

Overview of EU and Global Conditions for the Transformation of the TCLF Industry on the Way to a Circular and Digital Economy (Case Studies from Poland)

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Abstract

The article aims to review the changes that have taken place in the European and global TCLF (Textiles-Clothing-Leather-Footwear) sector over the last decade from the perspective of new requirements of pursuing a circular and, especially in recent years, a digital economy. The paper describes the changes in the components of this industry (formerly called the light industry) in the European Union and the world economy in the context of sustainable development requirements and the effects of climate change. Recent European and global programs mainly aim to achieve the circular

economy's strict requirements, including reducing pressure on natural resources, to achieve climate neutrality by the end of 2050. This positive change for our planet is also supported by the pursuit of the development of the digital economy.

Keywords: textiles, clothing, leather, footwear, transformation, circular economy, digital economy, European Union, world economy, Poland

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Introduction

The aim of this article is to present an overview of the changes that have taken place in the European and global TCLF (Textiles-Clothing-Leather-Footwear) sector over the last decade from the perspective of the new requirements of pursuing a circular and, especially in recent years, a digital economy. The paper describes the changes in the components of this industry (formerly called the light industry) in the European Union and the world economy in the context of sustainable development requirements and the effects of adverse climate changes.

To compete in European and global markets, firms must not only offer high-quality products, but they must also provide innovative and attractive product designs. Every firm that wishes to compete in the open, contemporary global market should focus on creating innovative projects based on creative designs and ideas put forward by their employees. The European Commission and other international organizations with global reach, such as UNCTAD, are concentrating on inspiring regional authorities to develop active policies to help firms become more competitive in this area. It is estimated that the creative sector (including modern eco-design) is a driving force of economic growth for the entire EU (as well as other highly developed countries), creating over 5% of the EU's GDP and systematically increasing this share (Wysokińska 2015, p. 14).

In the new *circular economy* EU action plan for a greener and more competitive Europe (Annex to the new Communication... 2020), the European Commission has announced that it will launch initiatives to restore resources to the economy. These initiatives will cover the entire life cycle of products, from design and production to use, repair, reuse, and recycling. The plan addresses areas where action at the EU level brings added value. The Action Plan is the cornerstone of the *European Green Deal*, the EU's Action Plan for Climate Neutrality. Half of all greenhouse gas emissions come from the extraction and processing of resources. Achieving the climate neutrality goal by 2050 will not be possible without a full transition to a circular economy.

Between 1970 and 2018, global extraction and processing of raw materials such as fossil fuels, metals, and minerals tripled and continues to grow, causing greenhouse gas emissions, loss of biodiversity, and water stress. A circular economy model, where value and resources exist in the economy for as long as possible and the generation

of waste is limited, reduces pressure on natural resources (European Commission 2020b; see also: UN Environment Programme 2019; Report from the Commission to the European Parliament... 2019).

In the Action Plan, several proposals were adopted regarding various industries, including the clothing industry, for which a comprehensive policy framework was announced that aims to strengthen industrial competitiveness and innovation, support the EU market for sustainable circular textile products, including the textile reuse market, and introduce new business models to enhance competitiveness and innovation in this sector, and stimulate the EU market for product reuse (European Commission 2020a, p. 11; see also: Annex to the new Communication... 2020).

The state of development of the European TCLF sector

The European textile industry is becoming increasingly innovative and competitive and it plays a significant role in economic development (Dziuba and Jabłońska 2017, p. 14). The TCLF sector is one of the leading industrial sectors in Europe and a source of new trends and innovations. It is estimated that the European sector's annual turnover is over 200 billion euros, and about 225,000 firms employ 2.2 million people, 66% of whom are women (The European Skills Council n.d.).

Textiles are in fourth place in terms of the greatest pressure on using virgin raw materials and water, and fifth place in greenhouse gas emissions. The future strategy's objective will be to support the development of the sustainable textile products market within a closed-loop, including the secondary use market for textile products. The new approach will focus on new business models that relate to both production and consumption. The European Commission will also provide guidance on the selective collection of textile waste, which the Member States should implement by 2025. It also announced the development of cooperation with industry and market players to identify bottlenecks in textile products' circularity and to stimulate market innovation.

The European EU textile and clothing industry is one of the leaders in world markets. Exports from the EU to the rest of the world represent approx. 30% of the world market, while the EU single market is also one of the most important in terms of both size and especially quality. The European Commission works to ensure a level playing field in international trade. It does so multilaterally within the World Trade Organization, on a bilateral level through free trade agreement negotiations, and in dialogues, such as the Euro-Mediterranean dialogue, mainly focused on the textile and clothing industry, and in bilateral dialogues with Colombia and China.

The EU textiles and clothing sector's leading role has been attributed to its high-class specialization and flexibility, and its ability to constantly adapt its structure to market needs and develop products in response to new demands (such as technical textiles for

industrial applications). Therefore, despite the negative trade balance, the sector has increased exports by 13% and imports by 4% in recent years.

