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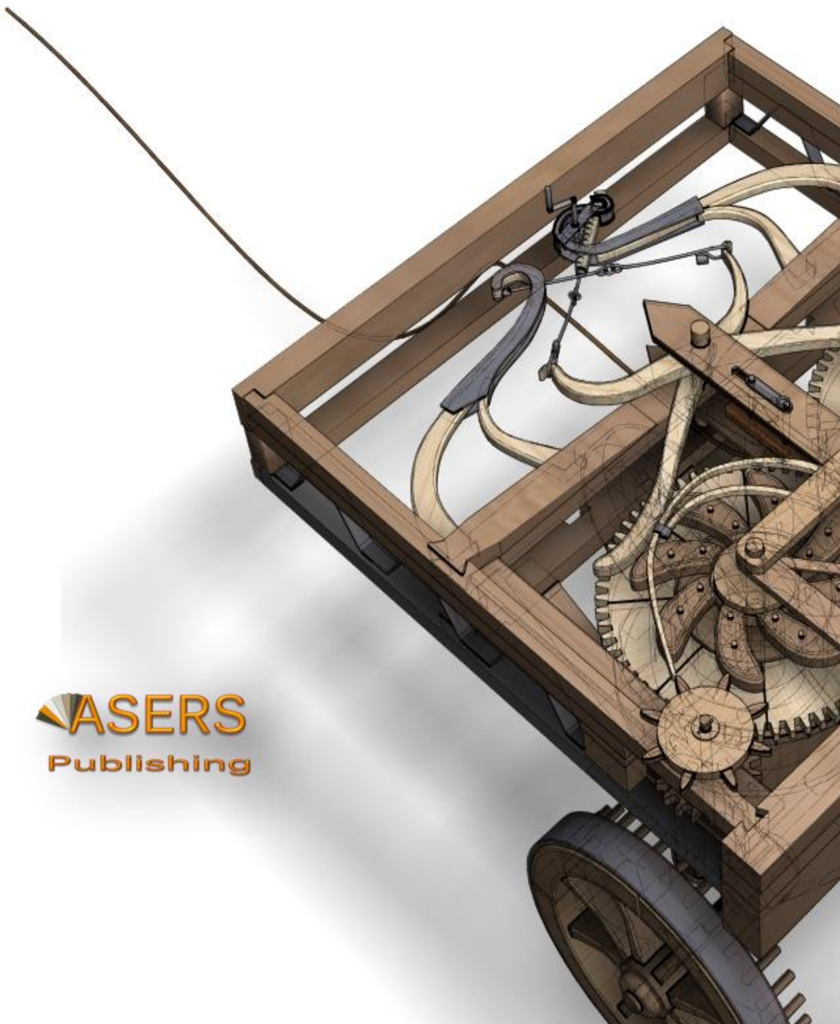

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Table of Contents:

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Mitigating Pollution at the Source and Textile Waste Minimization in Poland: Findings from In-House Research

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Abstract: Currently, since the fast fashion phenomenon has existed, the number of new collections appearing in chains and online stores has increased from four to about fifty per year, thus the amount of clothing bought by one person per year is on average 16 kilograms, and as a result, the amount of clothing thrown away by Poles themselves is approximately 2.5 million tons of waste per year. From 1996 to 2012, the amount of clothing purchased per capita increased globally by 40%. In the years 2000–2014 it was 60% more. The problem needs to be solved because it causes a lot of damage to the environment and pollutes the environment a lot. All we need to do is extend the life cycle of clothes by 10% and we will save as much as three million tons of CO2 and 150 million liters of water per year. The aim of the article is to analyze two closely related areas: customers' awareness of the impact of clothing production on the environment and their attitude towards reusing unwanted clothing, and solutions implemented by e-shops in the fashion industry in the area of consumer returns management. The analysis used the results of secondary research and the author's own periodic research from 2017-2023.

Keywords: environmental protection; clothing production; reverse logistics; reuse; second life of the product.

JEL Classification: L81; L67; M11; P56.

Introduction

The textile and clothing industry plays an important role in the global economy. Its trade value is estimated at over USD 1.5 trillion per year (Leal Filho *et al.* 2019). It provides many jobs, and for some areas of the world it is often the most important sector generating income and ensuring economic development. Based on data published by Clean Clothes Campaign (Stotz and Kane, 2015), it can be stated that approximately 100 million people are employed in the textile, clothing and footwear industries around the world. EU-28 textile and clothing industry reported a turnover of 178 billion Euros and investment of more than 4 billion Euros, in 2016, and the main exporters to the EU are the China, Bangladesh, Turkey and India (L'Abbate *et al.* 2018). It is worth noting that this industry is also characterized by dynamic development in the use of the latest technological and material solutions. Apart from the positive aspects activities of this sector, however, attention should be paid to numerous problems that require solutions in accordance with the assumptions of sustainable development of the world economy, the basic message of which is to prevent undesirable society and the environment, instead of removing the negative effects of human activity that disturb the balance in these areas.

