more difficult to develop trend forecasting. With a freer user group that creates their own trains, it has shaped the spread of fashion and the concept of trend. In the textile industry, the annual subscription fees of trend analysis companies such as WGSN, which are at a key point in the determination and analysis of trends, can reach up to 50,000 dollars (Lauglin, 2017). Therefore, in this situation, which puts the manufacturers in a difficult situation, the necessity of accurate and accessible trend forecasting is clearly seen. On the other hand, at the point reached today, the critical point for the textile industry is an ongoing production problem for ever-changing trends. Therefore, the important thing is to be able to design sustainable products and systems that support the global economy.

As a way of forecasting (predicting) the upcoming demand, AI can do much more than predict demand with the help of machine learning, historical sales data, seasonality data and past consumer trends. More data and more feedback means

accurate predictions; however, in extreme cases, the forecast will not be as accurate as the real-life scenario. Demand planning is used to make better financial decisions, increase operational efficiency, and increase supply chain efficiency. It also reduces unwanted production, which means a better customer experience and less waste.

The Swedish fashion empire H&M has created an AI department and employs more than 200 data scientists for trend analysis and prediction. The AI algorithm captures the information and analyses with the past data sets, then plots the most important data: when, how much, and where… With the data given, the company would produce the exact amount and transport goods to the necessary stores at the forecasted timeline. This helps not only the company to reduce waste it also helps the company not to spend unnecessary supplies and money (Nikolopoulos, 2022).

This method could be defined as new, but it is developing and becoming a must in the sustainable fashion industry; however since slow fashion is timeless and it does not follow up on any trend, forecasting the demand is almost impossible for slow fashion.

3.1.4.2. Contribution to the Design Research

As a result of rapid developments in technology and globalization, designers have started to turn to innovative working methods in the light of collaborative, flexible, versatile and current developments. Today, some fashion designers use computer technologies to facilitate the design process, which includes the steps of thinking with different perspectives, comprehensive research, analysis, experimentation and transforming experiences into products. A designer can use the computer as a design development tool on the way to the purpose of the design, as well as enable the emergence of a form that he did not think through the computer environment during the process (Turan, 2011). In such a case, the fabric of the designer would be software programs and the computer. At this stage, computer aided drawing programs are frequently used today. The use of cognitive information technologies in the research and development activities of designers is becoming increasingly common.

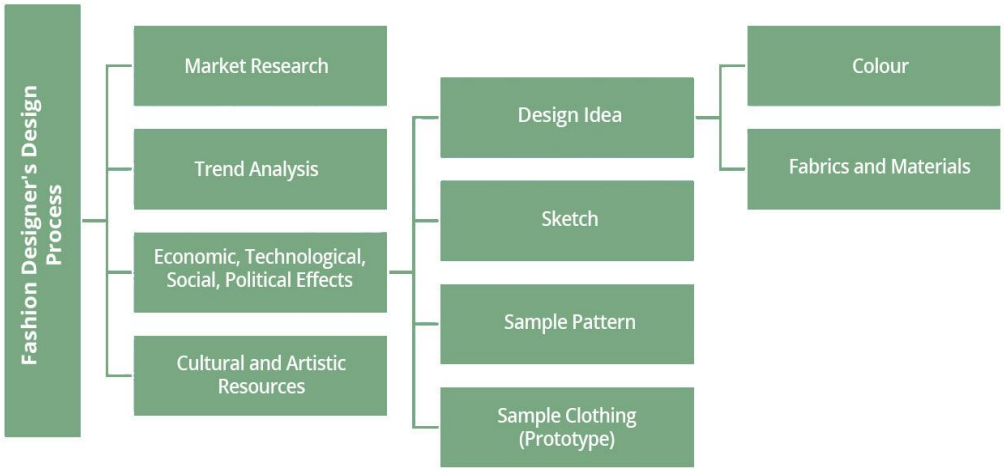

Figure 50. Fashion Designer's Design Process (Source: Siersema 2015)

Cognitive information technologies, which quickly provide data-based information in the most practical way for designers to design more effectively, paves the way for design. IBM's cognitive information technology "Watson"'s data analysis work for Falguni and Shane Peacock brand can be shown as an example of this situation by summarizing it with three items.

1)Color estimation for the collection: Determining seasonal color trends and trend colors by analyzing the visuals examined in line with the determined frame, using image recognition technology.

2)Visual Scanning: Gathering design samples compatible with the silhouette, pattern and style line of the brand by analyzing visual data.

3)Pattern Inspiration: Analyzing thousands of patterns with artificial intelligence technology and developing unique textile pattern designs with artificial intelligence technology (Nadasbaş, 2020).

Although it is seen as a technology that supports and facilitates fast fashion, it is important to determine which data is researched for what purpose and for what purpose, so focusing on the possibilities it can show for a craft-oriented, slowing down design process may search for another door.

3.1.4.3. Improvement in Production Processes

In addition to the use of automation technologies with artificial intelligence in the production process, current technology trends that offer opportunities for the development of the industry, studies also carried out on cognitive technologies that affect the selection of materials to be used and production strategies. The company named Investopedia carried out studies to control the supply chain with the blockchain. In addition to the labels and instructions for use on every garment produced, attempts are made to add a QR code (QR) that provides information about the product. Thus, it reveals that a more transparent supply chain can be created and a system that improves the production process for all manufacturers can be built (Nadasbaş, 2020). Therefore, a transparent and sustainable fashion network can be created by using information technologies.

3.1.4.4. Generative Design

Design, which is the product of a creative process, is a process based on using the knowledge and skills brought by the designer from the past, such as materials and ideas, in the most correct way to reach the best result. The design process, which proceeds with primitive methods and research, begins with the visualization of a concept in the mind. This image, which has not yet been fully clarified in the mind, takes shape according to the experiences and practices experienced throughout the process, and the result is reached. A designer, who creates a design proposal, is a person who can solve the problem by developing solutions for unexpected results encountered on the way to the goal and has the ability to reach the final goal (Cross, 1999; Nadasbaş, 2020).

Therefore, artificial intelligence, which is built on imitating human intelligence, improves its skills by learning from experience and mistakes, just like a craftsman. In order to answer the question of whether machines can replace designers in the future, companies are working on machines that design clothes according to the expectations of consumers by using cognitive information technologies. An example of this is the Project Muze project, realized in partnership with the online fashion platform Zalando and Google. The project, designed with the aim of "developing a design in line with the user's tastes and preferences," has created a data pool that collects taste, style, moods and different style characteristics of trend setters. This data

pool, created to be analyzed with cognitive information systems, reaches the designs developed for them after the users fill in the relevant sections (Google, 2017).

Generative design could be described as a design exploration process. Designers or engineers input design goals and other parameters (spatial requirements, materials, manufacturing methods, and cost constraints) into the software, then the software calculates all the possible outcomes and quickly generates the design alternatives. This not only saves time for the company or the designers, it also saves money and reduces the waste material in prototyping processes (Autodesk, 2020).

In the fashion industry, there are two main approaches to algorithmic fashion design: generative clothing design and AI-aided digital fashion sketching. These methods are the equivalent of generative design for the fashion industry, and they emphasize “form-finding” over “form-making” (Särmäkari and Vänskä, 2021).

- Generative clothing design: Matti Liimatainen case study
- AI-aided digital fashion sketching: The Fabricant case study

Figure 51. Polartec and Browzwear Launch First True-to-Life 3D Performance Fabrics (Source: Polartec, 2020)

The Fabricant Studio, which defines itself as a digital fashion house, is a digital fashion design firm that aims to steer the fashion industry towards a new industry of only digital clothing, which wastes nothing but data and uses nothing but imagination. Fabricant, which produces digital design and fashion experiences and operates at the intersection of fashion and technology, aims to build a collaborative, creative, inclusive, and sustainable fashion future with digital clothing. A collection project

consisting of special digital clothing created for the metaverse, named “Season 0”, was created. It is the first collection curated through The Fabricant's Studio platform, where users can create virtual couture as NFTs with fashion brands and creatives. A total of 50 pieces were produced for the Season 0 collection, created by 50 individual users of The Fabricant Studio. Each one-off garment is NFT-printed, meaning it can be traded and worn in various environments in the metaverse – an interesting example of a waste-free fashion design combined with fashion and the digital universe (Crook, 2021).

Therefore, in digital fashion, where people are not passive consumers while expressing their virtual identities with digital clothing, it does not have a harmful environmental impact. Fabricant says that digital clothing is drastically reducing the impact of the fashion industry on the physical world, which consumes the planet's resources. Fabricant states that digital clothing is sustainable in nature, as it does not reveal any physical pollution and waste. Thus, there is no need for samples, high retail stock levels, and size ranges in the industry created by digital products (Fabricant, n.d.).

Also, the Digital Fashion Collection was designed by Amber Jae Slooten, who is the creative director and co-Founder at Fabricant. It is a collection created by the cooperation of a computer and a human, started with the question of can computers be creative? The algorithm was created using the Paris Fashion Week inputs. In the first part of this two-part process, there are main source images. In the second part, the computer has to guess what the images look like. The continuous estimation process starts with just random pixels.

However, after a period of deep learning, the computer can no longer identify the difference between the generated image and the original images. Because the results were striking, Amber decided to use the designs as an inspiration for her outfits in terms of color, material, and shape. The process, which gave rise to interesting energy, led the designer to create things that she could never have found on her own. She combined this with inspiration from her experience as a designer and an emotion she needed to incorporate into the collection. It is a comprehensive experiment that takes the viewer on a journey to a new frontier that has not been explored before by fashion design or animation. This project is one of the first hyperreal visualizations of

a complete fashion collection where the collection does not exist in real life. (Golub, 2019) An amazing achievement of artificial intelligence was developed by DeepBlue Technology. Their deep learning "DeepVogue" system beat out many designers and became second in a contest in China. DeepVogue was the only “non-human” participant among 16 teams and the system won the runner-up prize overall, as well as the “People’s Choice Award.” (Jain, 2019).

This achievement is a tremendous success and a great accomplishment as well as it raises many questions. Will AI replace human designers? The system would work only if the data is provided and design goals and tasks are specified. Also, human designers or engineers have to select suitable designs or designs out of the pool. However, when there is a need for repetitive tasks or when the ecosystem lacks the design capabilities, then AI would easily take the crown.

Figure 52. DeepVogue AI: The Era of AI Design (Source: ELSE Corp, 2019)

CHAPTER 4: USE OF TECHNOLOGY FOR SMES IN TURKEY

This chapter contains the research of the thesis. As mentioned in the methodology, the research part of this thesis is divided into two sections: survey and interviews. The main goal of these interviews and surveys could be summarized as how SMEs use and could have used technology in their businesses.

Small and Medium Enterprises, as in their name, are not huge companies, and should not be expected to have enough resources to spend on the latest technology machines or even the latest software. Because of the limited resources and lack of the need for technological advancements, it is expected that almost all of the SMEs won't be involving technology in their businesses. However, as mentioned in the previous paragraph this research is not only focused on the current situation of the SMEs; it is also looking for a solution on how to use the technology as an advantage in slow fashion.

The research proceeded in line with the questions developed under three headings. The survey and interview questions developed within the scope of company information of small businesses producing with different slow fashion design methods, their compatibility with slow fashion principles, and their relationship with technology have been prepared to support each other.

In this context, the research proceeded in line with the questions developed under 6 headings. Company information, resource use and supply chain, vision, design modeling and technology use of small businesses producing with different slow fashion design methods, the relationship of order distribution and sales processes with production, Survey developed within the scope of promotion, social responsibility, training activities and collaborations. interview questions were prepared to support each other.

4.1. Survey Evaluation

Depending on the slow fashion criteria, 55 companies with different production methodologies from different fields to learn their thoughts on technology and slow fashion, which are assumed to apply slow fashion and are followed on social media, use slow fashion methods in production and/or produce low volumes, are chosen

randomly, and are selected by random methods. An interview request was sent along with the questionnaire.

The questionnaire consists of 52 questions under 6 main sections; Business information, sourcing, usage and supply chain, vision, design modeling and technology usage, relation of order distribution and sales processes with production, Promotion, social responsibility, training activities and collaborations.

Out of 55 companies, 45 have participated in the interview and survey. In this academic study, the compatibility of businesses with the principles of slow fashion and their relationship with technology and the way they use technology were examined. Compliance with the slow fashion principle was measured with 11 questions in the questionnaire. (8, 9, 10, 13, 17, 18, 20, 26, 45, 49, 50)

The design methods used by companies that work in harmony with the principles of slow fashion were evaluated with 4 questions. (21, 41, 42, 43) The way businesses use technology and their approaches to technology were examined with 9 questions in the questionnaire. (19, 23, 24, 28, 29, 31, 32, 33, 35) Questions 37-38 and 39 were asked in order to examine the scope of the relationship between order distribution and sales processes and production.

The first questions of the survey were asked to get information about the enterprise, the fields of activity, monthly production quantities (production capacities), number of employees and their market definition. From these questions, it could be evaluated that, most of the local businesses' fields are "women's clothing" and "accessory design". Monthly production numbers are not very high, they generally work as order on demand or with small stocks.

These businesses, which do not have a very high number of employees, were founded by people from different disciplines and do not receive design support, which means, they do not employ designers. The majority of the brands that participated in the survey were small companies with no more than 5 employees. They also do not receive full-time production support. Considering the questions 8-9 and 10, which are asked in order to measure the company's compliance with the slow fashion principle.

As seen in Figure 51, 60% of the businesses define the fashion season as two seasons and 40% as 1 season. Which supports the timelessness of slow fashion against the variability of fast fashion. As mentioned earlier one of the identifying criteria for slow fashion is being timeless, which means the design does not require any fashion trend. It could be designed and crafted without being dependent on any season of the year.

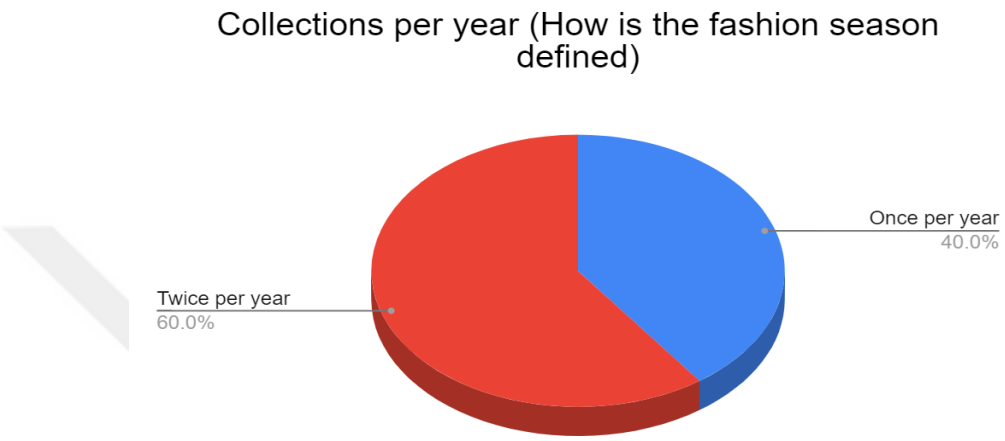

Figure 53. Collections per year (How is the fashion season defined)

Considering the number of collections in the defined seasons, the answers were concentrated in "5-10" and "10-20" options, as seen in table 3. There are no collections of 50 or more, and a low segment of (17.8%) the brands constitute the collections in the range of 20-50.

Table 3. Design Quantity of Collections

Design Quantity of Collections	Count	Percent
1-5	5	11.1
5-10	15	33.3
10-20	17	37.8
20-50	8	17.8
50+	0	0.0

Table 4. Characteristics of Collections

Characteristics of Collections	Count	Percent
Limited colors	32	71.1
Minimal quantities	40	88.9
Specific style / Capsule collection	42	93.3
Suitable for fashion seasons	2	4.4
Sustainable	43	95.6
Flexible	12	26.7
Functional	40	88.9
Comfortable	33	73.3

As can be seen in Table 4, the majority of the businesses defined their collection features as minimal colors, small pieces, in certain styles, original, sustainable, flexible, functional and comfortable, while 4.4% of the businesses stated that they were suitable for the fashion seasons. This situation shows that the companies participated in the survey, work with collections that support the principles of slow fashion, and they also challenge the variability and trends created by fashion with their qualified and timeless, sustainable designs.