The textile and apparel industry is a global industry with ever-increasing trade flows around the world. Tariff barriers, technical regulations, standards, and conformity assessment procedures are obstacles to trade development, and the European Commission is constantly working to reduce them. The Commission is also applying the World Trade Organization's (WTO) Agreement on Technical Barriers to Trade by non-EU countries and is fighting to remove unnecessary technical obstacles in non-EU countries in the context of WTO requirements.

In parallel to the multilateral framework, the Commission conducts a bilateral dialogue on industrial policy and related regulatory issues with non-EU countries to facilitate industrial relations and improve trade conditions. This dialogue takes place within a horizontal framework in which the textile and clothing industry plays an important role. The Euro-Mediterranean dialogue on the textile and clothing industry is a particularly important multilateral dialogue. This region plays a strategic role as it enables the entire production chain to be kept geographically close. One-third of the EU's textile exports go to the pan-Euro-Mediterranean area (European Commission n.d., *Textiles and clothing...*).

The European footwear industry comprises a wide variety of industrial products and processes. The European Commission works to promote innovation, companies' competitiveness in this field, and the fight against counterfeiting. It also supports protecting the health of consumers and the environment. Therefore, the footwear sector is a diverse industry with a wide range of materials and products, from different types of men's, women's, and children's footwear to more specialized products such as snowboard boots and safety footwear. After the global financial crisis of 2007–2010, the footwear sector comprised 21,000 companies with a turnover of EUR 24 billion. It generated EUR 6.2 billion of added value (around 0.5% of total EU production), directly employing 280,000 people.

Two-thirds of total footwear production in the EU is concentrated in three countries: Italy, Spain, and Portugal. Italy alone is responsible for around 50% of production. The European footwear industry comprises many small enterprises with an average of 10–15 employees and an average turnover of just over EUR 1 million. Most of these enterprises are located in regions with low industrial diversification. However, the number of firms and employment in the footwear sector declined in recent decades due to the relocation of production to economies with lower labor costs.

Many European companies moved into high-quality and value-added segments and niche markets. They include high-end footwear, children's footwear, footwear for specific applications (safety, golf, ski boots), and tailor-made footwear. European footwear products are in great demand, both in the EU and world markets, because of their quality, design, and style.

While the EU continues to face a footwear trade deficit, exports continue to rise. In the post-financial crisis period, exports increased by 48% in the early 2010s. Russia, the United States, and Switzerland remain the main export markets, but exports

to countries such as China, the United Arab Emirates, and Turkey recorded the most significant increases. The leading suppliers of footwear to the EU are China (almost 50% of total imports) and Vietnam (14% of total imports) (European Commission n.d., *Textiles and clothing...*).

In response to the challenges of the European footwear industry, the Commission has commissioned an in-depth assessment of the situation and prospects for future development. The study includes reports on restructuring, research and innovation, and education and training, as well as an analysis of the sector's competitive position and policy recommendations. Essential here are European standards relating to footwear, such as testing methods, terminology, minimum performance requirements for individual components of footwear and entire shoes, and environmental aspects.

European leather industry

The EU is one of the major players in the global leather market, and its leather-based industry consists of a wide variety of industrial products and processes. The European Commission works to promote companies' innovation and competitiveness in this field while protecting the health of consumers and the environment. The leather industry includes a variety of industrial processes. Leather tanning involves the processing of raw materials, i.e., the processing of raw hides and the finishing of the hides for use in the production of a wide variety of products. The footwear, clothing, furniture, automotive, and haberdashery industries are the most important EU tannery markets. The tanning industry uses hides and skins (by-products from the meat and dairy industry) that would otherwise be disposed of by landfill or incineration. Leather is the main product of the tanning sector. It is an industrial intermediate used in the downstream sectors of the consumer goods industry. The most important outlets for EU tannery production are: footwear – 41%; furniture – 17%; automotive – 13%; the manufacture of leather goods – 19%; clothing – 8%; others – 2%.

Leather processing also generates other by-products used in several industrial sectors, such as pet and other animal food, fine chemicals (including photography and cosmetics), and fertilizers. The leather and related goods sector also generates significant economic effects as it comprises around 36,000 companies with a turnover of EUR 48 billion. These enterprises employ approximately 435,000 people. Tanneries in the European Union are usually small and medium-sized family businesses. Regional concentration is strong, and the industry often plays a key role in the local economy, being the prime source of employment and wealth.

The tanning industry is global, and the EU tanners depend heavily on access to raw materials and export markets. Indeed, the EU is the source of some of the most valuable calfskins. The EU tanning industry continues to be the world's largest leather supplier in the international market despite the shrinking EU share in world mar-

kets caused by the expansion of leather industries in other regions of the world, such as Asia and the Americas.