In the textile industry, sales have doubled between 2000 and 2015, and the trend is still upwards. At the same time, disposal has decreased and only 1% of products are returned to circulation (Šajn, 2022), so the system is almost completely linear (European Parliament, 2020). The challenges facing the industry are enormous, so it is worth taking a closer look at them and jointly showing the possibilities of a positive impact. The long-term strategy for the industry assumes a closed textile cycle. We need recycling technology that will allow clothes to be converted into virgin fibers in a cost-effective and large-scale manner. This will actually reduce the use of primary raw materials and the amount of textile waste. Currently, only 10% of fabrics used in the fashion industry in the world come from recycling - mainly recycled PET bottles (Majumdar *et al.* 2020). Efficient fabric recycling is not only the appropriate technology, but also a whole system involving the effective collection and sorting of clothing.

This article analyzes the development of the textile and clothing market and the problem of clothing returns from consumers in Poland, as well as consumers' attitudes regarding the frequency of clothing purchases, management and use of used or unwanted clothes. The article is based on the literature on the subject and the results of own and secondary research.

1. Research Background and Impact of Textile Production on the Natural Environment

Clothes are the first necessities, after food. The clothing industry consumes the most water (after agriculture) and releases it toxic chemical compounds into the environment and is a significant source of carbon dioxide emissions into the atmosphere. Clothing sector is supported by a long and complex supply chain. At one end there is a sales market dominated by well-known brands and clothing chains, dealing mainly with retail sales, which is the most lucrative side of the clothing industry. At the other end of the chain there is production subcontracted, mainly from weaker countries developed: primarily from Asia and Eastern Europe. The relocation of clothing production to these countries has created an opportunity lower price both at the expense of lower quality and environmental standards.

It is estimated that approximately 63% of the textile fibres are derived from petrochemical products whereas cotton, the most popular natural fibre, contributes only about 24% (Sandin and Peters, 2018). Of all the synthetic fibres available, polyester is the most commonly and frequently used in the textile industry because it is economical, and has good physical and mechanical properties (L'Abbate *et al.* 2018). However, textile industry is also facing tremendous environmental problems and resource challenges. Use of large amount of chemicals, energy and water, emission of greenhouse gases, and generation of huge quantity of waste and effluent are some of the serious environmental impacts of textile industry (Leal Filho *et al.* 2019).

Textile production requires a lot of water, as well as land to grow cotton and other fibres. It is estimated that in 2015 the global textile and clothing industry used 79 billion cubic meters of water, while the needs of the entire EU economy amounted to 266 billion cubic meters in 2017. It is estimated that the production of one T-shirt consumes 2,700 liters of fresh water, which is enough for one person for 2.5 years.

The textile sector was the third largest contributor to water and land use degradation in 2020. In the same year, the production of clothing and footwear for one EU citizen required on average nine m3 of water, 400 m2 of land and 391 kg of raw materials (European Parliament, 2020).

According to estimates, textile production is responsible for approximately 20% of global clean water pollution due to the dyeing and finishing of products. Every year, an estimated half a million tons of microfibers released when washing synthetics end up in the seas and oceans.

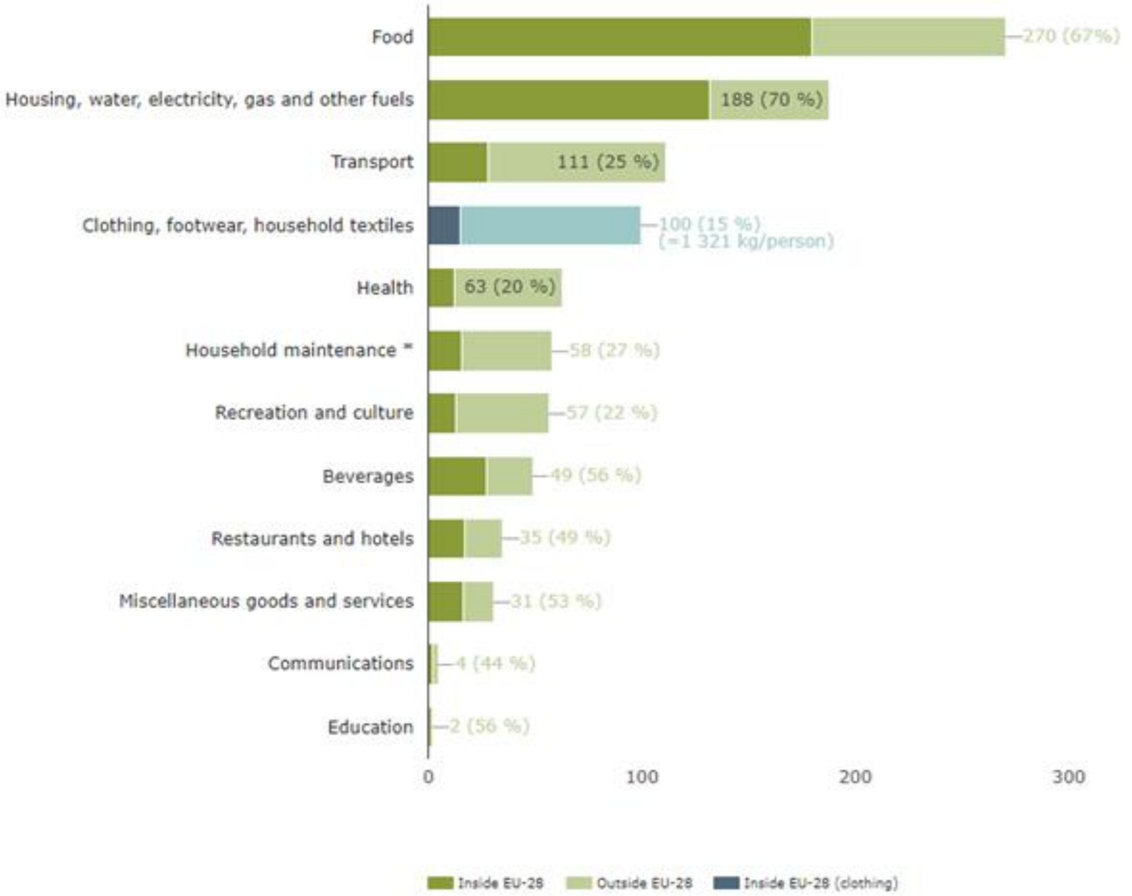
Washing synthetic clothing is responsible for 35% of the primary microplastics released into the environment. Washing polyester clothes can release 700,000 microfibers that can enter the food chain (https://ungc.org.pl). Most microplastics from textiles are released during the first few washes. Fast fashion is based on mass production, low prices and high sales volumes, which favors many first washes. Laundering of synthetic products has resulted in over 14 million tons of microplastics accumulating at the bottom of the oceans. In addition to this global problem, pollution generated by clothing production has a devastating impact on the health of local residents, animals and the ecosystems in which factories are located.