Table 5. Sources and Materials used in Products

Sources and Materials used in Products	Count	Percent
Natural resources, biodegradable materials	28	62.2
Organic cotton	36	80.0
Silk	23	51.1
Ahimsa silk	3	6.7
Raw linen	29	64.4
Leather	3	6.7
Dead stock	8	17.8

The vast majority (62.2%) of surveyed businesses work with biodegradable and organic materials, while 3% of the enterprises use leather, 8% use deadstock materials, for their designs and production activities with the practice of upcycling under slow fashion methods. In terms of resource supply, most of the enterprises carry

out their production with internal and external sources. This situation, which does not fully support the local economy in terms of resource supply, causes businesses to act dependent on foreign sources at some point. In addition, the majority of the enterprises participated in the survey do not receive manufacturing support and cooperate with cooperatives and independent producers. 9% states that they received contract manufacturing support sometimes, 2% often, and the other 2% as always. Although these answers leave a question mark for the businesses working with slow fashion principles participating in the survey, it should be noted that there are ateliers that produce under ethical production conditions and in small numbers when compared to the interview questions.

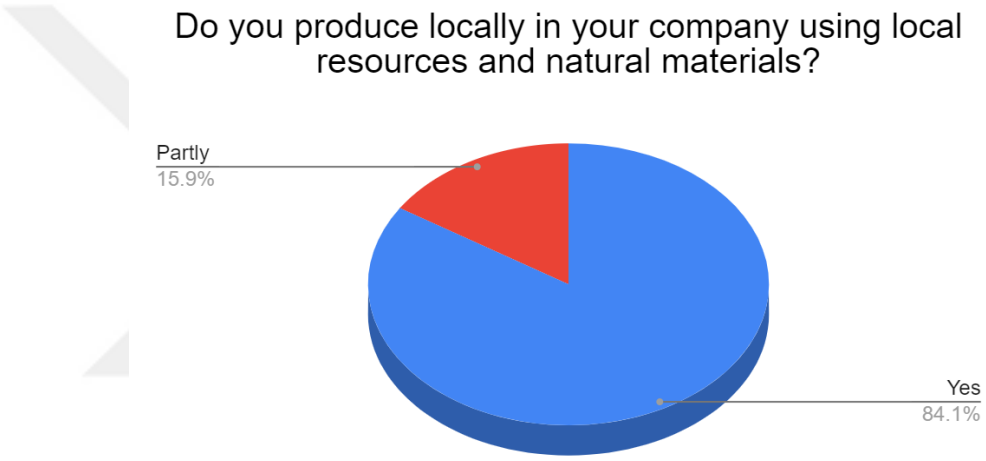

Figure 54. Do you produce locally in your company using local resources and natural materials?

84.1% of the small businesses that participated in the survey mentioned that they supply their production using local resources and natural materials, while 15.9% answered as partially, none of the companies answered “no”.

While the majority of the businesses define sustainability for their businesses, they specified all options (as seen in Table 6) responsible production, responsible consumption, slowness, biodegradable natural materials, transparency, fair working conditions, and low production quantities. The usage of biodegradable materials is lower compared to other substances, although this could be questioned. On the other hand, for a small group that did not answer this question, the reason could be due to products such as wedding dresses that provide upcycling or emotional sustainability.

Table 6. Concept of Sustainability

Concept of Sustainability	Count	Percent
Responsible production	36	80.0
Responsible consumption	35	77.8
Slowness	36	80.0
Natural materials (biodegradable)	28	62.2
Transparency	35	77.8
Fair working conditions	35	77.8
Low quantity production	35	77.8

While the majority of the enterprises participated in the survey stated that they created their collections according to the timeless, qualified, functional, comfortable and minimal design principles that equate the design principles with the principles of slow and sustainable fashion, 20% of the enterprises defined the repair practice as a principle, which is a significant amount since most of the brands do not own a repair-based service or an application-oriented workshop based on repairs. (Table 7)

Table 7. Design Principles

Design Principles	Count	Percent
Natural ingredients	37	82.2
Comfortable	37	82.2
Minimal	27	60.0
Stylish	13	28.9
Qualified, original design	39	86.7
Detailed designs	19	42.2
Functional	40	88.9
Timeless	15	33.3
Daily	28	62.2
Repair	9	20.0
Upcycling	19	42.2

Most companies define their collections with principles that comply with sustainable criteria are composed of businesses that do not act according to fashion trends and create their own design language, creating their own identity against the lack of identity of fast fashion. However, as seen in Figure 53, 24.4% of them stated that they would choose it partially, and that they create their designs based on trends

or inspired by them. Compared to interviews, this situation represents that business owners who do not have a design discipline feel the need to be inspired by trains even if they assume the identity of a designer. It should also be considered that it can be interpreted as products that can adapt to every trend with its timelessness.

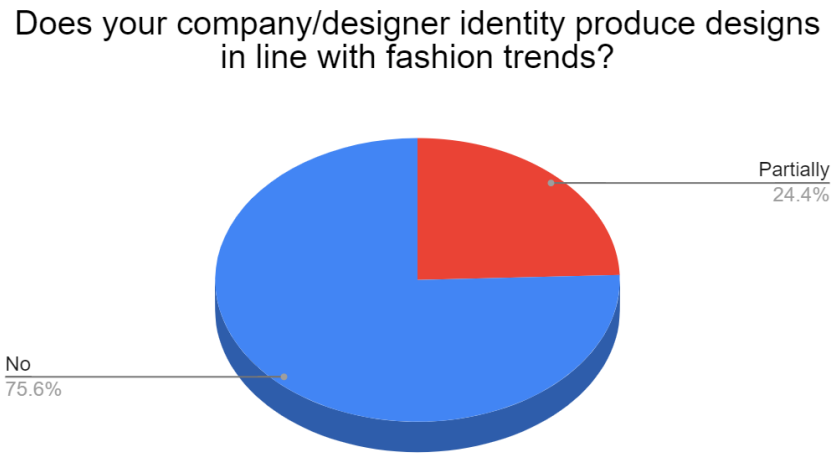

Figure 55. Does your company/designer identity produce designs in line with fashion trends?

One of the most notable features of slow fashion is that it is fair, transparent and sincere. In this context, it is seen that the companies that are expected to shine are trying to shine with the answers given by the production conditions, supply chains, people with whom it cooperates, social responsibility projects, sharing the environmental and social effects of fashion, in short, by raising awareness. As seen in Table 8, the lowest sharing rate is the item of sharing in the supply process with 11.1%. Compared to the interviews, companies stated that this situation arises from the fact that the social media shares can be made effectively with the owner of the business taking on every role, and as a result, all stages can be managed effectively. In addition, during the interviews, the companies that stated that they had difficulties in sourcing, stated that they had difficulty in accessing organic and waste materials. Therefore, it could be determined that this subject is an area open to development.

Table 8. The content/criteria covering social media posts

The content/criteria covering social media posts	Count	Percent
Production process	37	82.2
Knowing the manufacturers	17	37.8
Product ingredients	35	77.8
User stories	21	46.7
Dressing practices / style suggestions	31	68.9
Repair stories	10	22.2
Design stories	33	73.3
Workshop environment	28	62.2
Supply process	5	11.1
Knowing the craftsmen	22	48.9
Awareness about the textile industry	22	48.9
Social and environmental impacts	22	48.9
Social responsibility	25	55.6
Platforms, collectives	11	24.4
Events	20	44.4
Collaborations	23	51.1
Workshops	12	26.7
Educational videos (DIY, repair, etc.)	2	4.4

Another item seen in Table 8 is the 37.8% producer promotion item. Although businesses create transparent content on their websites during the interviews, the prevailing opinion is that sharing under the title "who made my clothes" in social media shares and promoting the manufacturer creates another marketing perception and creates a label. Another critical point seen in Table 8 is the criterion covering repair stories, platform and collective collaborations, training videos and DIY applications.

With a 22.2% rate of repair stories, it could be clearly seen that studies in this direction could be increased. Thanks to the repair activities of the enterprises, it would prevent being a local brand by creating a deeper bond with the user. Collaborations with Platforms and Collectives, and projects based on volunteerism could be identified as areas open to development. It could be determined that projects should be developed for the inclusive structure of slow fashion based on acting together. Considering the

DIY activities that have increased with the effect of the Covid 19 Pandemic, the fact that the lowest content in the table is educational videos with a rate of 4.4%, although it is a surprising criterion, the interviews support those numbers. Businesses stated that although they wanted to do something about this issue, they could not find the necessary time and that this issue was a practice that should be studied in a main field but can be done through collaborations. Therefore, it could be stated that this area is open to improvement with the effect of technology and possible collaborations.

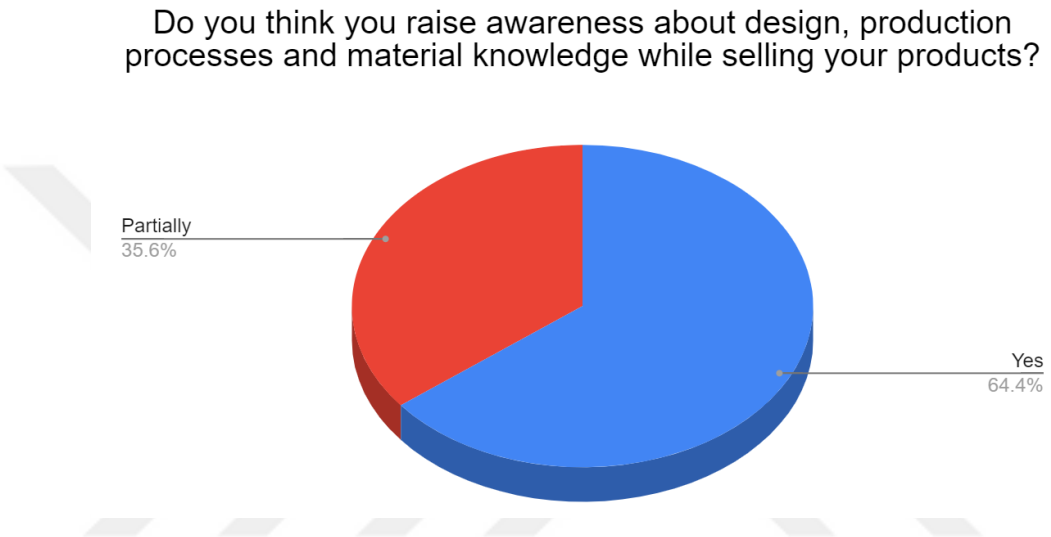

Figure 56. Do you think you raise awareness about design, production processes and material knowledge while selling your products?

As seen in Figure 54, although the majority of the enterprises (64.4%) who participated in the survey thought that they created awareness about design, production processes and material information; however, some of them (35.6%) were not very sure about this. On the other hand, during the interviews, the brands stated that this situation was due to the fact that a person could not be assigned to every job. Business owners stated that they needed to improve themselves in this regard.

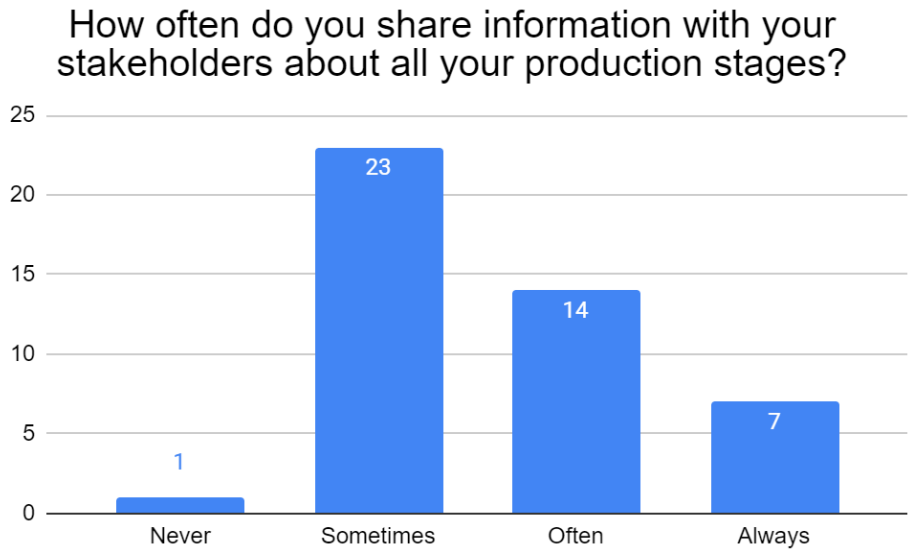

Figure 57. How often do you share information with your stakeholders about all your production stages?

As seen in Figure 55, the majority of the enterprises stated that they sometimes share their production stages with their stakeholders. While 14% stated that they shared it frequently, 7% stated that they shared it often, and 1% stated that they never shared it. This situation could be considered as a response given by a wedding dress production brand operating in the field of Houte Couture.

Table 9. Sustainable Design Methods Used

Sustainable Design Methods Used	Count	Percent
Ecological dyeing, printing	18	40.0
Upcycling	23	51.1
Needle works, punch, etc.	13	28.9
Participatory design	8	17.8
Adaptable, functional design	35	77.8
Weaving	4	8.9
Repair	4	8.9

It could be seen in table 9 that the companies that participated in the survey use all of the slow design methods. It could clearly be seen that there are adaptable and multifunctional design methods with 77.8%. In addition to the businesses stating that they have functional clothing serving many purposes, the upcycling method is in 2nd

place in terms of method usage trends with a rate of 51.1%. Primitive dyeing method with a value of 40%, could also be an experimental production technique preferred by businesses among slow fashion design methods. The tendency of the enterprises that participated in the survey mentioned that they use weaving and repair methods with a rate of 8.9%. Repair could be defined as an effective way of maintaining the life of products as stated in the previous questions. In terms of sustainability, it could be determined that local businesses have areas that are open to improvement in this regard. The most striking value in Figure 58 is the approach of Participatory Design with a rate of 17.8%. The participatory design is an approach that includes the user in the production process by making a passive consumer an active consumer that enables the user to connect with the object. Therefore, it has been determined that the companies participating in the survey need to improve themselves in this respect.

Figure 58. Do you carry out workshops within your company?

As it could be seen in Figure 56, most of the companies do not carry out workshops that involve the user in the manufacturing or repair process. On the other hand, 22.2% of the brands organize workshops and 17.8% of all stated that they are doing it from time to time.

Figure 59. Do you organize training/workshops/etc for production and design methods?

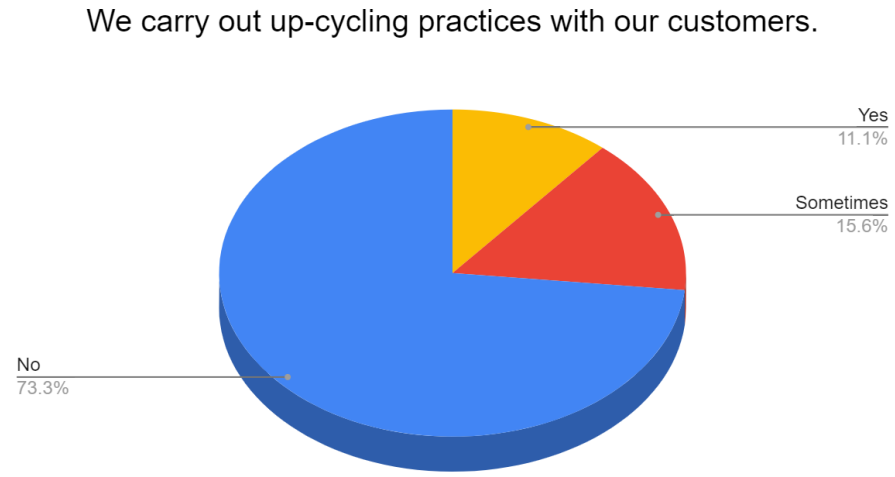

Figure 60. Do you organize training/workshops/etc. for production and design methods?

As it could be seen in Figure 57, the majority of the enterprises that participated in the research stated that they did not organize training or workshops, while 37.8% of the participants stated that they organized a workshop. Interviews also support this situation. In fact, it has been confirmed by interviews that most of these workshops were carried out by businesses using natural dyeing methods. Some of the workshops carried out are studies carried out with the forward conversion method. As seen in Figure 58, 11.1% of the enterprises carry out studies in this field. The interviews also support this situation. Even though the businesses wanted to organize more workshops,

they had to postpone the work they wanted to do in this field due to the pandemic conditions and not being able to find the opportunity. Therefore, this area is considered as an area open to improvement and development through possible collaborations.

