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# RESEARCH REPORT

# INVESTMENT AND EXPORT PROMOTION VIA DIAGONAL CUMULATION BETWEEN GEORGIA, TÜRKIYE AND THE EUROPEAN UNION



2022

## TABLE OF CONTENTS


**SUMMARY** 1

**INTRODUCTION** 1

**METHODOLOGY** 3

**DIAGONAL CUMULATION** 4

**BRIEF OVERVIEW OF THE PRODUCTION AND TRADE OF INDUSTRIAL GOODS IN GEORGIA-TÜRKIYE-THE EU** 5

**POTENTIAL EXAMPLES OF PRODUCTION DEVELOPMENT OF EXPORT PRODUCTS THROUGH DIAGONAL CUMULATION IN GEORGIA** 15

**1. VALUE CHAIN OVERVIEW: PLASTIC** 15
PRODUCT: NONWOVEN SINGLE-USE SURGICAL GOWNS 16
PRODUCT GROUP: PP WOVEN PACKING BAGS 22
PRODUCT: FLEXIBLE INTERMEDIATE BULK CONTAINERS 22
PRODUCT: PACKING BAGS AND SACKS 23

**2. VALUE CHAIN OVERVIEW: ALUMINIUM** 31
SEMI-FINISHED PRODUCT: ALUMINIUM PROFILES 34
PRODUCT: DOORS, WINDOWS AND THEIR FRAMES AND THRESHOLDS FOR DOORS 42
PRODUCT: ALUMINIUM HEATING RADIATORS 42
PRODUCT: PLATES, SHEETS AND STRIP, OF ALUMINIUM ALLOYS 43
PRODUCT: ALUMINIUM COMPOSITE PANEL 46
PRODUCT: BICYCLES WITH BALL BEARINGS 48
PRODUCT: ROAD WHEELS OF ALUMINIUM 54

**3. PRODUCT: MATRASSES** 61
PRODUCT: MATTRESSES WITH SPRING INTERIORS 63

**4. PRODUCT: WHITE GOODS** 66
PRODUCT: DISHWASHING MACHINES OF THE HOUSEHOLD TYPE 68
PRODUCT: AUTOMATIC WASHING MACHINES, OF A DRY CAPACITY <6 KG 73

**5. VALUE CHAIN OVERVIEW: TEXTILE/COTTON** 79
PRODUCT: BED LINEN 81
PRODUCT: WOMEN'S, GIRLS' TROUSERS & SHORTS, OF COTTON, NOT KNIT 86

**6. PRODUCT: FOOTWEAR** 92

**ANNEX 1: GEORGIAN AND TURKISH COMMPANIES** 97

# SUMMARY

The present document is a report of a study carried out by the Policy and Management Consulting Group (PMCG) research team from November 2021 to May 2022, as requested by the USAID Economic Security Program for Investment and Export Promotion via Diagonal Cumulation between Georgia, Türkiye and the European Union (EU). PMCG conducted the study using quantitative and qualitative research methods, as a result of which various most promising sectors and value chains and the respective goods have been identified. Production of the identified goods could be economically attractive in light of the diagonal cumulation, i.e. manufacturing in Georgia using Turkish raw materials and intermediate products for exporting to the EU. The report includes the list of Georgian and Turkish companies[1] that may be potentially interested in production of these goods in Georgia.

# INTRODUCTION

Since April 29, 2021, according to the Diagonal Cumulation between Georgia, Türkiye and the EU, Georgia-made products (outside of agriculture sector) that include Turkish raw inputs may be exported to the EU under the Free Trade Agreement (FTA).[2] Aside to increasing Georgian export potential to EU, the Diagonal Cumulation will also encourage Foreign Direct Investments (FDI) from Türkiye to the Georgian economy. In addition, it will support innovation by promoting establishment of joint companies by Turkish and Georgian business communities, which will certainly, create new high-value jobs.

The need for investment and export promotion via Diagonal Cumulation between Georgia, Türkiye and the EU was outlined during the USAID Economic Security Program's Public-Private Dialogue (PPD) activity for light manufacturing sector that focused on furniture and packaging value chains. At the PPD session,[3] the Business Support Organizations (BSOs) and business practitioners, especially those, exporting their products to the EU markets, persuasively demonstrated that the above-mentioned value chains offer significant potential for growth on an international scale. Therefore, they underlined that the effective use of Diagonal Cumulation is of crucial importance to boost competitiveness of the packaging and furniture value chains.