European tanners face two types of trade barriers: impeding the export of finished leather and restricting access to raw materials. Access to European raw materials has also become more difficult recently because beef production and the slaughter rate have decreased in recent years. Thus, access to raw materials outside Europe is now increasingly important. However, many countries outside the EU maintain bans and restrictions on the export of rawhides. Therefore, improving market access is expected most of all in the context of World Trade Organization regulations, where the European Commission supports the complete withdrawal of all export restrictions by various WTO members. To ensure that European industry has fair access to the raw materials it needs, the European Commission developed an integrated strategy outlined in its 2008 Communication “The Raw Materials Initiative: Meeting Our Critical Needs for Growth and Jobs in Europe” (European Commission n.d., *The EU leather industry*). According to statistical data, 50% of leather produced in the European Union is currently used in the footwear industry. The clothing industry accounts for 20%, while leather for upholstery accounts for 17% of European tanneries’ production (European IPPC Bureau 2013).

In the coming years, a critical condition for the development of TCLF industries in the EU will be *digitization*, which in the next decade will remain the main factor of social and economic changes and a carrier of values of increasing importance. Digitization is becoming universal and global. In the future, the TCLF industry will focus on investing and developing modern technologies and processing textile raw materials, especially from renewable resources. It will also focus on developing biomaterials engineering and multifunctional chemical fibers for special applications, including nanofibers. A considerable part of the assortment will be products with unconventional applications: in medicine (biomaterials, bioactive and biodegradable fibers), technology (intelligent textiles for the development of textronics), and agriculture (ecological textile products).

The development potential is to be found in robotics, automation, artificial intelligence, the circular economy, and the eco products market. The industry invests in technologies that reduce the impact of products (and production) on the environment, the reuse of materials, the reduction of energy consumption, and the implementation of *Responsible Research for Innovation – RRI solutions*. A great development opportunity is the acquisition and use of larger and larger volumes of data (Internet of Things, big data) and the development of analysis techniques (artificial intelligence). The digitization of business is clearly associated with positive changes, as it significantly increases work efficiency, improves communication and activities in groups, and allows for better customer service. Moving from an analog to a digital work style will enable businesses to be more agile and competitive. Digitization is currently the most effective tool for managing and implementing innovation.

An important aspect of the EU's policy is and will be to reduce the number of hazardous substances, especially in textiles (*Clothes and textiles* n.d.). For many years, the EU has restricted or banned many dangerous chemicals in textiles, e. g. azo and some other dyes (found in textiles and leather products), chromium VI (in leather products), dimethyl fumarate (DMF, used to prevent mold), and some phthalates (textiles, plastic shoes). Many textile manufacturers also reduce the number of hazardous chemicals in their products. The evaluation of traditional restricted substances usually focuses on product testing, but this can be ineffective and lead to a costly product recall. By focusing on chemicals and input products, manufacturers can reduce many of the hazards of restricted substances.

The TCLF sector in Poland

The Polish textile and clothing market is one of the most attractive in Central and Eastern Europe, with a long cultural and economic tradition. The region that has always stood out from the rest of the country is the Lodz region, where one of the world's largest textile industry centers was established in the 19th century. Since then, this industry has been an integral part of the national economy despite various political upheavals and organizational changes. According to European Commission data, Poland ranks 8th in Europe in terms of clothing production, with domestic production reaching EUR 22.1 billion in 2018. Besides, Poland is considered a tycoon in the field of textile and clothing exports in Europe. The value of exports in 2018 amounted to PEUR 11.9 billion (43% of the revenue from the sale of clothing and 61% of the revenue from the sale of textiles comes from exports). At the end of 2018, 44,447 firms were registered in the sector. Eight thousand four hundred thirty-two companies, i.e., almost 19% of the entire national potential in this area, are enterprises with their headquarters in the Lodz region, and it is estimated that the number will increase by almost 40% by 2035.

Poland also ranks high among the top fifteen exporters and importers of footwear in Central Europe. The exports of Poland's footwear industry in 2015–2019 increased from EUR 943 million to EUR 2.2 billion, while imports increased from EUR 1.4 billion to EUR 2.7 billion. The main export direction for Polish shoes is the EU. For many years, the largest recipient has been Germany, with nearly 39% of Polish exports in 2019, followed by the Czech Republic, Romania, and Italy (PKO Bank Polski S.A. 2020).

The hide processing technology includes chemical processes and mechanical operations that shape the structure of the hide. They protect against the destruction of hides and give them the characteristics typical for a specific ready-made assortment. Leather industry waste is both biologically unstabilized waste (including hazardous tanning waste, i.e., trimmings) and waste that results from the process of proper tanning, which is resistant to biological degradation. It is estimated that for every 4 tons of raw hides subjected to tanning, 1 ton of waste is generated. Production residues usually ac-

count for 2 to 20% of tanned leather weight – more than 2 kg of waste for every square meter of finished leather. According to the Central Statistical Office (GUS) data, the leather and leather goods manufacturing sector generated 55,100 tons of waste in 2019 (Główny Urząd Statystyczny 2020).