It is also estimated that the clothing industry is responsible for 10% of global carbon dioxide emissions - more than emissions from international flights and shipping combined. According to the European Environment Agency, EU textile purchases in 2020 resulted in around 270 kg of CO2 emissions per person - or greenhouse gas emissions of 121 million tones (European Environment Agency).

Regarding total use of primary raw materials in the supply chain for consumption in the EU, clothing, footwear and household textiles represents the fourth highest pressure category after food, housing and transport (Figure 1). These textiles are also the fourth highest pressure category for water use.

An estimated 1.3 tones of virgin raw materials and 104 m3 of water per person were used to produce and process all clothing, footwear and home textiles purchased by EU-28 households in 2017. About 85% of these virgin materials and 92% of the water were used elsewhere in the world, the highest levels of any consumption area. When it comes to upstream pressure on land use for EU consumption, clothing, footwear and home textiles constitute the second highest category of pressure, after food consumed in the EU (European Environment Agency). Most of the pressure on land use comes from outside the EU (93%) and is largely a consequence of cotton farming.

Figure 1. The use of primary raw materials in the upstream supply chain of EU-28 household consumption domains, 2017 indexed values with textile consumption = 100



Source: EXIOBASE, Netherlands Organization for Applied Scientific Research, 2019

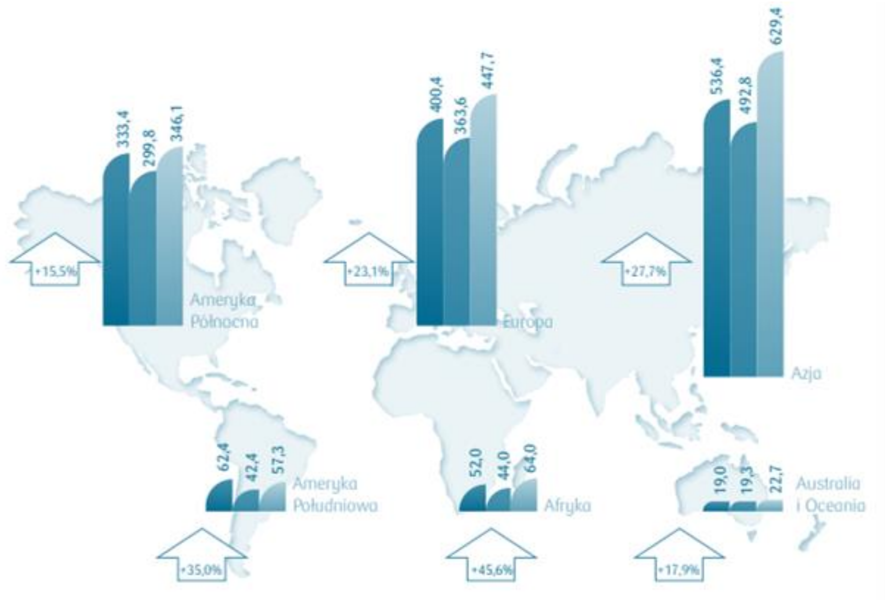
Another problem is how to dispose of unwanted clothes, which people throw away rather than donate to charity. Less than half of clothing used is collected for reuse or recycling. Europeans buy almost 26 kg and dispose of about 11 kg of textiles every year. Used clothes can be exported outside the EU, but are mainly incinerated or landfilled (Sandin, 2018).

New strategies to address this problem include developing new business models for clothing rentals, designing products to facilitate reuse and recycling (circular fashion), persuading consumers to buy fewer, better-quality clothes and, in general, driving consumer behavior towards more sustainable options.