In this section, where the methods of using technology and approaches to technology of the companies participating in the survey are evaluated with 9 questions;

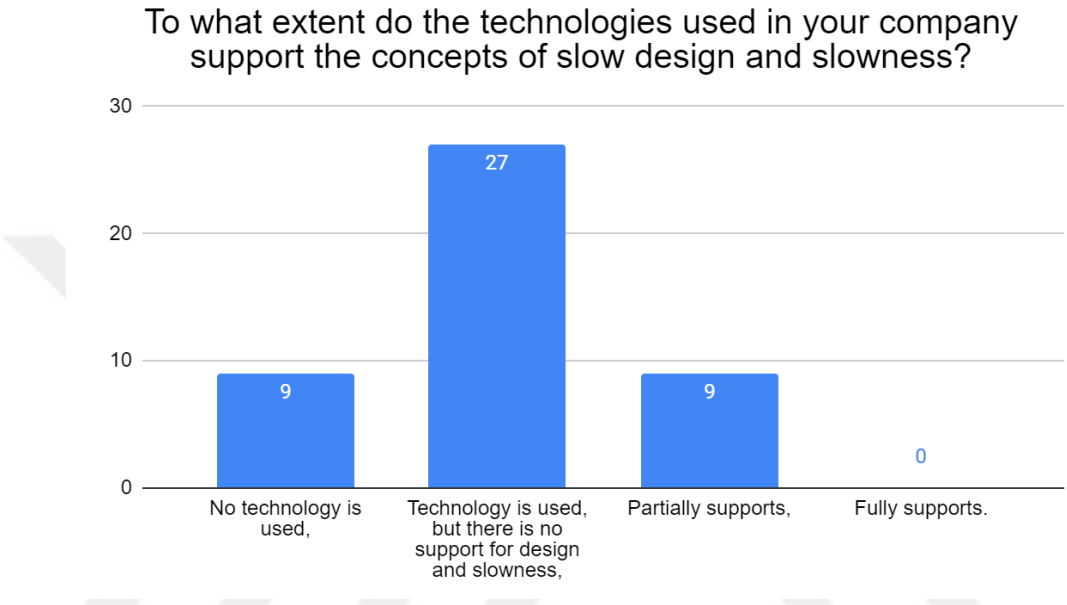

Figure 61. To what extent do the technologies used in your company support the concepts of slow design and slowness?

While 9 of the companies participating in the study stated that technology is not used, 9 of them stated that the technology used supports the concept of slowness. On the other hand, 27 of the participants stated that technology is used, but the technology used does not support the concept of design and slowness. The interviews held in this context also support this situation. Businesses that state that they do not use technology consist of people who live experimentally, even slowly, with primitive methods, hence brands. In other words, the principle of the business has turned into the life philosophy of the business owner. Therefore, this audience consists of a group that does not even use social media effectively. 27 of the first group uses technology mainly as a communication and marketing tool.

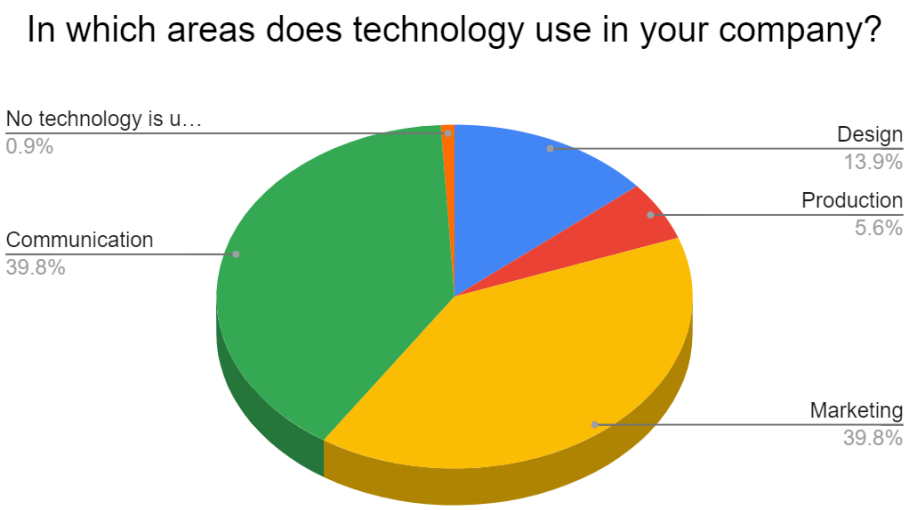

Figure 62. In which areas does technology use in your company?

In addition, as seen in Figure 60, the majority of the technologies used are communication and marketing with a rate of 39.8%. 13.9% of the technology used in the design consists of software programs. The most striking value is composed of the participating companies, who stated that no technology was used with a rate of 0.9%. Therefore, it is clearly seen that small businesses use technology mostly in the fields of communication and marketing. This question, which was crucial for this thesis that explores the possible potential of the relationship between slow fashion and technology, reveals that technology is used at a low level in the production and design stages. In addition, the technology, which is rarely used in material production by local design workshops, is also widely used in the textile industry. Therefore, technology used in recycling or developing innovative materials for ready-made clothing companies producing on a global scale cannot find an area of activity in small businesses. Interviews also support this situation. Most businesses consider it unnecessary to invest in such technology or knowledge, as they do not produce in large quantities and with harmless production processes.

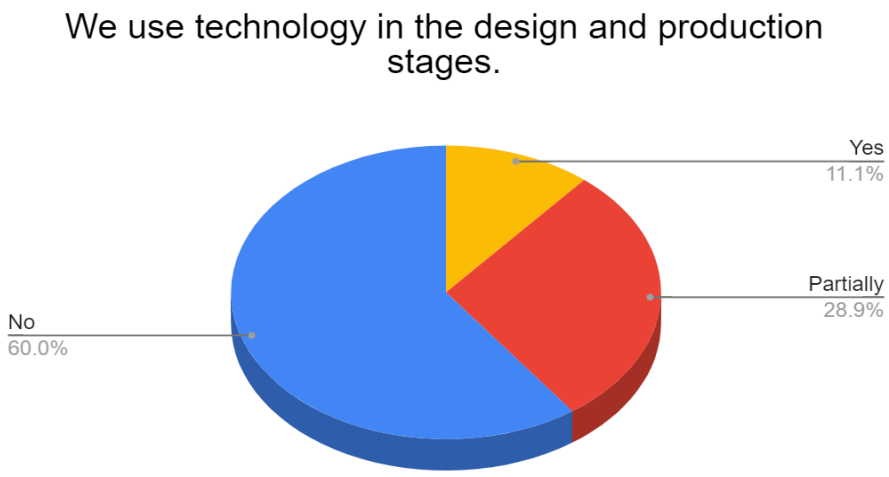

Figure 63. We use technology in the design and production stages.

We use technology in the design and production stages. As seen in Figure 61, 60% of the companies participating in the study stated that they did not use technology in the design and production stages, 28.9% stated that they used it partially, and 11.1% did.

Table 10. Equipment used in design and manufacturing process

Equipments used in design and manufacturing process	Count	Percent
Sewing machine	43	95.6
2D design programs (Photoshop - illustrator)	27	60.0
2D mold programs (Gerber)	9	20.0
3D design Programs (Clo, Marvelous, Gerber, Vidya)	0	0.0
3D Printing	1	2.2
Laser cutting	1	2.2
Biotechnology	0	0.0
Weaving Loom	2	4.4
Hand Drawing	1	2.2

Types of tools used by the technologies are indicated in table 10. It could be clearly seen that the technology that provides many opportunities to brands or users is not used by local businesses. It is possible to consider the 60% slice sewing machine indicated in table 10 as a sector that does not consider it a technology. In addition, the interviews supported this situation, and businesses stated that they either could not reach the software or did not know how to use it, even though they were happy to use

primitive methods and did not need to learn anything new. On the other hand, it should be noted that there is a group of enterprises that are against this situation and want to learn and prevent waste generation by carrying out studies in this field. In Table 10, it could be clearly seen that almost all enterprises use sewing machines in their production processes, as expected, and they benefit from 2D design programs during the design phase.

In addition, it is emphasized in the table that they receive support from mold programs at a rate of 20%. The interviews supported this situation, and they stated that they experienced a design process that progressed with primitive methods and various visuals. In addition, they stated that they developed a product as a result of an experimental process that leads to a result with the direction of the material. However, most of them emphasized that they needed a facilitator for cutting materials and placing molds. Thus, the disadvantages of prototyping to create samples are costs, time spent, and material usage. 3D software can be used to reduce these factors; However, this brings new problems with it. Since learning and advancing in 3D software is not an easy task, the time spent learning it makes businesses think twice about. In addition, the costs of software are considered as another disadvantage for SMEs.

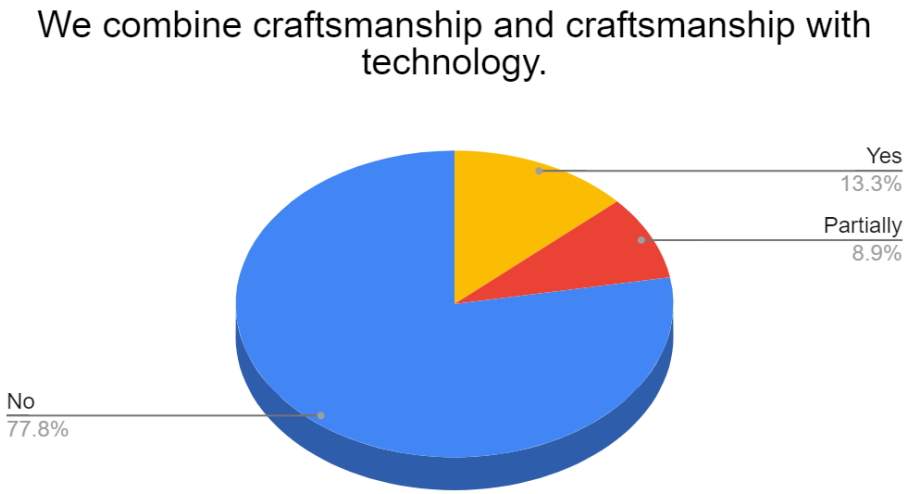

Figure 64. We combine craftsmanship and craftsmanship with technology.

Craft is the basis of technology, and craftsmanship is the basis of craft. Therefore, there is a craftsmanship that comes from experience and mistakes in the basis of technology. In this context, as seen in Figure 61, 77.8% of the enterprises

participated in the survey stated that they did not combine technology and craft, while 13.3% of the enterprises stated that they blended the methods based on handicrafts representing cultural elements with technology. 8.9% of the enterprises stated that they partially merged. In addition, the interviews also support this situation. Although there are very few businesses that combine it with production technologies such as 3D printers, there are also local brands that work in this field. However, what needs to be considered at this point should be what purpose the technology serves and how it is used.

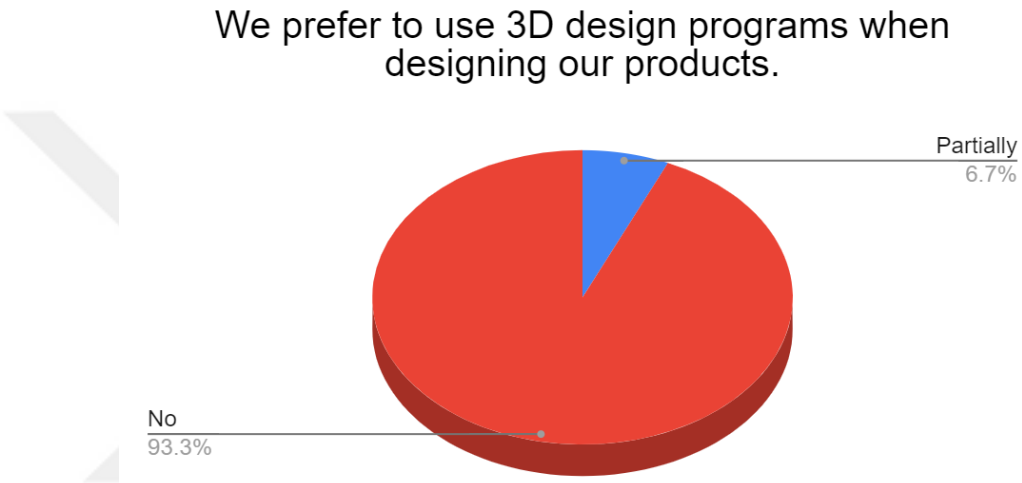

Figure 65. We prefer to use 3D design programs when designing our products.

Therefore, 3D design programs are one of the technologies used to reduce or even eliminate the concept of waste in production processes. It could be considered as a technology used to serve the transformation and save time for companies. As seen in Figure 62, 93.3% of the enterprises participating in the survey stated that they do not use it, while 6.7% stated that they do. The interviews support this situation, and the majority of the enterprises that participated in the study directly rejected the potential to have any relationship with technology, while some enterprises stated that they did not need such software at all due to their production patterns. Others stated that they are interested in this subject but stated that they cannot provide enough opportunities to develop themselves in this field.

Table 11. First interaction with the 3D design programs

First interaction with the 3D design programs	Count	Percent
Pre-Education	0	0.0
University	3	6.7
Internship	0	0.0
Work	2	4.4
Certificate Program	0	0.0
I don't know how to use 3D design program.	40	88.9

As seen in Table 11, the companies participated in the survey do not have experience in using 3D design programs nor have knowledge about this subject. On the other hand, 4.4% participants used it at work and 6.7% participants used it at university. In addition to this situation, the usage rates of 3D printer programs like the other ones are as seen in Table 12. The participants stated that they have used a 3D printer (or similar tools) in university with 2.2% and used it in their professional life with 6.7%. The interview study also supports this situation, and a small percentage of them do not prefer to use it even though they have this knowledge.

Table 12. First interaction with a 3D Printer (or similar tools)

First interaction with a 3D Printer (or similar tools)	Count	Percent
Pre-Education	0	0.0
University	1	2.2
Internship	0	0.0
Work	3	6.7
Certificate Program	0	0.0
I haven't used a tool like a 3D printer.	32	71.1

Therefore, when the companies participating in the survey are asked which technologies they would like to invest in, in Figure 63 material development is at the lowest level, while sales, marketing and sourcing are at the highest levels. Although production technologies and interface designs are the least preferred investment areas for investment support, it is thought that one of the areas open to development is system designs that will facilitate the supply of interface and resources in order to be able to produce on order. As stated during the interviews, the companies participating in the study stated that they would like to receive investment support in sales and marketing. Businesses that see themselves as deficient in this field prefer to complete

this deficient field. Another critical point for this question is the small number of enterprises seeking investment support to develop innovative materials. Considering the companies participating in the study, it has been observed that the number of enterprises developing alternative biodegradable materials is low. Therefore, this area is considered as an area open to development. In addition, since developing alternative materials is a situation that can be realized through interdisciplinary studies, it should be noted that an area open to development has been identified in this sense.

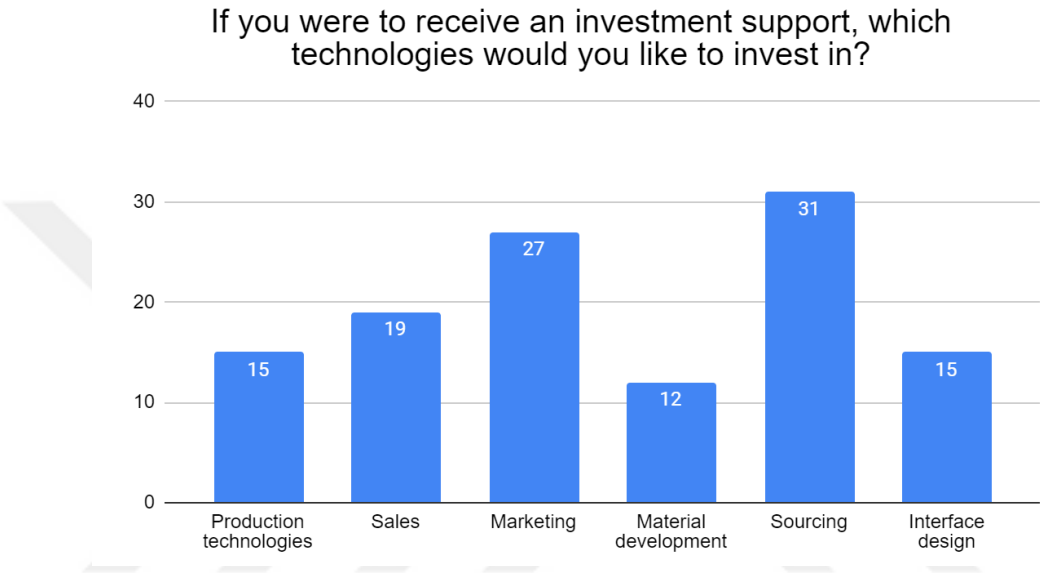

Figure 66. If you were to receive investment support, which technologies would you like to invest in?