Analysis of selected segments of the global textile, clothing, footwear, and leather market based on the latest available data in the UN international statistics (COMTRADE database) – Poland's position¹

Textiles

After the 2008–2010 crisis, the global textile market was characterized by upward trends, especially strong in 2016–2018 (recent years for which statistical data from international databases of the UN and Eurostat are available). Growth trends can be observed both in the global textile yarn market – where increases from USD 48 to USD 54.5 billion were recorded, as well as in the markets of fabrics (especially artificial ones) and crochet and knitted fabrics. The value of exports increased by 3.2% in the analyzed period (compared to a –1.4% average increase in *textiles made of chemical fibers (SITC 653 group²)* in the period 2014–2018). The leading exporters included China, South Korea, Taiwan, Italy, Turkey, India, Japan, Germany, the United States, and Spain. In turn, in 2018, the value of exports of *knitted or crocheted fabrics (SITC 655 group)* increased by 5.1%, i.e., to USD 37.0 billion (compared to the average growth rate of 2.1% in 2014–2018). China, South Korea, and other Asian countries were the leading exporters in 2018, accounting for 49.1, 8.4, and 6.6% of world exports, respectively. Vietnam, Cambodia, and the United Kingdom were the main destination countries, with 15.4, 9.6, and 6.1% of world imports, respectively. In 2018, the country with the highest net export value was China (USD +16.5 billion), followed by South Korea (USD +3.0 billion).

Commodity groups of great importance and dynamic development in world trade in the analyzed period also included *special yarns, special textile fabrics and related products (SITC 657 group)*, and *made-up articles, wholly or chiefly of textile materials, n.e.s.³ (SITC 658 group)*. They are particularly important groups from the point of view of Poland. It was among the world's 15 largest exporters, ranking 9th in exports of the latter group (which accounted for almost 2% of global exports) and 15th in exports of the former, accounting for 1.7% of world exports. In the import of goods from the

1 Based on: *International Trade Statistics Yearbook–2018 (2019)*.

2 Commodity group of the Standard International Trade Classification.

3 n.e.s. – not elsewhere specified.

first group, Poland ranked 7th (2.8% of world imports), and in the import of goods from the second group, it was 13th (1.6% of world imports).

According to UN analyses and assessments, the value of exports of *special yarns, special textile fabrics and related products (SITC 657 group)* increased by 6.4% in 2018 (compared to 1.1% average growth for the period 2014–2018) to USD 52.7 billion, while imports increased by 7.7% to USD 47.7 billion. The export of this raw material accounted for 2.3% of global exports of the SITC Section 6 and 0.3% of the total world exports of goods. In 2018, the largest exporters were China, Germany, and the United States, which accounted for 25.7, 10.5, and 9.1% of global exports, respectively. On the import side, the United States, China, and Germany were in the lead, with 11.2, 6.5, and 5.8% of the share, respectively.

On the other hand, UN analyses showed that in 2018, the value of exports of *made-up articles, wholly or chiefly of textile materials, n.e.s. (SITC 658 group)* increased by 5.8% (compared to 0.4% average growth in 2014–2018) to USD 61.2 billion. Imports increased by 6.5%, reaching USD 55.1 billion. The export of this raw material accounted for 2.6% of the world exports of the SITC Section 6 and 0.3% of the total world exports of goods. In 2018, the leading exporters were China, India, and Pakistan, which accounted for 44.6, 8.4, and 6.6% of global exports, respectively. On the import side, the United States, Germany, and Japan were in the lead, with 29.1, 7.9, and 6.6% of the share, respectively.

Men's and boys' and women's and girls' clothing (UN international nomenclature Division 84)

The global market of clothing and accessories for clothing after the global financial crisis was characterized by strong growth trends, especially from 2011 until 2018. The UN results were presented especially for 2016–2018 – the most recent years for which statistical data from international UN and Eurostat databases are available.

Men's or boys' outerwear of textile materials, not knitted or crocheted

In 2018, the value of exports of *men's or boys' outerwear made of textiles, not knitted or crocheted (SITC 841 group)* increased by 3.4% (compared to 0.1% of the average growth rate in the period (2014–2018)), reaching USD 81.0 billion, while imports increased by 7.0%, reaching USD 73.9 billion. Exports of these goods accounted for 3.6% of the world exports of SITC Section 8, and 0.4% of the total world exports of goods. The leading exporters were China, Bangladesh, and Vietnam, which accounted for 27.1, 9.1, and 7.4% of global exports, respectively.

The main target countries were the United States, Germany, and Japan, with 19.5, 9.9, and 6.8% of global imports, respectively. The high concentration of the largest trading countries on the world market is also characteristic. The 15 largest partner countries accounted for 78.5 and 74.7% of total global exports and imports, respec-

tively. The largest trade deficits were recorded in North America (USD –15.0 billion), Europe (USD –11.8 billion), and Australia and New Zealand (USD –1.3 billion).