2. Development of Textile Industry in World and Poland

Statista estimates that sales on the global clothing market decreased in 2020-2021 at an average rate of 5.2% annually, reaching a value of EUR 1,269.8 billion in 2021. The largest clothing market in the world is Asia - in 2021 its value revenues reached EUR 492.8 billion, which is 38.8% of global sales. The largest importer of clothing in 2020 was the United States - with a 19.1% share in global imports. In turn, China is the world leader in clothing exports. In 2020, they achieved market share at level of 30.2%. The first position in the world in terms of per capita expenditure on clothing is occupied by the inhabitants of Hong Kong, who spent an average of EUR 2,177 for this purpose in 2021. Second place was taken by the Norwegians (EUR 1,018), and third - with a slightly smaller amount - by the Swiss (EUR 1,011). The average spending per person on clothing in Europe was over €428 in 2021 (Statista).

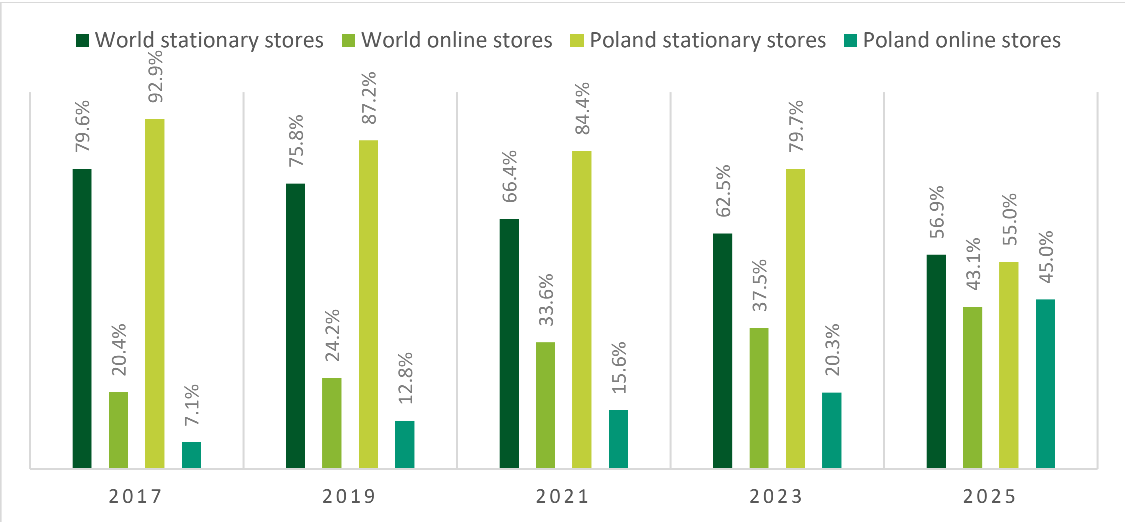
Figure 2. Clothing market in the world - sales by continent (EUR billion) and growth forecast for 2022-2026



Source: Department of Economic Analysis, PKO BP

According to Statista estimates, in 2021, 33.6% of clothing sales revenues will come from online stores. A significant increase in interest in this distribution channel and an increase in share is forecast to 43.1% in 2025. In Poland, according to own research[1], in 2023 approximately 1/4 of revenues in the clothing industry are generated by online stores (Figure 3).

Figure 3. Clothing sales structure in the world and in Poland by distribution channels, forecast 2025, (%)



Source: Statista and own research

The Polish textile and clothing market is one of the largest and most attractive markets in Central and Eastern Europe. In 2017, 13,485 enterprises were involved in the production of clothing, and 5,813 entities were involved in the production of textile products, most of which were private enterprises employing up to 50 employees (enterprises producing clothing employed a total of 96.8 thousand people, and producers of textile products – 59.9 thousand. people). The great openness of the Polish market is visible: in 2018, the value of Polish exports of clothing amounted to PLN 24.3 billion, and footwear - PLN 7.6 billion, while imports reached PLN 29.9 billion and over PLN 10 billion, respectively (Palmowska and Karasek 2019). The main export direction are European Union (EU) countries, primarily Germany (52% of exports in 2019), as well as the Czech Republic (6.2%), Romania (5.5%) and Hungary (3.7%). In the period 2015–2019, clothing exports to these countries

[1] Own research conducted in 2017, 2019, 2021 and 2023 on a group of at least 110 business entities declaring sales via the Internet.

increased dynamically. In the case of Germany, it was almost 60%, the Czech Republic – 97.2%, Romania – 220.8%, and Hungary – 172.7% (Impact of the global pandemic…, 2020).

In 2020, Poland was the 11th largest exporter of clothing in the world - with a share of 2.1% - and the 9th largest importer - with a share of 2.7%. Poland systematically improves its position on the global clothing market. In 2020, she was 11th. the largest clothing exporter in the world. Economic crisis caused by the pandemic COVID-19 has not affected what has been observed for years upward trend in Polish clothing exports – According to data from the Central Statistical Office, exports for the entire 2020 have ended an increase of 19.1% compared to the previous year (GUS, stst.gov.pl).

The most important phenomena determining the current dynamics of changes in the textile and clothing industry in Poland in the long term include: the political transformation and opening of the Polish economy in the 1990s, changes in international trade policy taking place in the first decade of the 21st century, the spread fast fashion phenomenon and the gradually growing popularity of the slow fashion strategy.