The relationship between order, distribution and sales processes and production was examined within the scope of three questions:

Table 13. How does your contact with the customer progress in the processes covering the order and production stages?

How does your contact with the customer progress in the processes covering the order and production stages?	**Count**	**Percent**
Mail order	30	66.7
By order - With standard sizes	37	82.2
By order - Made-to-order production with special dimensions	16	35.6
Hot sale in store	19	42.2

When the relationship between the order, distribution and sales processes of the companies participating in the study is examined, it has been determined that most of the companies produce on demand, that is, on order. There are also companies that make tailor-made production on order. As seen in Table 13, there are businesses that sell in the store. Slow fashion businesses, which expand further with the effects of technology, go beyond being a local manufacturer and contribute to their expansion. Therefore, meeting the users with the product by taking advantage of the possibilities of technology has come to a particularly important point. However, when all production stages are considered, being able to work with a make-to-order model is a very important criterion in terms of not creating waste, no matter how high production is not done.

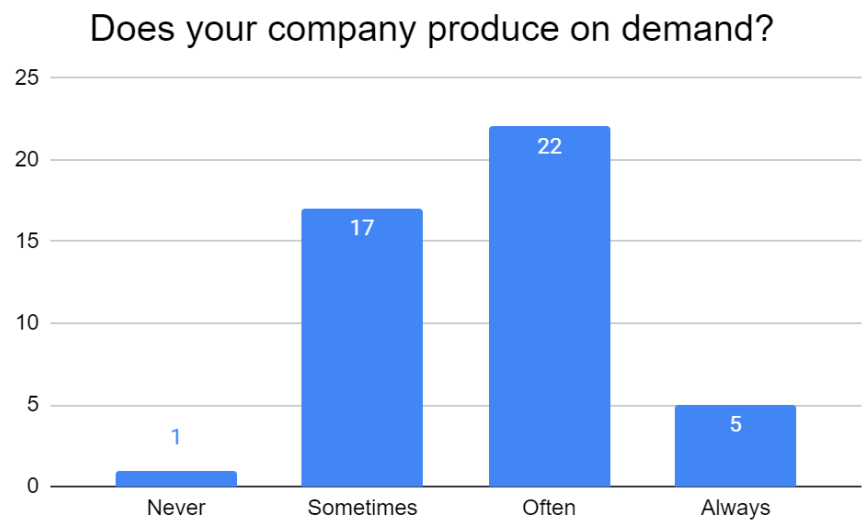

Figure 67. Does your company produce on demand?

Therefore, 22 of the enterprises that participated in the study, as seen in figure 64, often continue their work with this production strategy, while 17 sometimes prefer this model, while the first 5 of them always continue their production activities in this way. Interviews also support this situation. In fact, as stated before, they stated that they needed technological software to develop this system in this direction.

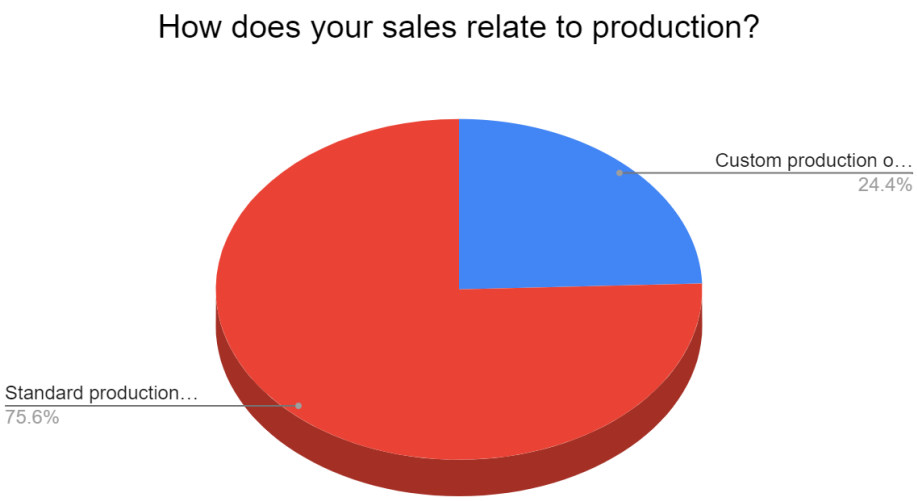

Figure 68. How does your sales relate to production?

The on-demand production model is divided into several variants. Most companies working with a make-to-order model operate a standard-to-order production model, as can be seen in figure 65. This situation further limits the relationship between the user and the business, and communication can be realized through a digital interface.

4.2. Evaluation of Interviews

The questions asked to SMES within the scope of the interview could be examined under six main headings. These main headings are parallel to the headings of the survey structure, and they are supportive of each other. A total of 40 interviews were held, and the interviews were recorded with the consent of the other parties. The interviews were held over the Zoom platform and lasted approximately between 25 and 45 minutes, and a total of 35 questions were answered. Questions were asked about the design principles, design methods, and detailed information was obtained about their views and principles on slow fashion. As a result of the interviews, the designers who use methods such as traditional weaving, upcycling, needleworks techniques, natural dyeing, and functional design, it was determined that they use technology mostly for sales, marketing, and creating awareness.

In the interviews, it was observed that the majority of the companies kept their distance from technology. Some companies participating in the study were approached with a more positive and open perspective. Generally, businesses that have applied the

philosophy of slowness to all their cells tended to think that they could not establish any relationship with technology. On the other hand, it has been observed that businesses use various social media applications within the scope of sales and marketing. In the interviews, it was emphasized that technology has a transformation and an important effect depending on the purpose, form and method of use, and inferences were made that innovations actually occur by blending ancient knowledge from the past with today's technology. This situation supports that the concepts of craft and technology are intertwined as mentioned in the previous sections.

In addition, social media content prepared in slow fashion and the use of technology raise awareness and instill a sustainable consciousness. In the design processes, designers from different disciplines, who generally follow an experimental method, develop prototypes and apply the made-to-order model. Generally, business owners who do not employ designers in their companies undertake the roles of both designer, craftsman, and marketer. Brands with a conscious customer base, prefer to follow the make-to-order model instead of working with stock products.

This is in line with the sustainability principles of slow fashion and aims not to create any more waste. However, when the same situation is examined within the scope of natural dyeing methods, one-of-a-kind, unique models consist of approximately 10-20 stocked designs, they state that they also work with a personalized color scale, that is, with a made-to-order model.

In addition, there are a few businesses that want to start the upcycling process by buying old clothes, and there are also companies that say they want to organize repair practices. One of the companies participating in the survey and interview study aims to create awareness on sustainable fashion by collaborating with small and medium-sized companies on upcycling, as well as with companies engaged in mass production. With its women's cooperatives, this business creates sustainable value both socially and environmentally. Collaborating with many local, small businesses, the firm carries out projects that refer to the inclusive and collective power of slow fashion. In addition, stating that it is working on a project on the waste textile platform, the company emphasized that more support can be obtained from technology with its non-profitable structure, and that a rapid transformation, a rapid slowness should be created in order to initiate a transformation against the global fashion industry. Another of the

businesses that bring traditional craft techniques to light is a company that works with women's cooperatives during the production phase and carries out its production with tiny stocks that create a sustainable social and economic value.

Although they do not use technology much in the production design stages, they have written an EU project based on the definition of artificial intelligence-craft in order to open a door to the data-based world of the future, and they continue to work on it.

In line with the questions asked to SMEs within the scope of the Interview, it was also concluded that most small businesses employ artisans with flexible working hours, but they produce within the scope of cooperation with women's cooperatives and independent and female local producers who apply original techniques in different regions of Turkey. Considering all these conditions, since businesses that make fair, sustainable, clean, and qualified products work with the principle of slow design, they thought that the concept of technology, which accelerates the textile industry and distances it from crafts and crafts, could not establish a relationship with them. Therefore, most companies use programs such as Illustrator and Photoshop, they do not use 3D design programs and do not have enough information and experience on this subject. When they were given some information about the 3D programs, their approach to the subject changed positively and they have shared the problems they have experienced during the mold and design process. At this point, many were excited about the potential of a digital design process in the first place, without wasting the precious material at hand. Also, they stated that they can benefit from software programs that can easily place patterns on waste fabrics with a zero-waste approach for cutting times.

In addition, a few of the brands that establish a transparent relationship with their customers hold workshops that make the consumer a producer with a participatory design approach. They even stated that they carried out these workshops with technology tools during the pandemic period. They generally stated that their approach to interdisciplinary studies and possible collaborations was quite positive and they could not create the necessary conditions.

When asked about where the slow design principle and technology could meet, and what is the potential of technology in your business, they were thinking of developing their own design methods with the support of technologies. To explain, it has been stated that businesses that create designs with the primitive dyeing method spend a lot of water in the dyeing process by accumulating rainwater or using the washing machine, a method that can consume less resources can be developed. On the contrary, there are many difficulties experienced by most of the companies interviewed in their sourcing processes. Companies that are in search of quality fabrics and waste fabrics with increasing costs have difficulty in accessing them. Businesses that realize one or two collections a year with a minimal production structure and versatile design stated that they have difficulty in obtaining sustainable resources. They also stated that it would be nice to have access to the software used in the textile industry for a cyclical fashion system. Therefore, it has been concluded that the creation of a fashion that is difficult to reach due to low quantity, high quality, qualified and handcrafted products can be changed with the right resource supply and interface designs for the needs of small businesses.

As a result, slow design workshops do not use technology as much as they should within the scope of production processes and production methods, however, the potential is foreseen where they can use technology when an opportunity is created in this regard.

CHAPTER 5: CONCLUSION

This study was conducted to measure the impact of technology as a design, production, and communication tool on SMEs' slow fashion brands. The main purpose is to create awareness in order to make the production and design processes more efficient, thanks to the possible relationship between the slow design methods and technology of the companies that produce with the principle of slow fashion.

In this thesis study, which examines the pradoxical relationship between slow fashion and technology, the body of the thesis was structured as three main parts. The content of the second part, the environmental and social destructive effects caused by the fast fashion industry, and the relationship between the production and consumption processes are examined and why this vicious linear production and consumption cycle that feeds each other should slow down. The necessity of a sustainable cyclical fashion was explained in terms of social, cultural and economic aspects. In this context, the definition, emergence, development and principles of the slow fashion movement expanding under the umbrella of sustainability were explained. Craft-oriented production and design practices were examined and classified under slow design methods. The classified design and production practices are supported by examples of businesses operating with the slow design principle and located in different countries.

These method definitions and exemplifications have laid the groundwork for examining the relationship between technology usage patterns and craft, production and design, which are examined in the third chapter. In the third chapter, the relationship between the concepts of design, craft, production, and craftsman and sustainable fashion is examined, and the relationship between slow design methods and sustainable design strategies and the concept of technology is examined and exemplified. In this section, where biodegradable materials and alternative textiles are also examined, the importance of interdisciplinary studies for a sustainable fashion is emphasized. Also, software programs used for a sustainable fashion system are defined, the relationship between cognitive information technologies and craft-oriented production and design processes is examined through examples. This section, in which the make-to-order model is analyzed, laid the groundwork for the fourth section. In this context, the following findings and outputs were revealed in the second part of the study;

- With the spread of global production technologies that have been developing gradually with the industrial revolutions, an unnecessary consumption and production culture has emerged.

- The system, which led to the emergence of a cheap and fast fashion with its products that imitate each other, has grown with increasing production amounts and profit rates. The fashion industry, which has become the protagonist of a brutal capitalist system, has created an army of "orphan clothes", which has no story and is called waste.

- Low quality products produced using toxic chemicals threaten consumer and worker health in the production process and use which causes environmental pollution, causes unnecessary consumption of resources with increasing production amounts.

- The system, which is accelerating with a linear production and consumption model, has created an unethical environment that ignores workers' rights, with unfair exploitation-based working and payment conditions.

- The fashion industry, which has environmentally and socially destructive effects for future generations, ethical, fair working conditions and “clean clothes”, needs to transform and build a fully sustainable structure.

- In order to build an environmentally, socially and economically sustainable structure, it has been demonstrated that it is necessary to develop systems that include fair working conditions, production and design strategies that will support the circular and local economy, where workers' rights are protected.

- Slow fashion creates civil resistance with its structure that honors cultural elements and celebrates the local. The slow fashion movement shaped in this context preserves local knowledge, talents and traditions by adopting transparent and fair production methods that support the local economy.

- Slow Fashion, which should not be seen as a reaction to fast fashion, develops a more careful and conscious approach by repositioning the strategies of design, production, consumption, use and reuse. It also represents a movement

in which the production and consumption processes are slowed down and the producer, worker and environment are protected.

- Instead of the hierarchical structure in traditional fashion design processes, slow fashion, which promises a transparent, sincere, sharing-based, craft-oriented and skill-based co-working experience, aims to transform the structure of 'planned obsolescence' and 'dispose of society'.

- The slow fashion movement, which unearths the experience and skill-based craft practices that define material culture by acting as a time machine, promises a planned repair, improvement and transformation.

In this context, craft-oriented design practices based on handwork and experience are classified under the following headings according to their application methods;

Repairing: A garment care practice in which a worn, torn or damaged item is restored for reuse and enjoyment. The importance of re-remembering skill-based practices that define culture and make industry forget, instead of disposable products, was emphasized.

Upcycling & Restructuring: This method, which aims to produce by reuse, advocates combining waste or old materials with creativity and turning them into a quality product.

Multi-Functional and Adoptable Design: This method serves for efficient use of resources and sustainability. Clothing made with a multi-functional and adaptable design method, clothes that can be transformed, that provide variability in terms of use, and that renew themselves make it possible to use time and resources effectively.

Natural Dyeing: This method, which requires both an instant like art and an intense effort and practice like a craft, is an experience-based method where natural resources meet with implicit knowledge. The method, which includes different methods according to the recipe followed throughout the process, follows a process-oriented structure, not a result, and can only be applied to natural fabrics.

Needlework Techniques: Handicrafts, which have a significant role in explaining folkloric features, traditions and customs of societies, are a form of production based on knowledge and skills. All needlework techniques of this method emphasizes that the material culture, which represents an imperfect perfection, should be kept alive.

Hand Weaving: It represents a method that can be produced from any kind of raw material, which is one of the varieties of weaving art, which is obtained by forming a whole by knitting hand-woven products or connecting the fibers with different methods. This creation process based on intense skills and craftsmanship continues with the sharing of experience and knowledge.

Hand Knitting: Hand knitting, which has been a part of cultures throughout the ages, appealed to personal tastes with its colors and patterns as well as its durability. Thanks to the connection established with the product, the practice of production drives the consumer away from passivity and creates a state of endurance in the object.

"DIY" Movement and Participatory Approach: DIY trend, which comes from the punk subculture, is basically the situation where the individual is a part of production for different purposes. This situation, which is a reflection of existence, progresses in parallel with the identity of the consumer and is defined as a free fearlessness, carelessness and expressionism that somehow chooses to do the production itself. In general, the concept of "Do It Yourself" refers to a process, action and practice that covers all kinds of work done using the material at hand without any master or guide. This movement, which is an action against the consumption culture, emphasizes the situation of taking a stand against the sameness imposed by the system, with different expressions and original production styles developed with skill-based practices under Slow design methods. In addition, the participatory design approach, which allows non-designers to actively participate in the creative process, contributes to the creation of a more democratic design practice by eliminating that hierarchical relationship. In this way, production spaces are transformed into educational spaces, and the preservation of material culture and the transfer of crafts are ensured.

The person who preserves his design ability against all kinds of vital developments and changes, on the other hand, represents the "manufacturer" person

who produces and is the ruler of material labor and practice, in other words, the craftsman.

Craftsmanship, which represents an internal resistance to the capitalist system, the development of the ready-made garment industry, the increasing rate of local migration from villages to metropolitan cities, the general lack of workers with appropriate craft knowledge and craft practices that cannot be combined with creativity. Practical habits and daily actions based on skills such as meeting our daily needs, sewing clothes at home, and repairing things began to be forgotten. At this point, designers started to take a cultural stance by incorporating Anatolian motifs into contemporary clothing designs as a reaction to the negative consequences of the global economy and the stereotyped design identity. This situation has led to the formation of a cultural design identity with high added value, supporting local design and supporting national strategies.

The slow fashion movement, which is a part of sustainable fashion culture, is fed by the craft traditions of Anatolia. The garments produced in the simplest forms with the highest quality fabrics in the collections designed with this understanding represent examples where the knowledge and skills of traditional weaving, embroidery or handwork are used. The clothes that make up the collection are pieces that are not affected by seasonal fashion trends, parallel to fashion, independent of fashion shows or large advertising budgets, fed by an evolutionary design sensitivity that develops slowly rather than radical changes. These designers make use of these traditional skills and details with their collections and express their desire to bring them back to the fashion arena. Designers produce in small craft-based production units based on the knowledge, skills and experience of individually working weaving, dyeing and embroidery masters.