Women's or girls' outer garments of textile materials, not knitted or crocheted

In 2018, the value of *exports of women's or girls' outerwear made of textile, not knitted or crocheted (SITC 842 group)* increased by 3.7%. (compared to 0.7% average growth rate in the period 2014–2018), reaching USD 101.5 billion, while imports increased by 8.9%, to USD 94.4 billion. The exports of these goods accounted for 4.5% of the world exports of the whole SITC Section 8, and 0.5% of the total world exports of goods. The largest exporters were China, Italy, and Germany, with 33.5, 6.0 and 5.5% of the share in world exports, respectively. The main target countries were the United States, Germany, and Japan, with 16.8, 9.0, and 6.8% of global imports, respectively.

The top 15 countries accounted for 83.8 and 75.1% of total global exports and imports, respectively. In 2018, China was the country with the highest export value (USD +32.2 billion), followed by Vietnam (USD +5.5 billion). In turn, the largest trade deficits were recorded in North America (USD –16.7 billion), Europe (USD –14.8 billion), and Latin America and the Caribbean (USD –2.4 billion).

Poland had a relatively high position, putting it among the 15 leading global exporters and importers. It ranked 12th in exports (which accounted for 2.1% of global exports in 2018, with dynamics of 46.7% in the last two analyzed years). It was ranked 11th in imports (which accounted for 2.4% of global imports in the same year, with import dynamics of 46.5% in 2018 compared to the previous year).

Men's or boys' outerwear made of textile fabrics knitted or crocheted

In 2018, the export value of *men's or boys' outerwear made of woven, knitted or crocheted fabrics (SITC 843 group)* increased by 3.7%. (compared to –0.2% in the period 2014–2018), reaching USD 32.6 billion, while imports increased by 8.6%, reaching USD 27.0 billion. The exports of this commodity group accounted for 1.5% of the world exports of SITC Section 8 and 0.2% of the total world exports of goods. China, Vietnam, and Cambodia were the leading exporters in the last analyzed year. These countries accounted for 30.1, 7.5, and 6.2% of the world export, respectively. The main target countries were the United States, the United Kingdom, and Germany, with 25.8, 6.4, and 6.2% of the share of global imports, respectively.

The 15 largest countries accounted for 80.2 and 74.8% of total global exports and imports, respectively, proving a high degree of trade concentration. The country with the highest value of exports was China (USD +9.3 billion), followed by Vietnam (USD +2.4 billion). The largest trade deficits were recorded in North America (USD –7.3 billion), Europe (USD –4.4 billion), and Australia and New Zealand (USD –487.1 million).

Women's or girls' outerwear of knitted or crocheted textile fabrics

In 2018, the value of exports of *women's or girls' outerwear, made of knitted or crocheted textile fabrics (SITC 844 group)* increased by 5.7% (compared to -2.0% average growth rate in the period 2014–2018), reaching the level of USD 58.0 billion, while imports increased by 5.3%, reaching the value of USD 48.2 billion. The export of these products accounted for 2.6% of the world exports of SITC Section 8 and 0.3% of the total world exports of goods. China, Vietnam, and Cambodia were the leading exporters in 2018, accounting for 36.0, 7.0, and 5.2% of world exports, respectively. The main target countries were the United States, Germany, and the United Kingdom, with 23.0, 9.9, and 6.3% of the share in world imports, respectively.

The 15 largest countries accounted for 80.2 and 74.8% of total global exports and imports, respectively, proving a high degree of trade concentration. The country with the highest value of exports was China (USD +9.3 billion), followed by Vietnam (USD +2.4 billion). The largest trade deficits were recorded in North America (USD -7.3 billion), Europe (USD -4.4 billion), and Australia and New Zealand (USD -487.1 million).

Textile articles of clothing, even knitted or crocheted, n.e.s.

In 2018, the value of exports of *textile articles of clothing, even knitted or crocheted, n.e.s. (SITC 845 group)* increased by 6.3% (compared to 0.5% average growth rate in the period 2014–2018), reaching USD 158.8 billion, while imports increased by 6.8%, reaching USD 154.1 billion. The exports of this commodity group accounted for 1.5% of the world exports of SITC Section 8 and 0.2% of the total world exports of goods. China, Bangladesh, and Vietnam were the main exporters in 2018. These countries' exports accounted for 28.2, 7.0, and 5.7% of the world export, respectively. The main target countries were the United States, Germany, and Japan, with 16.8, 9.0, and 6.8% of global imports, respectively.

The top 15 countries accounted for 78.1 and 75.8% of total world exports and imports, respectively. In 2018, the country with the highest value of exports was China (USD +42.1 billion), followed by Bangladesh (USD +11.1 billion). The largest trade deficits were recorded in North America (USD -15.0 billion), Europe (USD -11.8 billion), and Australia and New Zealand (USD -1.3 billion).

Articles of apparel, of textile fabrics, whether or not knitted or crocheted, n.e.s.