In the last century, the life cycle of clothing products lasted from several to even several dozen years. For decades, clothing products have been offered at high prices by luxury boutiques. Over time, they were offered to the remaining group of recipients at much better prices. Increasing competition among clothing companies contributed to the emergence of the fast fashion strategy (Kowalski and Salerno-Kochan 2018). This phenomenon appeared in Poland at the turn of the 20th and 21st centuries and caused profound changes in the field of fashion and clothing consumption (Palmowska and Karasek 2019). The fast fashion strategy contributed to reducing the time needed to introduce a model to the market from six months to two weeks. The introduction of two collections a year (spring-summer, autumn-winter) has been replaced by a multi-season concept (up to a dozen or even several dozen seasons a year), which is characterized by rapid turnover and arousing customers' feeling of scarcity of goods (so-called scarcity value) (Kędzia 2015).

According to the concept of fast fashion, the shortened life cycle of products in the clothing sector results from social phenomena, and not from the material consumption itself, although changing the collection every few weeks means that the clothing offered is made of low-quality materials. Low prices encourage numerous purchases, but also encourage frequent throwing away of clothes, as the poor quality of materials makes them more easily damaged. The negative impact of the fast fashion phenomenon on the natural environment has paved the way for a new strategy, slow fashion, i.e., the concept of more sustainable fashion, requiring, above all, changes in consumers' worldviews and habits. If consumers decide to buy clothing of higher quality and price, they are less likely to dispose of it, and thus contribute to extending the product life cycle. The slow fashion phenomenon is characterized by paying attention to respect for tradition and the environment. Clothing companies are involved in slow fashion, including: through small-scale production, use of regional materials and raw materials or used textile products (Kowalski and Salerno-Kochan 2018).

3. The Attitude of Polish Consumer Stores Towards a Responsible Approach to "Responsible Fashion"

When focusing on responsible fashion, the company must face many challenges. The first is creation long-term brand management strategy in a responsible manner. This strategy should apply to everyone areas of the company's operations, combining both social aspects, such as care for employees at each level stage of the supply chain as well as a comprehensive plan to minimize the impact of production on the environment (Camacho-Otero, Boks and Pettersen, 2018). Optimally, the strategy should include as many possible pro-social and pro-ecological solutions as possible.

Companies can choose from a wide range of options related to a responsible approach to the clothing industry, including:

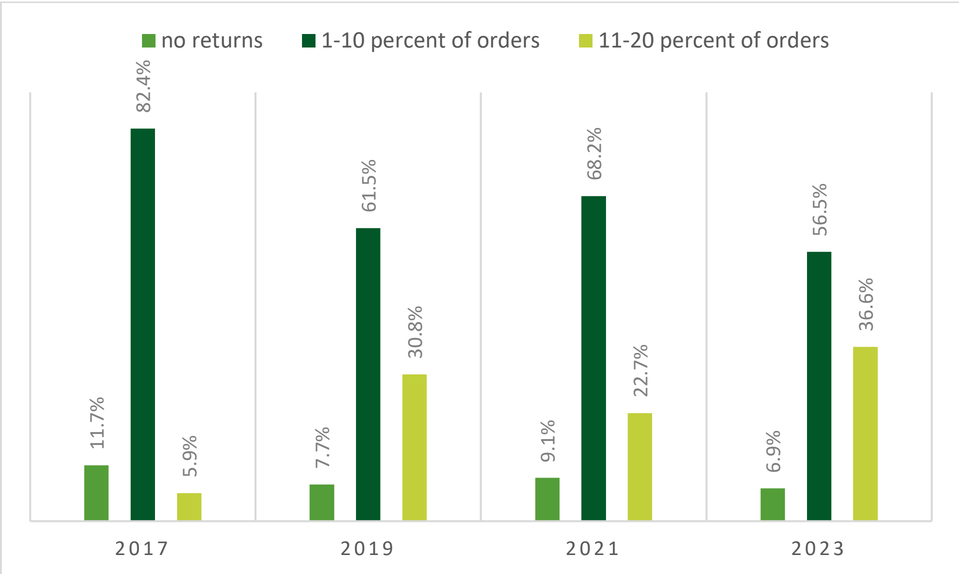
- recycling involves reducing waste by reusing the raw material used to create the product (Villalba *et al.* 2002). The most common example of raw material recycling is the processing of PET bottles into rPET (recycled PET), which is used to produce coats and jackets;
- upcycling is a type of recycling, but it involves increasing the value of processed waste (Sung, 2015). The result of upcycling is a high-quality product made from seemingly useless things. Upcycling refers to both the re-use and processing of second-hand clothing as well as the use of products that had nothing to do with fashion in their original use;
- multifunctional clothing is not only a method of protecting the natural environment (Sharda 2012), but also an innovative solution for the customer. Clothes, which can fulfil many functions, for example it can be both a dress, a scarf, a skirt, a sweater and a blouse;
- reversible clothes allow customers to choose freely and are more environmentally friendly. They can be washed less often, because if they get dirty, all you have to do is turn them over. An additional advantage

of double-sided clothes is the ability to diversify them by rolling down the sleeves or legs, which makes the clothes even more interesting;

- clothes that do not follow trends, such as jeans or the "little black dress", last longer and replace many seasonal clothes. Thanks to their permanence and universality, they stay with the consumer for many seasons, reducing the amount of waste. Such clothes are useful for various circumstances, and therefore help to reduce the negative effects of overproduction of clothing.