Another chapter which lays the groundwork for the fourth section is the third chapter. Following findings and outputs could be mentioned from the third part of the study;

- The technology used to slow down the global fashion system is in an effective position to slow down the system and raise awareness with innovative tools, methods and forms of communication.

- Technological innovations and digital revolutions have completely changed the relationship between body and clothing, and the creative evolution of fashion. It has also transformed the way of design and marketing.

- Current applications of the technologies used for a sustainable future scenario and the technologies used for sustainable fashion design should be examined within the framework of slow fashion within the scope of production, design, material and user relationship, and possible potentials should be researched.

- The unceasing development of technology, which carries the fashion industry to a more productive and, also serves to the realization of the constant change in the nature of fashion. But making this service more efficient is all about asking how and why. In this context, it is necessary to evaluate the technologies used for a better production model, and therefore their relations with sustainable design methods, material development processes, recycling, production and service concepts.

- In today's world where sustainability has become a necessity, production must become a tool, not an end. In order to develop sustainable strategies, product life cycle analyzes and planning are required. The methods used within the framework of sustainable strategies (3R) have a relationship with technology. The Rebirth application used in the industry is considered to be a more advantageous option compared to the recycling processes that require intensive labor and energy.

- Cognitive information technologies can be used to develop this system. Although this relationship seems to serve the global fashion industry, there are also technologies used within the scope of slow design methods.

- At the core of the Maker movement, which aims to create a production culture instead of a world where everything is consumed rapidly, lies an education strategy that gives importance to the process rather than the result, which also includes mistakes.

- Strong design examples developed within the scope of the maker movement, which emphasizes the importance of interdisciplinary studies, reveal that

technology, user, craft, design and production concepts are intertwined, and that production or transformation can be done better.

- The labor-oriented, slow production process that makes slow design methods strong, the workshops organized with "Participatory Design Approach" and "Do It Yourself" practices contribute to creating a magical bond between the user and the object. User-oriented applications are an effective way to challenge the systematic passivity and hierarchy created by the fashion industry, and it is emphasized that this path can be expanded with technology.

- All these applications, in which the production area is transformed into an education area, have turned into black mirror workshops with the effect of developing technologies and the Covid 19 pandemic process, while black mirrors have turned into a training area, and the place where the user's hands are turned into a workshop area. The relationship of the zero waste strategy, which serves to eliminate cutting and sewing waste, with technology consists of examples that can be adapted to the industry.

- Applications such as the method of adding or joining - Puzzle approach - Minimalist -Mosaic -Patchwork represent primitive methods. The concept of technology, which is shaped by the structure that can be adapted to the industry as a result of the relationship of these methods with technology, creates a transparent bridge between craft and production. Therefore, it plays a significant role in sustainable fashion production.

- The main problem of the textile industry is the waste problem that develops depending on the amount of production. In this context, in order to prevent the formation of "orphan clothes" waiting in warehouses, the "production on demand" model was examined depending on the concept of Zero Warehouse.

- It is cited as an example of slow responsible consumption of leveraging existing digital systems that develop new digital processes where they can connect more with the customer, from online experience, interaction to production information communication.

- A blend of craft, manufacturing, technology and nature, biotechnology is a science-driven industry sector that uses living organisms and molecular biology to produce health-related products. While designing the forms, looks and materials of the future, the new generation designers are transforming the clothes from passive appearances to active technological tools. Where the link between creativity and innovation is expressed as material design, it is emphasized that this field, which is a part of a labor-intensive process, can enable the creation of new tools and the development of new materials for the design and modeling of more complex products that are not found in nature. In addition, the importance of interdisciplinary studies was emphasized.

The role of the designer in creating a sustainable design culture, the role of slow fashion brands goes beyond the structuring of clothes to create a social and environmental awareness as “communicators, educators, activists and entrepreneurs”. In this context, there are many small design businesses working with this principle in Turkey. And these businesses represent the focus group of the research.

The main purpose is to create awareness in order to make the production and design processes more efficient, thanks to the possible relationship between the slow design methods and technology of the companies that produce with the principle of slow fashion. Businesses can solve their problems in terms of resource supply and use with more innovative methods. Possible answers are sought to the question of how technology can improve business and how the possible relationship of slow design methods with technology could help to solve problems such as service and application that support business management of the enterprises.

It was examined whether the slow fashion companies, which produce in minimum quantities and therefore do not produce much waste, if they were supported by an interface design and/or whether they worked with a production-to-order model. In this context, the research was examined in two parts as questionnaires and interviews, supporting each other. These titles were examined: Improvement of repair-based practices and services from slow fashion methods. As a result, areas open to development and improvement were identified.

From the survey and the interviews, it could be easily seen that the use of 2D and 3D softwares and interfaces between enterprises would be beneficial for the improvement and development of companies in this regard. In this context, it is emphasized that a zero-stock system can be built instead of a system that creates dead stock with applications developed such as Sharecloth, UnmadeOS, Techpacker and on-demand production model. Software programs such as Stitch, Vizoo, Vidya, CLO-3D, Accumark Gerber 3D, Vstitcher Browzwear, which are used in the design and production phase, are generally used on the scale of companies that produce high volumes in the industry. These programs, which are used to prevent the waste problem in the sample stage, It is thought that when combined with the on-demand production model, it can also contribute to companies working with the slow fashion principle. Since the design and mold process is a process that continues at the same time, it is thought that these programs will facilitate the make-to-order model. Also, systematically conducting education, information and orientation studies under the leadership of universities, in a way to answer the question of how to unify platforms such as academic and collective.

Difficulty in sourcing, organic and waste materials; By using technological software for the formation of transparent supply platforms between commercial companies that have adopted the sustainability understanding, mass production and small businesses that have adopted the slow fashion principle, trainings could be given by the Chambers of Industry and creating platforms and solutions together with academic approaches will contribute to the solution of this problem.

Increasing cooperation and voluntary projects with platforms and collectives; Companies that apply the slow fashion principle adopted as the target audience could be provided with information and guidance training by Chambers of Industry, universities, and various fund organizations to increase their awareness. Workshops and DIY practices made with a participatory design approach that transforms the passive consumer into an active consumer, which creates a bond between the user and the object, were identified as areas open to development. Regarding this, receiving support from state institutions, Chambers of Industry and universities for funding laboratory environments where interdisciplinary studies could be carried out will contribute to its improvement. It could be clearly seen that the awareness for the

biodegradable materials was not enough, and it is an area open to improvement, and it would be a terrific opportunity to conduct academic training to increase awareness.

In order to create less or no waste and to use materials effectively, it is important to produce in low quantities and to benefit from technologies in this field. Therefore, the creation of interface and system designs for production on demand would contribute to the improvement and development of this subject. In addition, using 3D design programs in the design processes would make the process more efficient and would be beneficial in reducing the waste created. Therefore, with the activation of the platform and the power of technology, a structure that allows individuals, designers, artists, masters, local brands and even the industry to transform itself could be created with possible collaborations.

As a result, it is of significant importance for what purpose the developing technologies serve and how they could be used. The paradoxical relationship between slow fashion and technology needs to be professionally managed; otherwise, this thin line could turn into a line that defines sustainability, a tool of mass production.

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APPENDICES

Appendix A – Survey Form

The Role of Technology in Slow Fashion Practice With an Analysis of Turkish SMEs

This survey study is related to the application part of the master's thesis titled "The Role of Technology in Slow Fashion Practice With an Analysis of Turkish SMEs" being conducted at Izmir University of Economics Institute of Social Sciences, Design Studies. It is an academic study conducted to measure the ways in which companies working with the principle of slow fashion use technology in the production, design and sales stages and their approaches to technology. The research carried out is purely academic, the information obtained from the study will be used for scientific purposes and no personal/company information is requested in the answers you give to the survey questions, these surveys will be answered anonymously. We thank you for your valuable contribution to the study and present our respects.

*When technology is mentioned in production: software programs for production, sewing machines with software, laser cutting, 3D printer, 3D body scannerand etc. are meant.

*When technology is mentioned in design: 3D design programs, design platforms, 3D fabric scanning machines, and etc. are meant.

*When technology is mentioned in sales: sales-oriented internet applications, social media, e-commerce, mobile applications, banking transactions are meant.

1. Please mark the fields of activity of your business.

Tick all that apply.

- [ ] Accessory design and production
- [ ] Women's wear
- [ ] Men's wear
- [ ] Kid's wear
- [ ] Wedding Dress' (Houte Couture)
- [ ] Home textile
- [ ] Wearable technologies
- [ ] Other: _____

2. What are your production numbers and production capacity?

Mark only one oval.

- ◯ 0-10 per month,
- ◯ 10-20 per month,
- ◯ 20-50 per month,
- ◯ 50-100 per month,
- ◯ 100+ per month.

3. How would you describe your market?

Mark only one oval.

- ◯ Local
- ◯ Foreign
- ◯ Both

4. What are your distribution channels? What are your sales and marketing channels? Please mark.

Tick all that apply.

- ☐ Local stores (outside the brand)
- ☐ Website
- ☐ Shop of own brand
- ☐ Design websites

5. How many people do you employ in your company, excluding yourself?

Mark only one oval.

- ◯ 0
- ◯ 1-3
- ◯ 4-6
- ◯ 7-9
- ◯ 10-20
- ◯ 21+

6. Do you have a design team in your company? / Do you work with a designer in your company?

Mark only one oval.

- Yes
- No, I subcontract
- I do my own designs

7. How often do you need a craftsman in your company? Do you work with craftsmen in your company?

Mark only one oval.

- Never, I handle myself
- Never, I don't need craftsmanship
- Part-time
- Freelance
- Always

8. How many collections do you create in a year ? (How do you define a fashion season?)

Mark only one oval.

- Once per year
- Twice per year
- Three times per year
- Four times per year
- Six times per year

9. How many designs do your collections contain?

Mark only one oval.

- 1-5
- 5-10
- 10-20
- 20-50

10. Please mark the options that describe your collections.

Tick all that apply.

- [ ] Limited colors
- [ ] Minimal quantities
- [ ] Specific style / Capsule collection
- [ ] Suitable for fashion seasons
- [ ] Sustainable
- [ ] Flexible
- [ ] Functional
- [ ] Comfortable

11. What are the sources and material contents used in your products? Please mark.

Tick all that apply.

- [ ] Natural resources, biodegradable materials
- [ ] Organic cotton
- [ ] Silk
- [ ] Ahimsa silk
- [ ] Raw linen
- [ ] Leather
- [ ] Dead stock

12. Where does your company resource the raw material from ?

Mark only one oval.

- ◯ Brand sources
- ◯ Foreign sources
- ◯ Both

13. How often do you receive contract manufacturing support in your company?

Mark only one oval.

- ◯ Never
- ◯ Sometimes
- ◯ Often
- ◯ Always

14. Are there any institutions, organizations or individuals that you work in cooperation with?

Mark only one oval.

- ◯ Yes
- ◯ No

15. Please mark the institutions, organizations and individuals with whom you work in common cooperation.

Tick all that apply.

- ☐ Suppliers
- ☐ Contract manufacturing units
- ☐ Cooperatives
- ☐ Independent manufacturers
- ☐ Artisans
- ☐ Tailors
- ☐ Artists
- ☐ Designers
- ☐ Other: _____

16. How much of your collections are in-house production and how much is off-house production?

Mark only one oval.

- ◯ %100 in-house
- ◯ %25 in-house - %75 off-house
- ◯ %50 in-house - %50 off-house
- ◯ %75 in-house - %25 off-house
- ◯ %100 off-house

17. Do you produce locally in your company using local resources and natural materials?

Mark only one oval.

- ◯ Yes
- ◯ Partly
- ◯ No

18. Please mark the items that cover the concept of sustainability for your business.

Tick all that apply.

- [ ] Responsible production
- [ ] Responsible consumption
- [ ] Slowness
- [ ] Natural materials (biodegradable)
- [ ] Transparency
- [ ] Fair working conditions
- [ ] Low quantity production

19. To what extent do the technologies used in your company support the concepts of slow design and slowness?

Mark only one oval.

- ◯ No technology is used
- ◯ Technology is used, but there is no support for design and slowness
- ◯ Partially supports
- ◯ Fully supports.

20. What are your design principles? Please mark.

Tick all that apply.

- [ ] Natural ingredients
- [ ] Comfortable
- [ ] Minimal
- [ ] Stylish
- [ ] Qualified, original design
- [ ] Detailed designs
- [ ] Functional
- [ ] Timeless
- [ ] Daily
- [ ] Repair
- [ ] Upcycling

21. Which sustainable design methods do you use? Please mark it.

Tick all that apply.

- [ ] Ecological dyeing, printing
- [ ] Upcycling
- [ ] Needle works, punch, etc.
- [ ] Participatory design
- [ ] Modular design - reuse
- [ ] Adaptable, functional design
- [ ] Weaving
- [ ] Repair

22. What methods do you follow in the design process?

Mark only one oval.

- ◯ Experimental
- ◯ Prototype
- ◯ Personal

23. In which areas does technology use in your company?

Tick all that apply.

- [ ] Material
- [ ] Design
- [ ] Production
- [ ] Marketing
- [ ] Communication
- [ ] No technology is used at all

24. What kind of tools and equipment do you use in your design and manufacturing process?

Tick all that apply.

- [ ] Sewing machine
- [ ] 2D design programs (Photoshop - Illustrator)
- [ ] 2D mold programs (Gerber)
- [ ] 3D design programs (Clo, Marvelous, Gerber, Vidya)
- [ ] 3D Printing
- [ ] Laser cutting
- [ ] Biotechnology
- [ ] Other: _____

25. Our collections consist of only new products.

Mark only one oval.

- Yes
- Partially
- No

26. Does your company/designer identity produce designs in line with fashion trends?

Mark only one oval.

- Yes
- Partially
- No

27. We use upcycling methods in our collections.

Mark only one oval.

- Yes
- Partially
- No

28. We use technology in the design and production stages.

Mark only one oval.

- Yes
- Partially
- No

29. We combine craftsmanship and craftsmanship with technology.

Mark only one oval.

- Yes
- Partially
- No

30. When did you first learn about the technologies you are using during the design period?

Mark only one oval.

- ◯ Pre-Education
- ◯ University
- ◯ Internship
- ◯ Work
- ◯ Certificate Program
- ◯ I don't use any technology in the design process

31. We prefer to use 3D design programs when designing our products.

Mark only one oval.

- ◯ Yes
- ◯ Partially
- ◯ No

32. When did you first meet with the 3D design programs you are using? Please mark.

Mark only one oval.

- ◯ Pre-Education
- ◯ University
- ◯ Internship
- ◯ Work
- ◯ Certificate Program
- ◯ I don't know how to use 3D design program.

33. When did you first produce with tools such as the 3D printer ? Please mark.

Mark only one oval.

- ◯ Pre-Education
- ◯ University
- ◯ Internship
- ◯ Work
- ◯ Certificate Program
- ◯ I haven't used a tool like a 3D printer.

34. How often does your company/designer identity organize interdisciplinary studies?

Mark only one oval.

- ◯ Never
- ◯ Sometimes
- ◯ Often
- ◯ Always

35. If you were to receive an investment support, which technologies would you like to invest in? Please mark.

Tick all that apply.

- ☐ Production technologies
- ☐ Design technologies
- ☐ Sales & Marketing
- ☐ Material development
- ☐ Sourcing
- ☐ Interface design
- ☐ Blockchain & NFT
- ☐ Other: _____

36. Do you collaborate with brands and communities in the production and sales stages?

Mark only one oval.

- ◯ Never
- ◯ Sometimes
- ◯ Often
- ◯ Always

37. How does your contact with the customer progress in the processes covering the order and production stages? Please Mark.

Tick all that apply.

- ☐ Mail order
- ☐ By order - With standard sizes
- ☐ By order - Made-to-order production with special dimensions
- ☐ Hot sale in store

38. Does your company produce on demand? If so, how often, please specify.

Mark only one oval.

- ◯ Never
- ◯ Sometimes
- ◯ Often
- ◯ Always

39. How does your sales relate to production? Please mark.

Mark only one oval.

- ◯ Custom production on order
- ◯ Standard production to order

40. Have you participated in training and/or seminars on the production, design methods and technologies you use in your company?

Mark only one oval.