In 2018, the value of exports of *Articles of apparel, of textile fabrics, whether or not knitted or crocheted, n.e.s. (SITC 846 group)* increased by 4.9% (compared to -0.5% the average rate for 2014–2018) to USD 31.6 billion, while imports increased by 2.8%, reaching USD 27.4 billion. This group's export accounted for 1.4% of the world exports of SITC Section 8, and 0.2% of total world exports of goods. In 2018, the leading exporters were China, Italy, and Turkey, with a 43.1, 7.3, and 4.0% share in global exports, respectively. The main target countries were the United States, Japan, and Germany, with 18.0, 8.0, and 7.9% of world imports, respectively.

The 15 largest countries accounted for 82.3 and 67.9% of total global exports and imports, respectively. In 2018, the country with the highest export value was China (USD +13.3 billion), followed by Italy (USD +1.4 billion). The largest trade deficits were recorded in North America (USD -4.7 billion), Europe (USD -3.5 billion), and Latin America and the Caribbean (USD -484.7 million).

In the global import of products belonging to this product group, Poland had a relatively high position (15), which meant a 1.6% share with the import growth dynamics in 2018, equaling 19.1%, compared to the previous year.

Articles of apparel and clothing accessories of other than textile fabrics; headgear of all materials

In 2018, the value of exports of *articles of apparel and clothing accessories of other than textile fabrics; headgear of all materials* (SITC 848 group) increased by 9.5% (compared to 1.1% average growth in 2014–2018) to USD 35.1 billion, while imports increased by 7.7% to USD 32.4 billion. The export of this group accounted for 1.4% of the world exports of SITC Section 8, and 0.2% of total world exports of goods. In 2018, China, Malaysia, and Italy were the leading exporters, with 37.7, 12.8, and 6.5% of the share in global exports, respectively. The main target countries were the United States, Germany, and Japan, with 16.8, 9.0, and 6.8% of global imports, respectively.

The top 15 countries accounted for 86.2 and 72.7% of total world exports and imports, respectively. In 2018, the countries with the highest value of exports were China (USD +12.5 billion), followed by Malaysia (USD +4.3 billion). The largest surpluses were recorded in East Asia (USD +33.2 billion), Southeast Asia (USD 21.1 +billion), and South Asia (USD +2.6 billion). The largest trade deficits were recorded in North America (USD -8.2 billion), Europe (USD -4.1 billion), and Latin America and the Caribbean (USD -1.0 billion).

Leather and shoes

Leather

In 2018, the value of *leather* (SITC 611 group) exports decreased by 8.2% (compared to a -4.6% average growth rate in 2014–2018), reaching USD 22.6 billion, while imports decreased by 5.4%, reaching USD 23.5 billion. This group's exports accounted for 1.4% of global exports of SITC Section 6, and 0.2% of the total world exports of goods. The leading exporters were Italy, the United States, and Brazil, with 19.4, 8.9, and 6.4% of the share in global exports, respectively. The main target countries were China, Italy, and Vietnam, with world import shares of 18.8, 13.2, and 7.7%, respectively.

The top 15 countries/areas accounted for 70.7 and 74.2% of total global exports and imports, respectively. In 2018, Brazil was the country with the highest value of exports (USD 1.4 billion), followed by Italy (USD 1.3 billion). The largest trade surpluses in this product group were recorded in Latin America and the Caribbean (USD +1.7 billion),

North America (USD +1.4 billion), and Australia and New Zealand (USD +519.9 million). The largest trade deficits were recorded in East Asia (USD –3.8 billion), Southeast Asia (USD –2.0 billion), and West Asia and North Africa (USD –5.0 million).

Footwear

In 2018, the value of *footwear (SITC 851 group)* exports increased by 4.9% (compared to an 0.8% average growth rate in 2014–2018), reaching USD 145.3 billion, while imports increased by 7.2% to USD 144.0 billion. Footwear exports accounted for 6.5% of world exports of SITC Section 8, and 0.8% of the total world exports of goods. The leading exporters in 2018 were China, Vietnam, and Italy. These countries had 32.4, 11.9, and 8.5% of the share in global exports, respectively. The main target countries were the United States, Germany, and France, with 19.1, 9.3, and 5.9% of global imports, respectively.

In 2018, the top 15 countries accounted for 84.8 and 71.0% of total global exports and imports, respectively. The country with the highest value of exports was China (USD +42.5 billion), followed by Vietnam (USD +16.2 billion). The largest trade deficits were recorded in North America (USD –28.3 billion), Europe (USD –15.2 billion), and Latin America and the Caribbean (USD –4.2 billion).

In the international footwear trade, Poland's relatively good position should be noted, as it is among the 15 leading global exporters and importers, ranking 14th in both exports and imports, accounting for a 1.4% share in global exports and a 1.9% share in global imports in 2018. In turn, the annual export dynamics of footwear in 2018 compared to 2017 amounted to 40.7%, and the import dynamics amounted to 46.9%.

Conclusion

The textiles, clothing, and footwear markets were characterized by relatively stable growth after the 2008–2010 financial crisis and the dynamic development of exports and imports between 2016 and 2018. They presented a high concentration of the strongest trading partners and the dominance of Asian partners (China, South Korea, Vietnam, Taiwan, India, and Japan) as well as relatively large shares of partners from Southern Europe (Italy and Spain), with the significant position of Turkey, Germany, and Great Britain and the United States.