In the era of dynamic development and the increasing share of online clothing sales, a problem has arisen regarding clothing returns. In recent years, a clear trend has emerged where consumers order large quantities of clothes in e-shops, then try them on at home and leave only single items of clothing, and return the rest, for example using the right to return the order within 14 days. In extreme cases, stores report that these clothes show signs of use, even though their tags are intact.

Figure 4. Percentage of returned orders recorded by online stores, clothing industry, 2017-2021, forecast 2023



Source: Statista and own research

According to the author's own research, in 2023 every third consumer surveyed declares that they buy clothes online, at the same time 55% of them order more and then return unwanted/inappropriate clothes to the store. In 75% of cases, the size of the product does not fit, and in almost 50% of cases, its use is uncomfortable. Every fifth consumer imagined the ordered item differently. In turn, other online stores operating in the fashion industry declared the level of returns at 10-20% of completed orders. As you can see, e-stores are reporting an increase in the level of clothing returns and this is a serious problem for them, as the product cannot always be re-sold.

Every second return recorded by stores is a consumer return without giving a reason, followed by: sending the wrong goods (25%), complaints related to the goods breaking down during use (15%) and damage to the goods during transport (10%). This is not only a problem for sellers, but also a threat to the environment. Transport from the store to the customer and then again from the customer to the store means twice as much fuel consumption, twice as much carbon dioxide emissions, more production of packaging and boxes, and above all, the problem - what to do with the returned product?

Fashion businesses must have a well-developed and organized returns policy to save money and valuable time. Especially nowadays when it is so easy to order and return products purchased online. In order for this entire process to exist, from the production of clothes in factories, to sale, purchase and, in some cases, return by the final customer, it must be accompanied by separate smaller processes that help and facilitate the functioning of the entire supply chain in the fashion industry, namely: control over received goods and checking the quality and quantity in stock, warehouse automation systems, reports, disposal, introducing new collections, personalization, efficient order completion and shipping, the shortest possible delivery time and an efficient returns handling system (Żurek 2021).

Although it may seem unlikely, some returned clothes and home furnishing textile products are incinerated after returning to the manufacturer. This especially applies to premium products with a well-known logo. Luxury brands want their clothes and accessories not to return to the market at lower prices, as this would lower their status. As a result, it is more cost-effective from an image point of view to dispose of returned clothes - either by burning them or by throwing them in a landfill - rather than placing them back on the shelves.

In a situation where a piece of clothing that has not been removed is in perfect condition, but does not meet the customer's taste and is sent back, it is not immediately re-sold. To put the clothes back into circulation, the brand must incur costs of up to several zlotys. This is an income for the employee who checks whether the clothes are actually in intact condition, sometimes sending them to be washed, repacking the clothes in new foil, and possibly replacing the tag if the first one has been crumpled. The box must be disposed of and replaced with a new one. Additionally, you must remember that most brands currently offer free returns, which means that they cover the shipping costs (Skurpel 2019).

Instead of using worn-out slogans such as eco-fashion, green fashion, ecological clothing, companies should reliably and thoroughly inform consumers in what aspects the products offered are more environmentally and people-friendly. If only some products are more "ecological", this should also be clearly communicated. A consistent and honest message is very important and will certainly pay off more than hiding the truth. It is worth presenting what steps the brand has already taken towards greater responsibility, what has been achieved and what has not been achieved and what plans it has for the future. It is important to present this information in a clear and comparable way (*e.g.*, information about how many kg of organic cotton is used in production cannot tell much unless this value is expressed as a percentage of the company's entire production). It is also worth explaining to consumers why responsible products and services are more expensive than conventional ones.

4. Consumer Behavior towards Responsible Clothing Purchases

When buying clothes in the last six months or a year, almost every second Pole (49%) noticed that their quality had deteriorated. This is the result of a nationwide study by UCE Research conducted for the SkipWish Group. Consumers observe that now even renowned brands sew clothes from lower quality materials and use cheaper substitutes, *e.g.*, they replace 100% cotton fabric with a similar one, but with a large admixture of polyester. However, only slightly over 20% respondents did not notice any changes. Less than 22% consumers stated that they did not have sufficient knowledge on this subject. Nearly 6% respondents did not remember whether the quality of clothing was better before. In turn, slightly over 3%. respondents are not interested in this topic at all.

People who spend the most on clothing are more likely to buy clothes for new trends and style than for practical reasons (Ferraro, Sand and Brace-Govan 2016). Only slightly more than half of clothes are worn regularly, and consumers do not read labels and cannot indicate what their clothes are made of. However, customers declare their readiness to purchase products with ecological ingredients if the higher price goes hand in hand with the high quality of the goods.

A responsible fashion consumer thinks not only about himself and his comfort, but also about others and the impact of his choices on the environment. This is a person who has knowledge and awareness of where the materials from which clothes are made come from, who made them and how long they have travelled before they hit the store shelf.