- ◯ Yes
- ◯ No

41. Do you organize training/workshops/etc for production and design methods?

Mark only one oval.

- ◯ Yes
- ◯ No

42. We carry out up-cycling practices with our customers.

Mark only one oval.

- ◯ Yes
- ◯ Sometimes
- ◯ No

43. Do you carry out workshops within your company? (Works involving the user in the manufacturing or repair process.)

Mark only one oval.

- ◯ Yes
- ◯ Sometimes
- ◯ No

44. What are your promotional and marketing activities? Please mark.

Tick all that apply.

- ☐ Social media ads
- ☐ Media channels (Magazine, tv, series)
- ☐ Website
- ☐ Google ads
- ☐ Website (stores)
- ☐ Local design stores
- ☐ Printed adverisements (Brochures, posters, etc.)
- ☐ Influencer adverts
- ☐ Personal store/ shop/ workshop

45. Please mark the content/criteria covering your social media posts.

Tick all that apply.

- ☐ Production process
- ☐ Knowing the manufacturers
- ☐ Product ingredients
- ☐ User stories
- ☐ Dressing practices / style suggestions
- ☐ Repair stories
- ☐ Design stories
- ☐ Workshop environment
- ☐ Supply process
- ☐ Knowing the craftsmen
- ☐ Awareness about the textile industry
- ☐ Social and environmental impacts
- ☐ Social responsibility
- ☐ Platforms, collectives
- ☐ Events
- ☐ Collaborations
- ☐ Workshops
- ☐ Educational videos (DIY, repair, etc.)

46. Are there any collectives, formations, associations or platforms that you are affiliated with? (such as Sustainable Fashion Platform, Fashion Revolution, Notion Collective)

Tick all that apply.

- [ ] Chambers of Craftsmen
- [ ] Trade Associations
- [ ] Exporters Union
- [ ] Chamber of Commerce
- [ ] None
- [ ] Other: _____

47. Do you attend the trainings and events organized by the organizations and platforms you are registered with?

Mark only one oval.

- ◯ Yes
- ◯ No

48. How often does your company/designer identity cooperate with academia and/or students?

Mark only one oval.

- ◯ Never
- ◯ Sometimes
- ◯ Often
- ◯ Always

49. Do you think you raise awareness about design, production processes and material knowledge while selling your products?

Mark only one oval.

- ◯ Yes
- ◯ Partially
- ◯ No

50. How often do you share information with your stakeholders about all your production stages?

Mark only one oval.

- Never
- Sometimes
- Often
- Always

51. How often do you inform your clients about clean design and fair trade?

Mark only one oval.

- Never
- Sometimes
- Often
- Always

52. How often do you run social responsibility projects in your company?

Mark only one oval.

- Never
- Sometimes
- Often
- Always

53. Do you organize trainings and seminars for the technologies you specify that you use in your company?

Mark only one oval.

- Yes
- Sometimes
- No

Appendix B – Survey Answers:

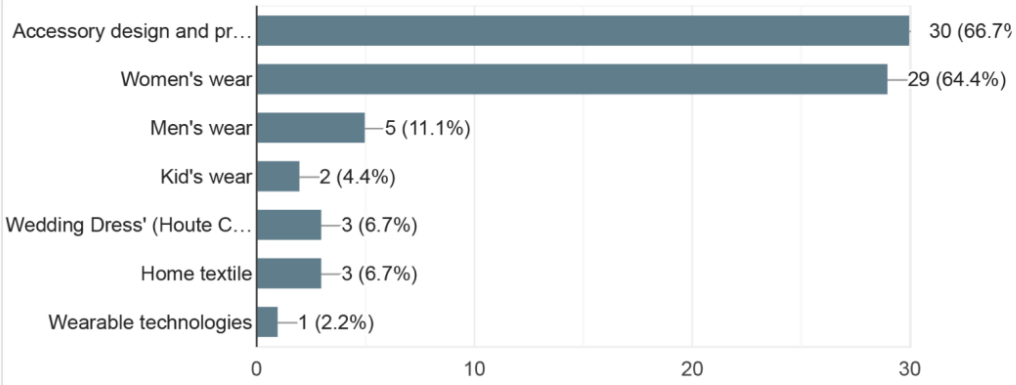
The Role of Technology in Slow Fashion Practice With an Analysis of Turkish SMEs

45 responses

Publish analytics

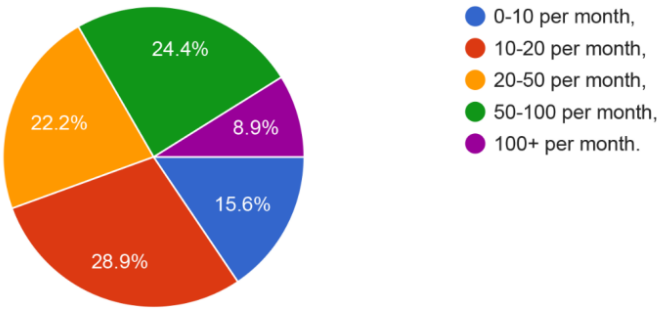
Please mark the fields of activity of your business. Copy

45 responses



What are your production numbers and production capacity? Copy

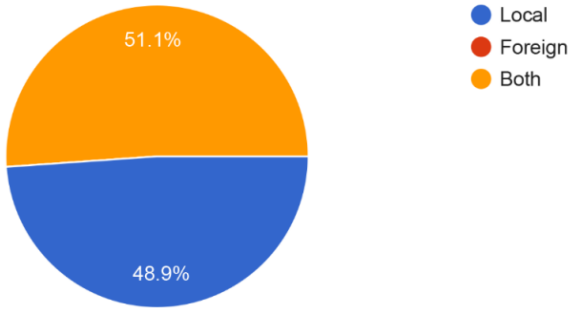
45 responses



How would you describe your market?

Copy

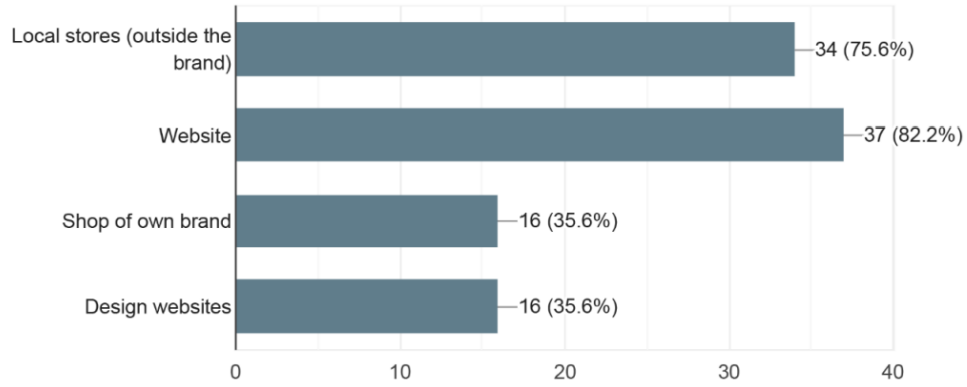
45 responses



What are your distribution channels? What are your sales and marketing channels? Please mark.

Copy

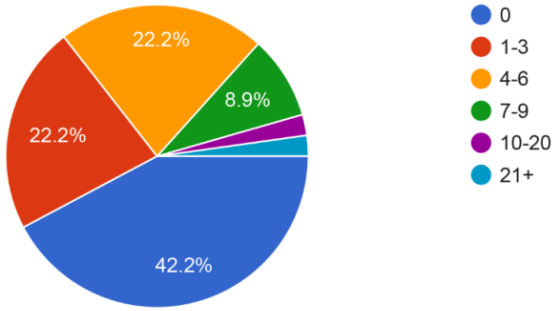
45 responses



How many people do you employ in your company, excluding yourself?

Copy

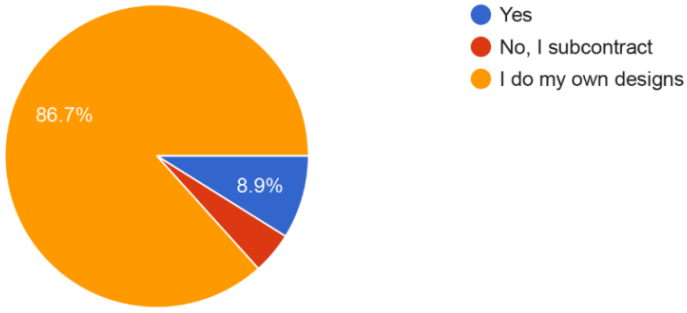
45 responses



Do you have a design team in your company? / Do you work with a designer in your company?

Copy

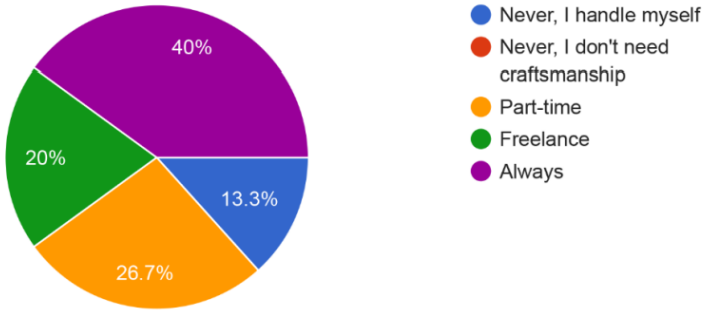
45 responses



How often do you need a craftsman in your company? Do you work with craftsmen in your company?

Copy

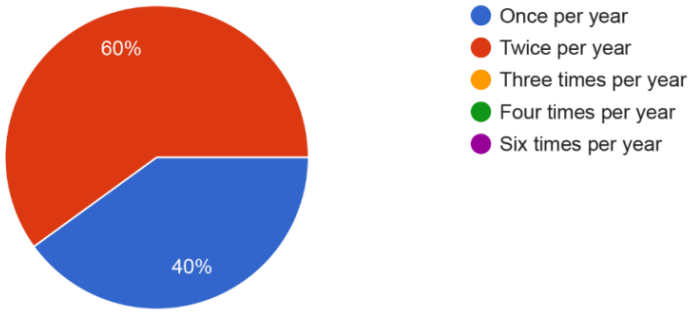
45 responses



How many collections do you create in a year ? (How do you define a fashion season?)

Copy

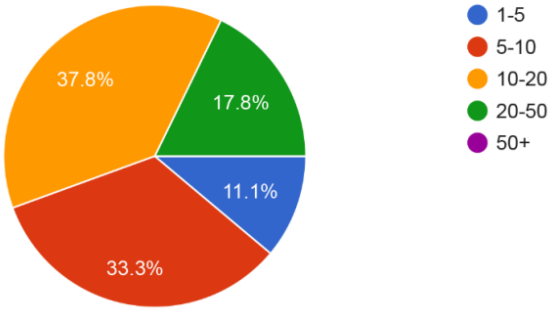
45 responses



How many designs do your collections contain?

Copy

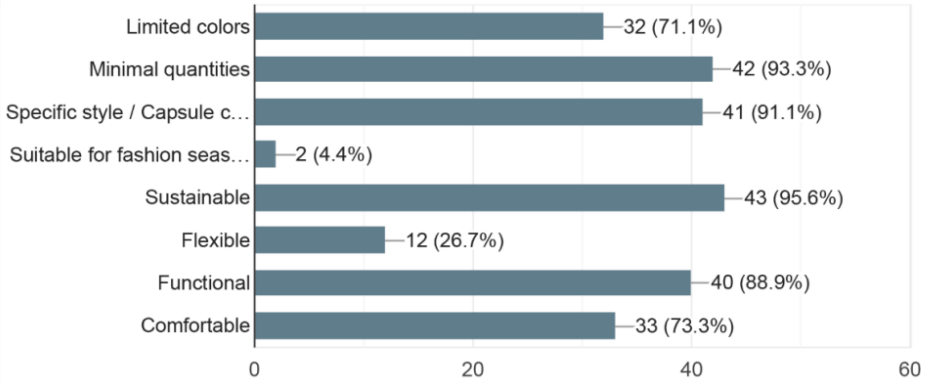
45 responses



Please mark the options that describe your collections.

Copy

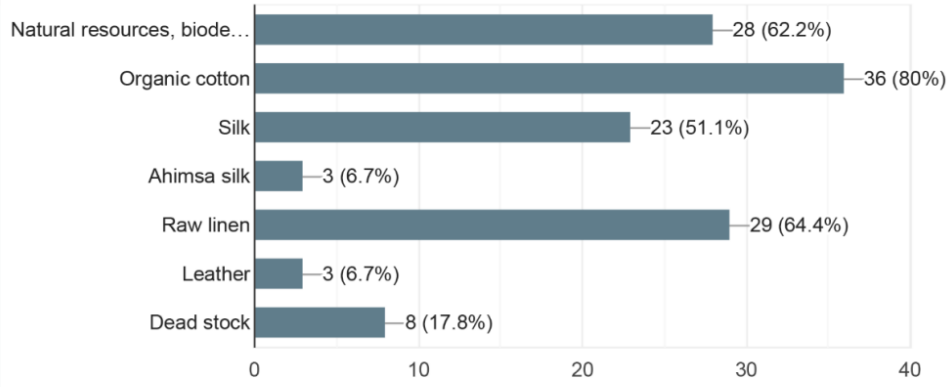
45 responses



What are the sources and material contents used in your products? Please mark.

Copy

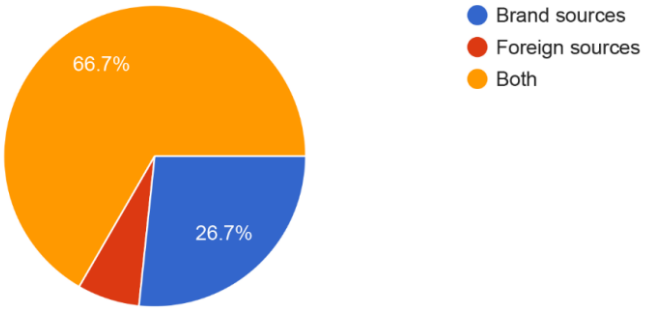
45 responses



Where does your company resource the raw material from ?

Copy

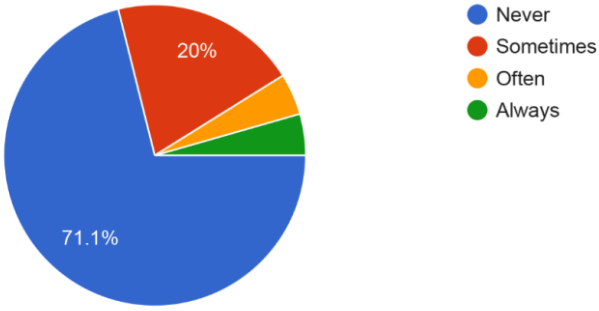
45 responses



How often do you receive contract manufacturing support in your company?

Copy

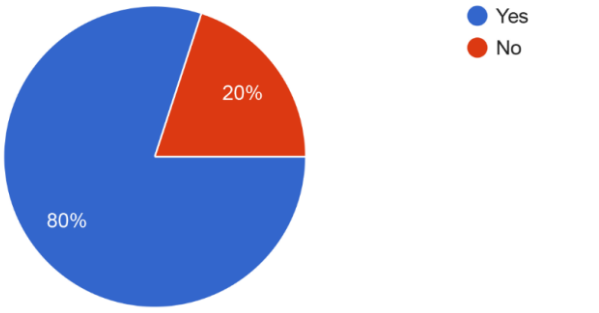
45 responses



Are there any institutions, organizations or individuals that you work in cooperation with?

Copy

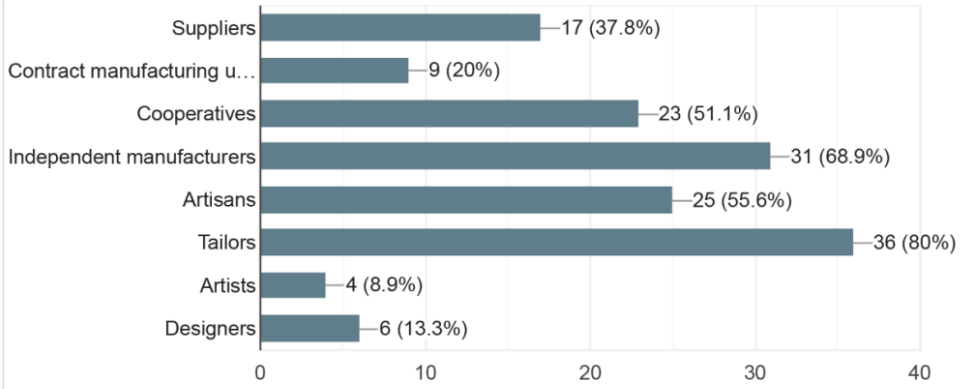
45 responses



Please mark the institutions, organizations and individuals with whom you work in common cooperation.