Poland's position was relatively good in several groups of commodities, i.e., in the trade in textiles such as goods from SITC Section 6: *special yarns, special textile fabrics and related products (SITC group 657)* and *made-up articles, wholly or chiefly of textile materials, n.e.s. (SITC group 658)*. These are particularly important groups for Poland, ranking among the world's 15 largest exporters: 9th in exports of the latter group (which accounted for almost 2% of global exports) and 15th in exports of the first group (which accounted for 1.7% of world exports). In turn, in the im-

port of goods from the first group, Poland ranked 7th (2.8% of world imports), and in the import of goods from the second group, 13th (1.6% of world imports).

Among the articles of apparel and clothing accessories belonging to Section 8, Poland achieved a high position in trade in *women's and girls' outerwear of textile fabrics, not knitted or crocheted* (SITC group 842). It was among the world's 15 leading exporters and importers, ranking 12th in exports (which accounted for 2.1% of global exports in 2018, with dynamics of 46.7% in the last two analyzed years). It was ranked 11th in imports (accounting for 2.4% of global imports, with import dynamics of 46.5% compared to 2017).

In the *SITC 846 group*, which includes *clothing accessories, of textile fabrics, whether or not knitted or crocheted*, Poland achieved a relatively high position (15), which meant a 1.6% share, with dynamics of import growth in 2018 (compared to the previous year) at 19.1%.

In the international *footwear* trade, Poland's relatively good position puts it among the 15 leading exporters and importers of the world, ranking 14th in both exports and imports (which accounted for 1.4% share in global exports and 1.9% share in global imports in 2018). In turn, the annual export dynamics of footwear in 2018 compared to 2017 amounted to 40.7%, and the import dynamics amounted to 46.9%.

Annex

The TCLF industry in Poland – Łukasiewicz Research Network – Institute of Biopolymers and Chemical Fibers (IBWCh) and Łukasiewicz Research Network – Institute of Leather Industry – Case Studies

An example of selected achievements of the Institute of Biopolymers and Chemical Fibers – IBWCh

Since the Institute of Biopolymers and Chemical Fibers (IBWCh) began operations, scientific research on artificial fiber production, including cellulose, has been an outstanding achievement. Until the 1990s, these cellulose fibers were produced by the viscose method. The Institute uses a specialized pilot line from Blaschke (Germany) – a spinning machine – to produce viscose and cellulose fibers. This line made it possible to improve the viscose process and analyze the influence of various types of cellulose pulp on the viscose or cellulose fiber properties. The new preparations and methods were implemented in the viscose fibers' factories of Wistom in Tomaszów Mazowiecki, Chodakowskie ZWCh in Sochaczew, Wiskord in Szczecin, Celwiskoza in Jelenia Góra, and Viscoplast in Wrocław.

Since the beginning of the 1990s, there has been intensive research on developing an alternative to viscose technologies to produce cellulose fibers. The IBWCh team, under the supervision of prof. Dariusz Wawro, has carried out many international projects, e.g., Biocelsoll, Marie-Curie ITN, a project within EPNOE (the European Polysaccharide Network), Wobama, or Elmo (Kuzmina et al. 2010; Wendler et al. 2010; Ek et al. 2014; Kuzmina et al. 2014; Wawro et al. 2014; Wawro et al. 2015). The team has extensive experience in forming classic cellulose fibers from alkaline cellulose solutions and modified with other biopolymers, such as plant polysaccharides or hydrolysates (Ek et al. 2014; Wawro and Stęplewski 2010) and animal proteins, such as fibroin and keratin (Strobin et al. 2006; Wrzesniewska-Tosik et al. 2007). Thanks to the introduction of biopolymers into the structure of cellulose fibers, the properties of the fibers, including bioactivity, were changed. The hydrothermal cellulose activation method developed at the Institute deserves special mention. The Institute currently carries out research services for industrial partners (Wawro, Stęplewski, and Bodek 2009).

Selected projects implemented in recent years as part of the Łukasiewicz Research Network – Institute of Leather Industry

Management of environmentally harmful waste from the leather industry in agrotechnics

Two projects are carried out in international consortia under the NCBR program: “New treatment for rape seeds based on collagen hydrolysates, in order to increase the drought resistance of the rape seedling” (Eureka program) and “New treatment based on collagen hydrolysates for increasing the drought resistance of Leguminosarum seedlings” (Era.Net *Rus Plus Innovation program*). The projects included activities to increase the yields of various plant species using the leather industry's by-products. The results of the research will be applicable in many sectors of the economy, especially

in agriculture. Among other things, a new material based on collagen preparations and seed coating technology was developed to increase their resistance to drought. They also developed a way of using waste biomass to develop a new foliar preparation that contains a fungicide and plant biostimulants. A team of researchers from Łukasiewicz Research Network – Institute of Leather Industry and Lodz University of Technology assessed the possibility of using a disk granulator to coat legume seeds with collagen hydrolysates obtained from tannery waste, which is burdensome for the natural environment. The resulting coatings are designed to increase resistance to drought and pests during seed germination. As part of the research, the team proposed a way to manage solid waste from the leather industry. Due to its unique properties, the resulting collagen hydrolyzate was used in the pelleting of legume seeds to reduce the risk of seeds not germinating during drought (Ławińska et al. 2017, p. 1877).