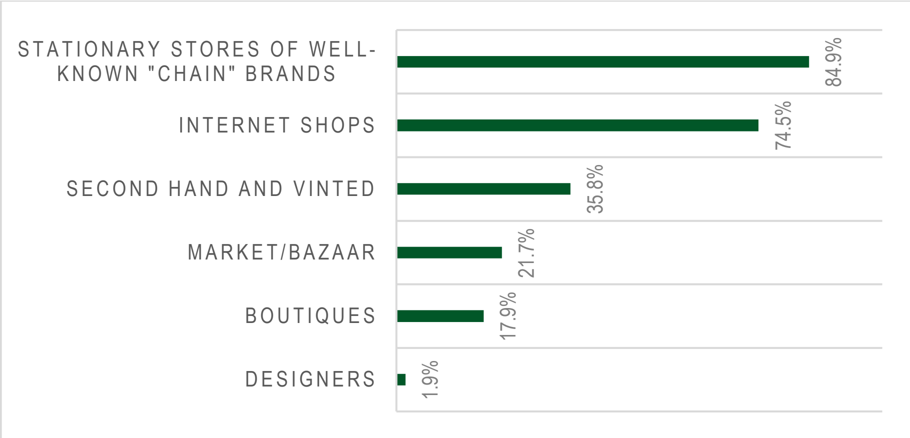
Such people are aware that mass production of clothing negatively affects the natural environment, and people working in factories spend several hours a day there, often in difficult conditions. Therefore, before making the first fashion choice, you must take into account ecological and ethical aspects.

Research shows that 85% of consumers buy clothes in stationary stores of well-known brands, the so-called chain stores, the second place to buy clothes is the Internet. Importantly, every third respondent declares buying second-hand clothes - in stationary stores or on second-hand clothing websites (Figure 5.).

The overwhelming number of respondents, 81%, are aware that produced clothing affects the deterioration of the natural environment, 17 people, 16% say that it has nothing to do with it and does not affect the deterioration of the planet, the remaining part (3%) claims that has no opinion on this topic or has not been interested in this topic before.

The group of consumers who are starting to switch to buying used clothing is constantly growing. Instead of chain stores, they go to second-hand stores, where they hunt for both branded items and just those that they like. In recent years, on the wave of vintage fashion, many shopping platforms and applications have been created that allow you to buy and sell used products. Also, those platforms that previously specialized in selling new clothes, accessories and footwear have made a special place on their websites for second-hand products (Dudel 2022). The prices of these things can be very attractive - even in the case of products from luxury brands. They are made of high-quality materials, which means they can last much longer than a few seasons. Unfortunately, the same cannot be said about items from mid- and low-price brands that flood online second-hand stores. The low price is so tempting that consumers are not deterred even by the prospect of the item being quickly destroyed. Besides, sooner or later there will be a lot of products on the Internet that will successfully replace the one that is no longer suitable for wearing. According to a report by the ThredUp shopping platform, the global second-hand clothing market is growing at three times the rate of the first-hand fashion market.

Figure 5. Places where respondents buy clothes



Source: Own study based on Dominika Jagiełło, Reverse logistics in waste management on the example of the fashion industry (Łódź, 2022)

Independent research by SecondHandy and LESS (2021 and 2022) shows that the most common reasons for buying in second-hand stores include the pursuit of savings (70-88% of consumers) and the possibility of lucrative purchase of branded or unique clothes (75%), as well as high-quality products (63%). A less important, but still important aspect for second-hand users is concern for the environment (54%), as they limit the waste of clothes. 73.6% of respondents claim that they do not throw away clothes, which is a very good behavior, but the rest throw away clothes. Of the people who throw away clothes, only 7% do it once every 3 years, 43% answered that they throw it away once a year, every third respondent throws it away once every six months, and the remaining part (15%) throws away their clothes when they notice that they are broken. or damaged and cannot be resold. The most common reasons why consumers decided to throw away clothes were spoilage or damage to the clothes - 79%, every tenth respondent claims that it was because the clothes were too large or small, and for another 10% the clothes had lost their attractiveness in their eyes and already you don't like it or it's out of fashion. 77.4% of respondents know institutions to which old clothes can be donated. These are entities such as Caritas, the Polish Red Cross, homes for single mothers and orphanages, a school boarding house for needy children, dog shelters, collections for war refugees, the needy and the poor, various types of foundations, social welfare centers, and the district family assistance center (Jagiełło 2022). There are many institutions to which you can donate clothes, you don't necessarily have to throw them away right away. It is important to give them a second life in this way and extend their life cycle.

Conclusions and Further Research

The fashion industry is developing very dynamically. The data presented above only prove the volume of clothing production around the world. Unfortunately, the production of clothing is accompanied by processes that are harmful to the environment and society, for example, the production of clothes generates a lot of various types of waste, including packaging waste, harmful substances are released into the atmosphere, many liters of water are used for the production and washing of clothes. In order to build a real green image without arousing suspicion and without losing consumer trust, the company should first of all become aware of its actual attitude towards environmental protection and social responsibility (Szydło and Potmalnik 2022).