Copy

45 responses



How much of your collections are in-house production and how much is off-house production?

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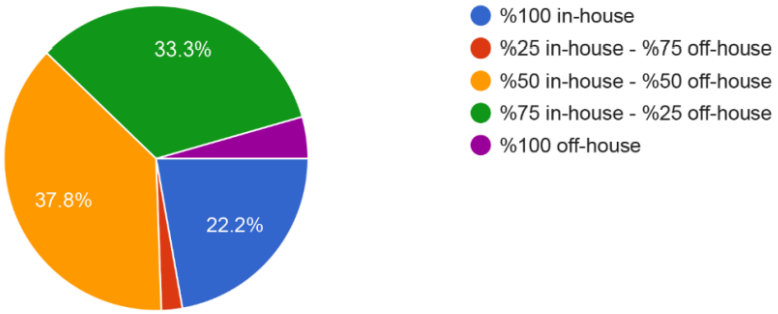

Do you produce locally in your company using local resources and natural materials?

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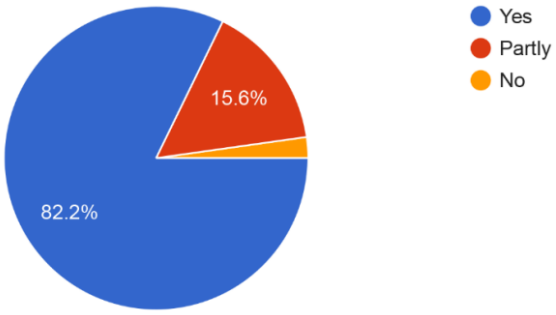
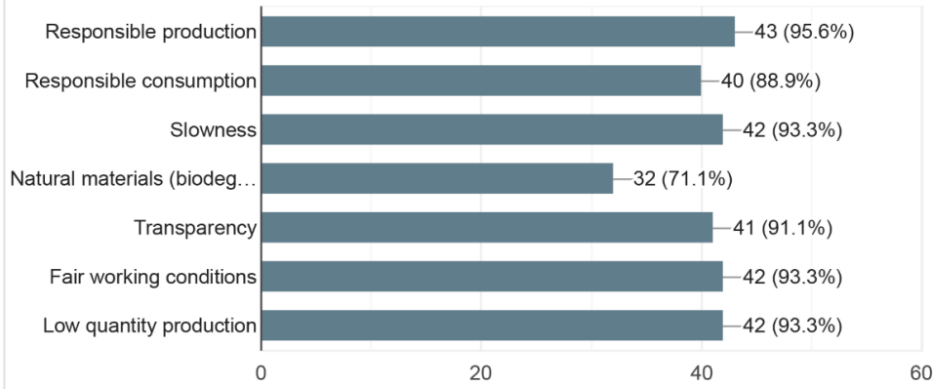


Please mark the items that cover the concept of sustainability for your business.

Copy

45 responses



To what extent do the technologies used in your company support the concepts of slow design and slowness?

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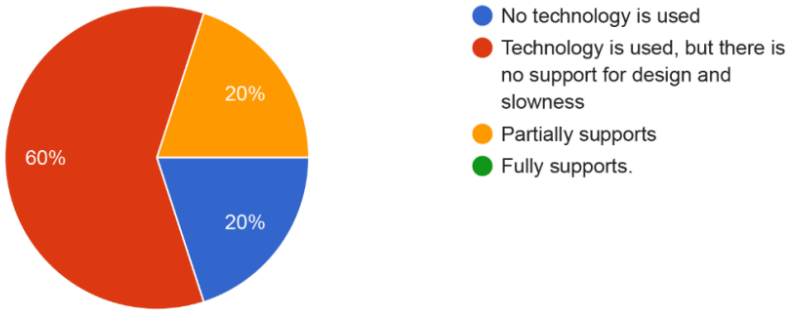

What are your design principles? Please mark.

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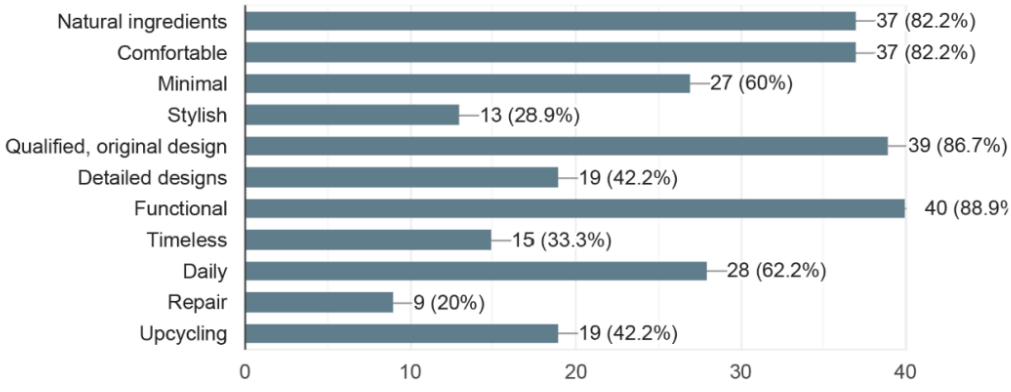

Which sustainable design methods do you use? Please mark it.

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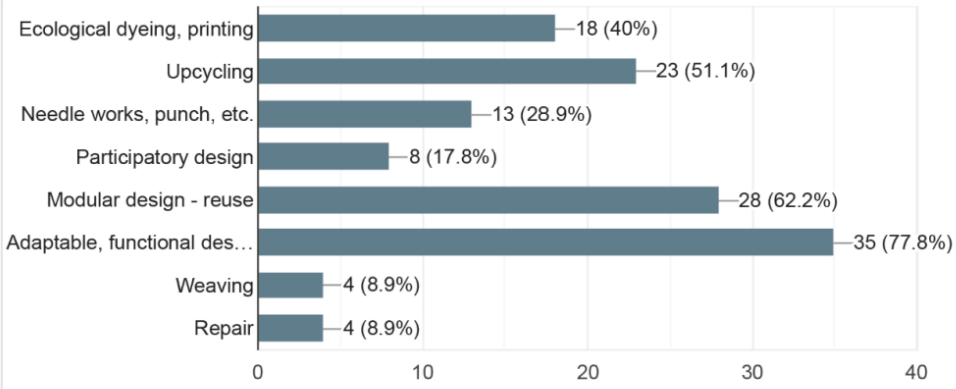

What methods do you follow in the design process?

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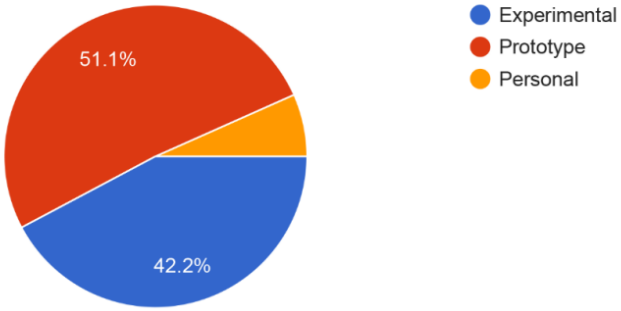

In which areas does technology use in your company?

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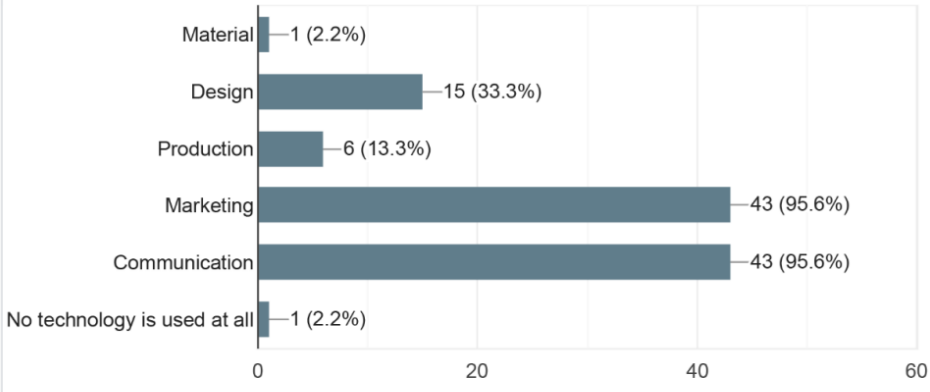

What kind of tools and equipment do you use in your design and manufacturing process?

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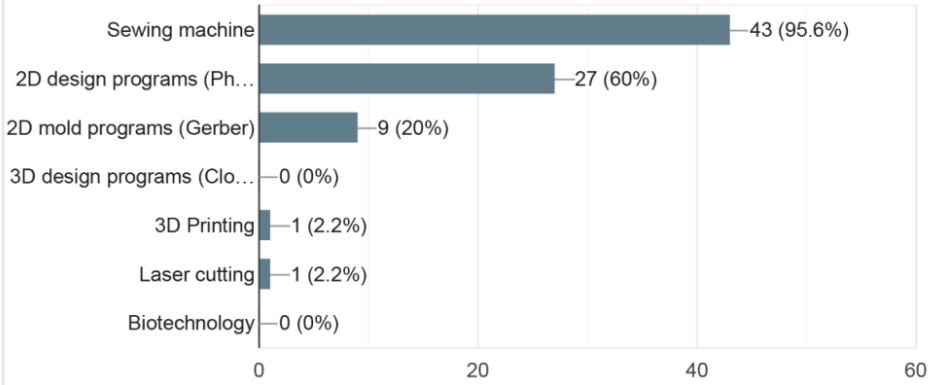

Our collections consist of only new products.

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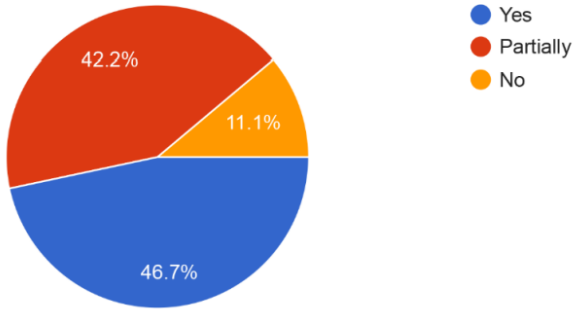

Does your company/designer identity produce designs in line with fashion trends?

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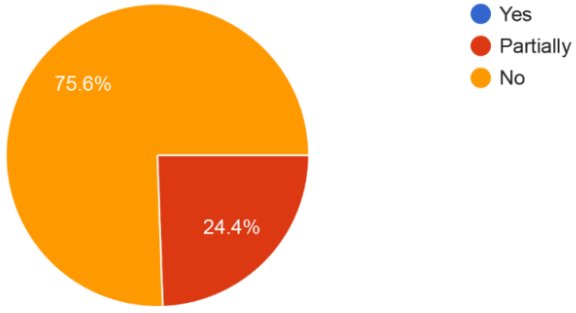
45 responses



We use upcycling methods in our collections.

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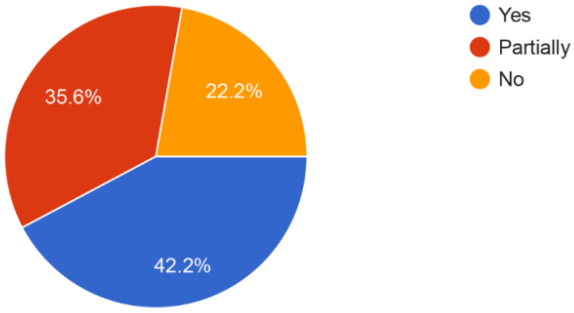

We use technology in the design and production stages.

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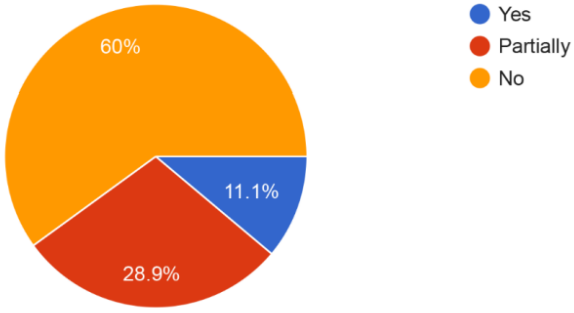

We combine craftsmanship and craftsmanship with technology.

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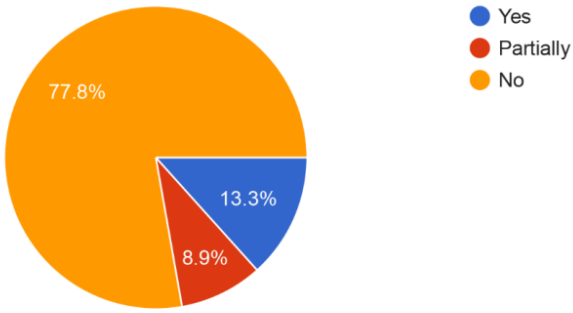

When did you first learn about the technologies you are using during the design period?

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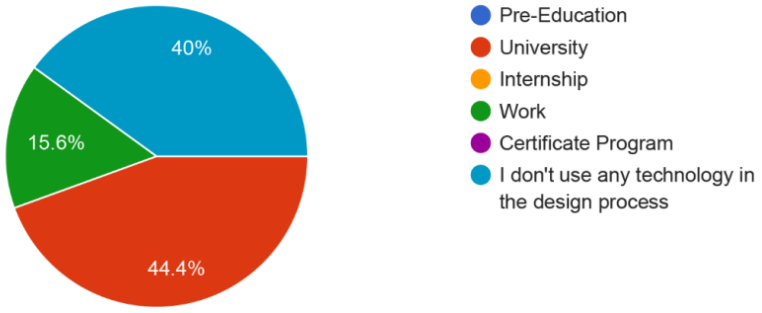

We prefer to use 3D design programs when designing our products.

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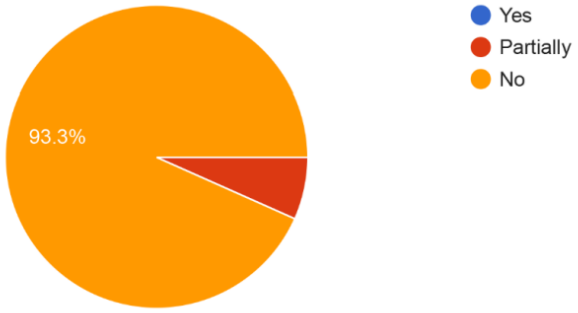

When did you first meet with the 3D design programs you are using? Please mark.

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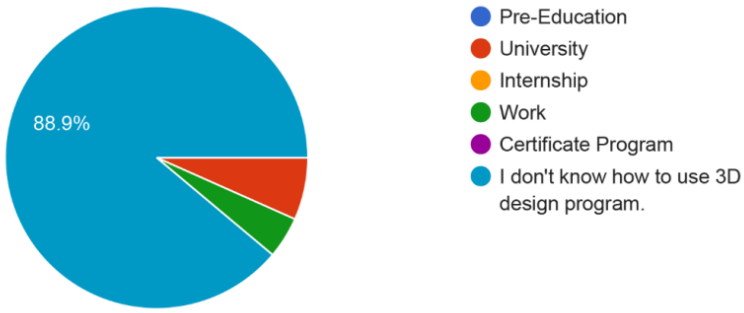

When did you first produce with tools such as the 3D printer ? Please mark.

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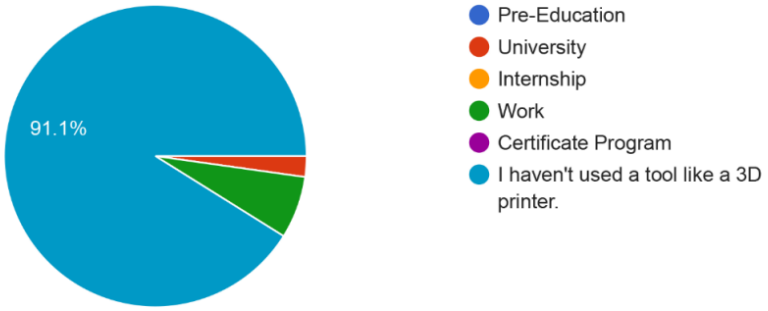

How often does your company/designer identity organize interdisciplinary studies?