Environmental responsibility

The LIFE + CO2Shoe project “LIFE12 ENV/ES/000315” has developed carbon footprint calculation tools for the footwear sector to estimate the greenhouse gas (GHG) emissions generated by footwear production. The project covered four EU Member States: Spain, Italy, Portugal, and Poland (countries which concentrated 79% of footwear companies in the EU in 2013) (*European footwear sector...* n.d.). The project aimed to provide footwear companies with a tool to allow the industry to identify the most important aspects of production that can reduce greenhouse gas emissions. In order to calculate the carbon footprint, a proprietary method developed by the consortium was used, based on the relevant standards: ISO 14040: 2006 Environmental management – Life cycle assessment – Principles and framework and ISO 14044: 2006 Environmental management – Life cycle assessment – Requirements and guidelines. The research material consisted of various footwear types: children’s, women’s, men’s, and work shoes. During the project, 36 models of footwear produced in the European Union were tested. It allowed them to calculate the average carbon footprint of a pair of footwear – 10.6 CO₂e (kg) (Serweta et al. 2019, p. 94). Carbon footprint calculations make it possible to identify the most environmentally damaging steps of the production process. In the analyzed models, footwear materials had the most significant impact on the carbon footprint, on average accounting for 57.4% of the total value.

Individual operations for the treatment of tannery waste for reuse

As part of the cooperation, work is carried out on the agglomeration methods of waste shavings from chrome and chrome-free tanning processes with mineral additives. Tanning shavings are characterized by many unfavorable physical properties, including very low apparent volume. They take up a lot of space, which makes them difficult to store and transport. These wastes have irregular, fluffy shapes, causing them to stick together into larger fragments. As a result of the conducted work, a loose agglomerated

granular bed is obtained, which combines both mineral and organic components; it is easy to store, transport, and dose. The obtained agglomerates can be used to produce composites based on collagen fibers instead of the previously used loose, moist, dusty shavings. The developed methods make it possible to process and change the physical properties of the waste product – shavings from chrome and chrome-free tanning processes, which are often stored on the premises of the tanning plant and sent for disposal (Ławińska, Obraniak, and Modrzewski 2019, p. 107; Ławińska et al. 2020, p. 1; Ławińska, Modrzewski, and Obraniak 2020, p. 119).

As part of the National Science Center's MINIATURA project, research was carried out to assess the possibility of using waste from the leather industry, especially waste leather tanned in the wet-blue technology, and readily available cheap natural minerals, for the formation of new composites with high physicomechanical parameters. The structure and high tensile strength of collagen fibers allow them to be used as a component of a composite. This topic combined with the issue of using mineral additives is part of the current issues of the sustainable development of the global economy, including the renewal and biodegradability of composite materials (Ławińska, Serweta, and Modrzewski 2018, p. 81; Ławińska, Serweta, and Modrzewski 2019, p. 106; Ławińska, Modrzewski, and Serweta 2019).

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Przegląd unijnych i światowych uwarunkowań transformacji przemysłu TCLF (włókienniczego, odzieżowego, skórzanego i obuwniczego) na drodze do gospodarki cyrkularnej i cyfrowej (przykłady z Polski)

Celem artykułu jest przegląd zmian dokonujących się w europejskim i światowym sektorze TCLF (włókienniczym, odzieżowym, skórzanym i obuwniczym) na przestrzeni ostatniego dziesięciolecia z punktu widzenia nowych wymogów dążenia do gospodarki cyrkularnej a w ostatnich latach do gospodarki cyfrowej. W artykule przeprowadzono charakterystykę zmian w częściach składowych tego przemysłu (nazywanego w przeszłości przemysłem lekkim), w Unii Europejskiej oraz w gospodarce światowej w kontekście wymogów zrównoważonego rozwoju oraz niwelowania skutków niekorzystnych zmian klimatycznych. W ostatnich programach europejskich i światowych chodzi bowiem głównie o osiągnięcie surowych wymogów gospodarki cyrkularnej, w tym zwłaszcza na zmniejszenie presji na zasoby naturalne o osiągnięcie celu neutralności klimatycznej do końca 2050 r. Tym pozytywnym dla naszej planety zmianom, sprzyja również dążenie do rozwoju gospodarki cyfrowej.

Słowa kluczowe: tekstylia, odzież, skóra, obuwie, transformacja, gospodarka cyrkularna, gospodarka cyfrowa, Unia Europejska, gospodarka światowa, Polska



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