It is impossible to build a credible image of an environmentally friendly company by selecting and emphasizing only certain features of products and services. Their pro-ecological nature should cover the entire life cycle of the product, from raw materials, through processing, distribution, until it is no longer needed by the consumer.

Consumers' pro-ecological awareness, and therefore the fashion for used products, especially clothing, has been growing for years. Consumers are making purchases more and more often, both in stationary stores and online. It is estimated that the value of the global second-hand market in 2023 will be USD 211 billion, which means an increase of 19% compared to 2022 (Ruben, 2023). We can observe upward trends not only on the global market, but also on the Polish market.

There are undoubtedly many benefits to purchasing second-hand clothing. First of all, these are economic benefits, because we can buy clothes at a very low price compared to store prices. It is worth adding here that selling unnecessary items is one of the ways to recover part of the capital and allocate it to our current or future needs. Moreover, in second-hand stores, both stationary and online, you can find original, unique and fashionable clothes that will help you stand out or create your own unique style. And what is very important, by buying second-hand clothes, customers support environmental protection and set an example of an ecological attitude.

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Credit Authorship Contribution Statement

The contribution of the author regards such actions as conceptualization, investigation, methodology, carrying out the formal analysis, writing original draft, data curation, writing, editing, visualization. The paper carried out the documentation analysis, but also very important was the application of the statistical, dynamics, and comparative analysis. The secondary data were used in the analyses. Reports, datasets, books, manuals, academic and commercial publications, and scholarly articles were used to compile the information for this study.

Declaration of Competing Interest

The author declares that it has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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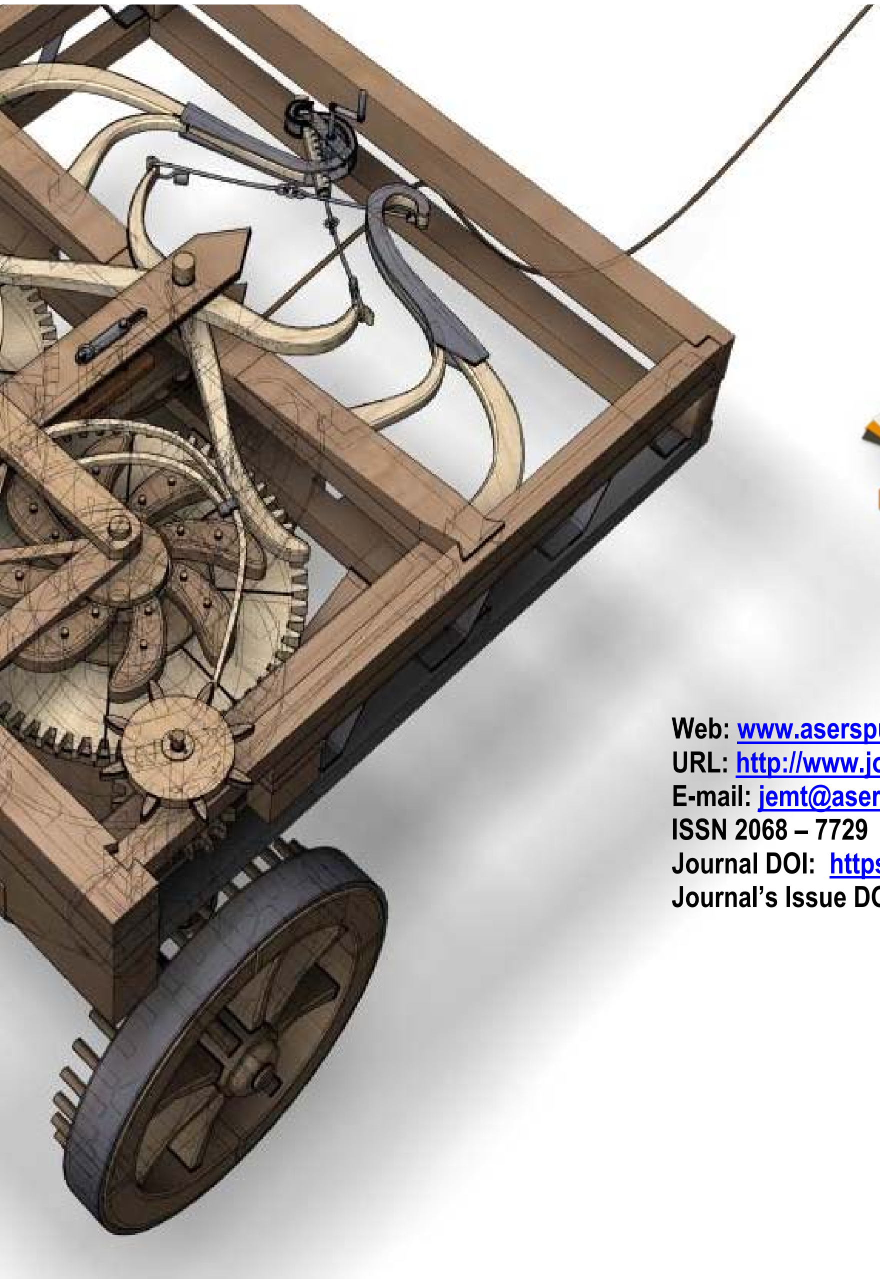

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