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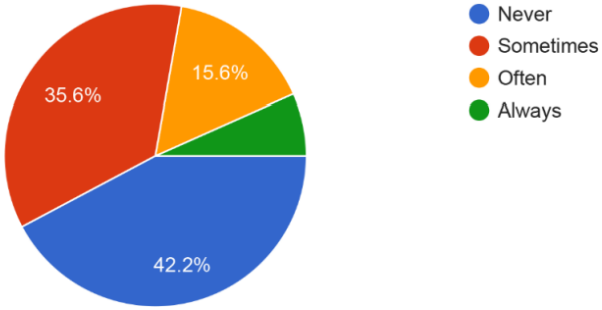

If you were to receive an investment support, which technologies would you like to invest in? Please mark.

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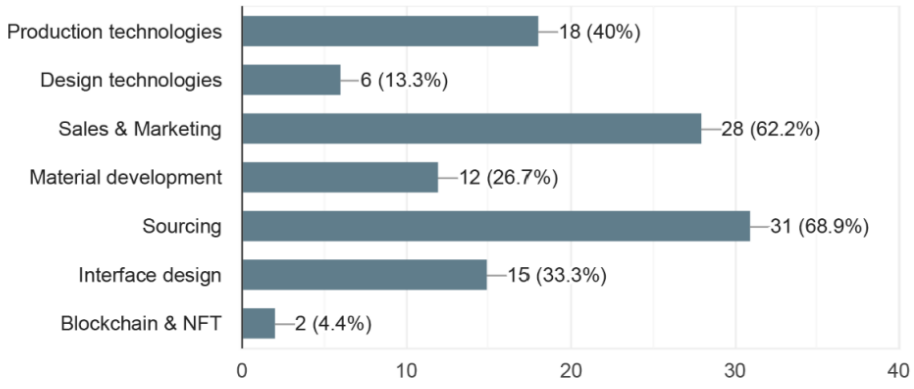

Do you collaborate with brands and communities in the production and sales stages?

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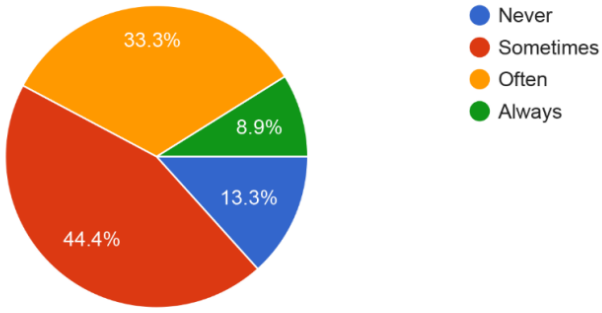

How does your contact with the customer progress in the processes covering the order and production stages? Please Mark.

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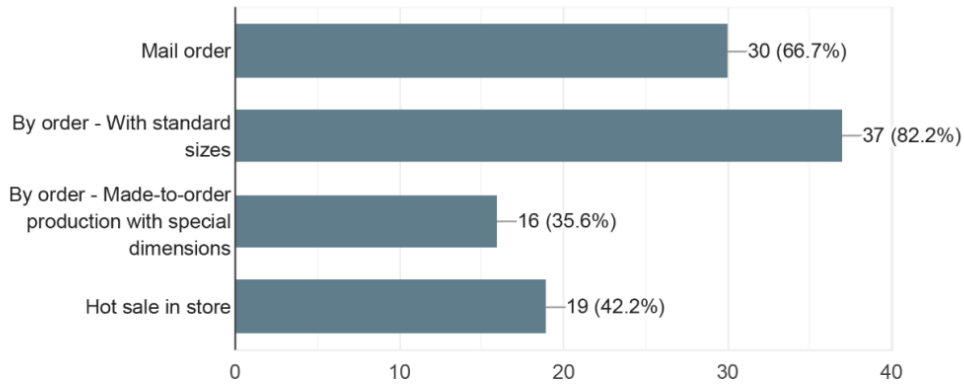
45 responses



Does your company produce on demand? If so, how often, please specify.

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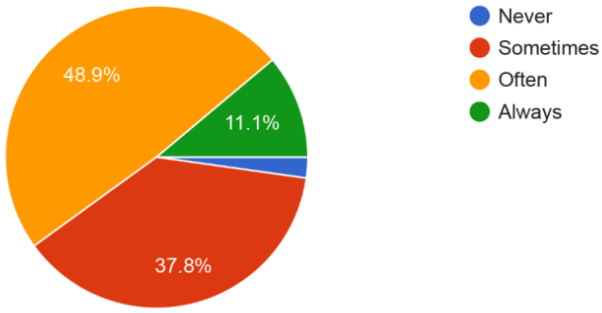

How does your sales relate to production? Please mark.

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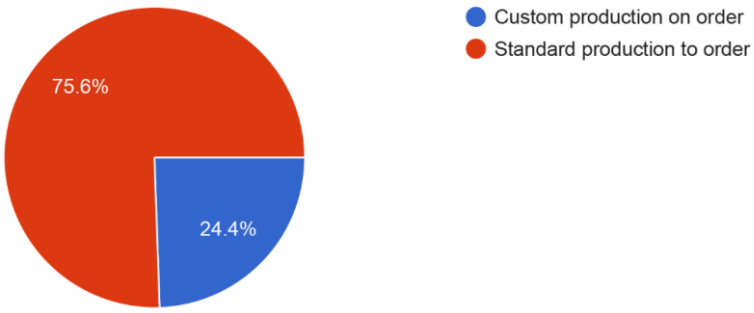

Have you participated in training and/or seminars on the production, design methods and technologies you use in your company?

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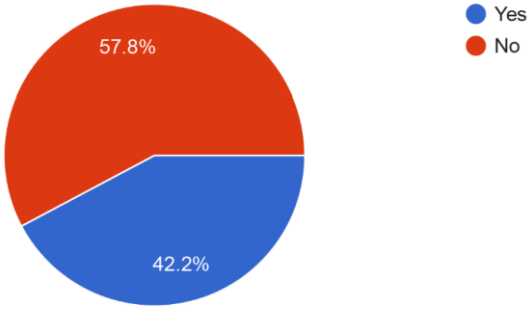

Do you organize training/workshops/etc for production and design methods?

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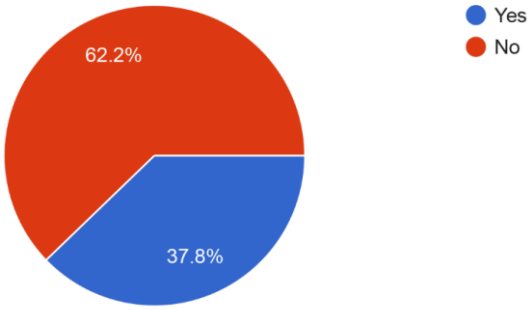

We carry out up-cycling practices with our customers.

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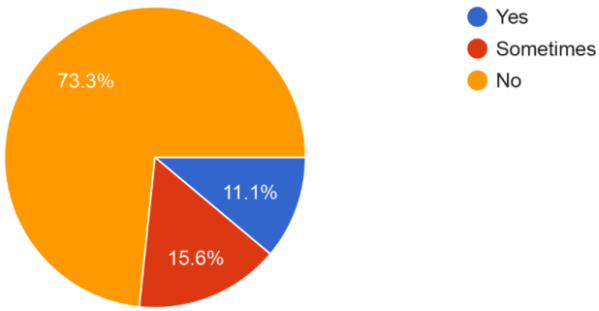

Do you carry out workshops within your company? (Works involving the user in the manufacturing or repair process.)

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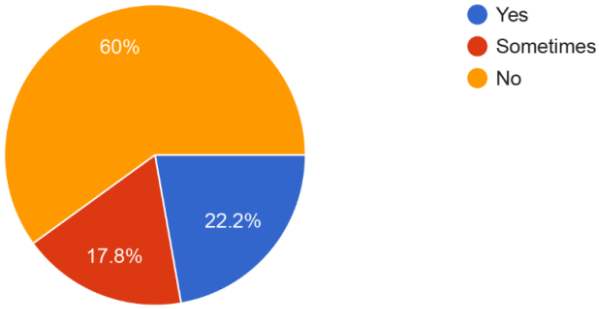
45 responses



What are your promotional and marketing activities? Please mark.

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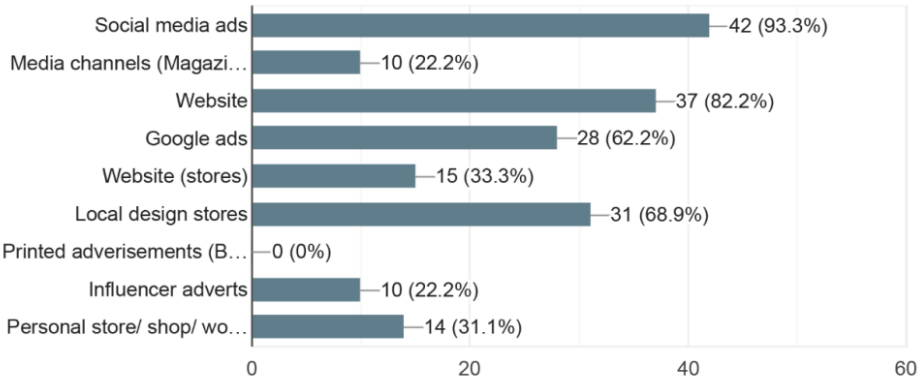
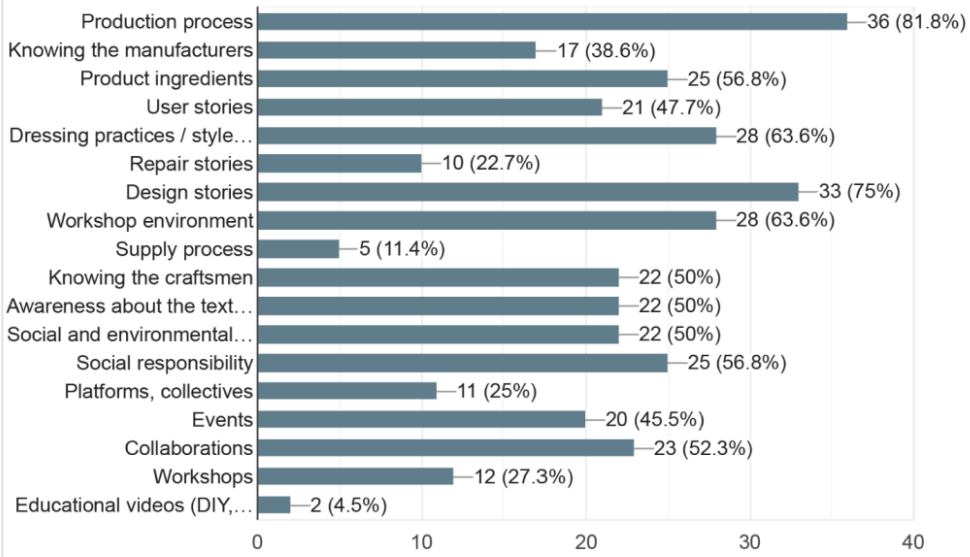


Please mark the content/criteria covering your social media posts.

Copy

44 responses



Are there any collectives, formations, associations or platforms that you are affiliated with? (such as Sustainable Fashion Platform, Fashion Revolution, Notion Collective)

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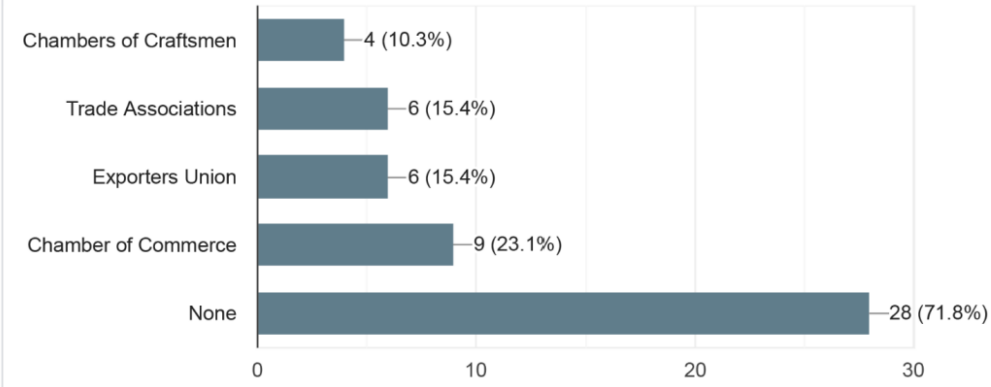
39 responses



Do you attend the trainings and events organized by the organizations and platforms you are registered with?

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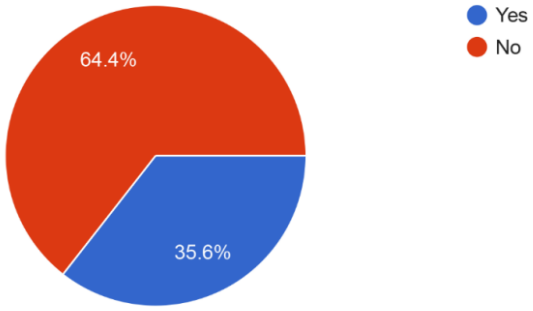

How often does your company/designer identity cooperate with academia and/or students?

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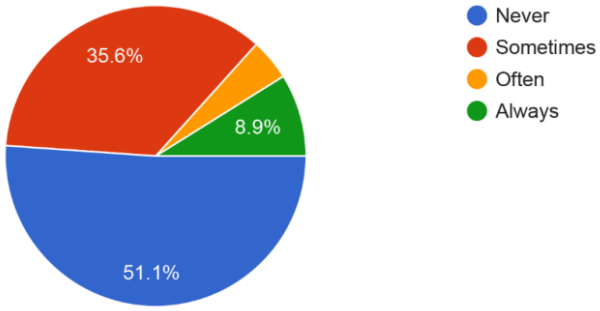

Do you think you raise awareness about design, production processes and material knowledge while selling your products?

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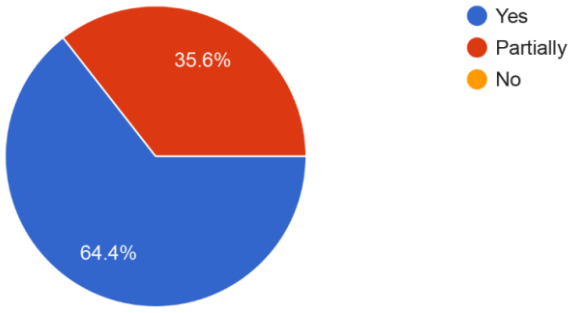
45 responses



How often do you share information with your stakeholders about all your production stages?

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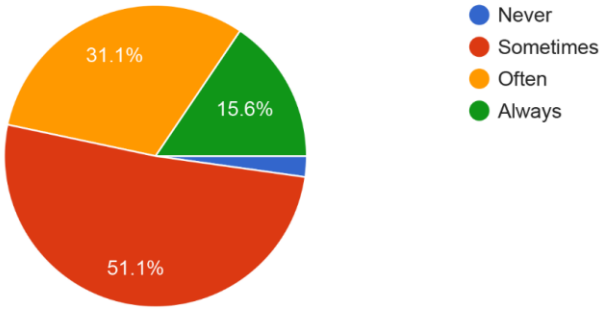

How often do you inform your clients about clean design and fair trade?

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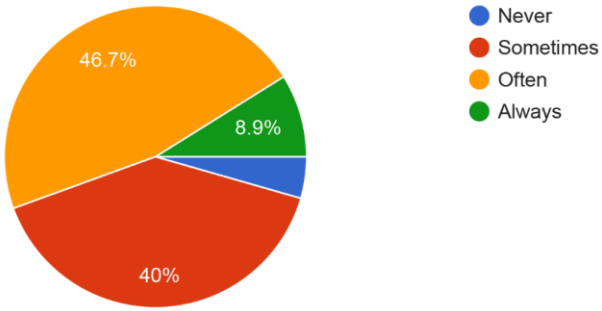

How often do you run social responsibility projects in your company?

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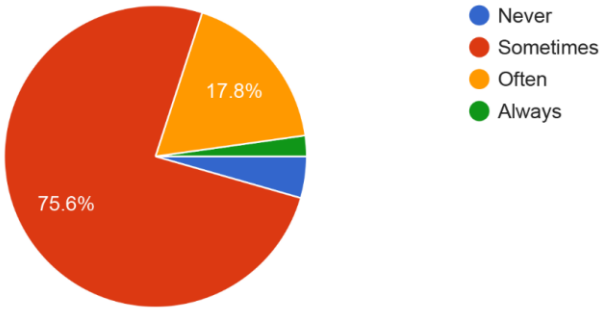

Do you organize trainings and seminars for the technologies you specify that you use in your company?

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45 responses