With this in mind, USAID Economic Security Program and the Ministry of Economy and Sustainable Development of Georgia (MoESD) gave a high priority to enabling Georgian private sector to capitalize on Diagonal Cumulation. For this purpose, in partnership with the MoESD and by applying the PPD approach with involvement of the Trade Advisory Group (TAG)[4], the Program conducted comprehensive research with help of the PMCG research team.

The aim of the research is to reveal the most promising sectors and value chains for investment and export promotion, as well as at least 100 Turkish and Georgian companies that may be interested in

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[1] THE LIST DOES NOT INCLUDE CONTACT INFORMATION OR ANY OTHER PERSONAL DATA. THE CONTACT INFORMATION OF THE COMPANIES WAS SUBMITTED SEPARATELY TO THE USAID ECONOMIC SECURITY PROGRAM AND THE MINISTRY OF ECONOMY AND SUSTAINABLE DEVELOPMENT OF GEORGIA

[2] DCFTA.GOV.GE/EN/NEWS/227

3 THE USAID ECONOMIC SECURITY PROGRAM FACILITATED THE PUBLIC-PRIVATE DIALOGUE SESSION ON LIGHT MANUFACTURING SECTOR ON THE 19TH OF APRIL 2021, IN CONJUNCTION WITH THE SECTOR ECONOMY AND ECONOMIC POLICY COMMITTEE OF THE PARLIAMENT OF GEORGIA AND THE MINISTRY OF ECONOMY AND SUSTAINABLE DEVELOPMENT (MOESD).

4 A PERMANENT PLATFORM FOR CONSULTATION BETWEEN GOVERNMENT AND THE PRIVATE SECTOR ON TRADE ISSUES ESTABLISHED UNDER THE MOESD WITH SUPPORT OF THE USAID GOVERNING FOR GROWTH (G4G) IN GEORGIA PROGRAM.

production of identified goods in light of the diagonal cumulation between Georgia, Türkiye, and the European Union.

Considering findings of the comprehensive quantitative and qualitative desk research and fieldwork activities, PMCG research team:

- ✓ Revealed the following most promising sectors and value chains that can benefit from utilizing the Diagonal Cumulation: Packaging and personal protective equipment (PPE); furniture; textile; apparel; footwear; construction materials; parts and accessories of the motor vehicles of headings; cycling and white goods industry/home electronic appliances.
- ✓ Identified the originating materials[5] of Türkiye that can be further processed or added to the products originating in Georgia for the Diagonal Cumulation purposes: Plastics, woven and non-woven fabrics; cotton, leather, rubber; aluminium; motors, pumps, electrical controls, and components, etc.
- ✓ Identified sixteen (16) products from the priority sectors and value chains the production of which could be economically most attractive in Georgia using the identified Turkish materials, that then can be exported directly from Georgia to the EU under the FTA. The identified products are listed in the following Table 1:

**Table 1: Selected products and the respective raw materials, sectors/value chains or industries**

| | | |
|---|---|---|
| **KEY SELECTED PRODUCTS** | | |
| **Plastic** | | |
| 1 | Flexible Intermediate Bulk Containers (HS Code: 63053219) | Packaging |
| 2 | Sacks and bags, of Polypropylene (HS Code: 63053390) | Packaging |
| 3 | Surgical Single-Use Gowns, of Nonwovens (HS Code: 62101092) | PPE |
| **Aluminium** | | |
| 4 | Semi-Finished Product: Aluminium Profiles (HS Code: 76042990) | Construction Materials |
| 5 | By-product: Doors, Windows (HS Code: 761010) | Construction Materials |
| 6 | By-product: Heating Radiators (HS Code: 7616991091) | Construction Materials |
| 7 | Semi-Finished Product: Aluminium Plates, Sheets, and Strip (HS Code: 760612) | Construction Materials |
| 8 | By-product: Composite Panels (HS 76169990) | Construction Materials |
| 9 | Bicycles with Ball Bearings (HS Code: 87120030) | Vehicles |
| 10 | Product: Road Wheels, of Aluminium (HS Code: 8708705050) | Parts and Accessories of the Motor Vehicles of Headings |
| 11 | Mattresses with Spring Interiors (HS Code: 94042910) | Furniture |
| **OTHER PRODUCTS WITH HIGH POTENTIAL** | | |
| **White goods** | | |
| 12 | Automatic Washing Machines (HS Code: 845011) | Home Electronic Appliances |
| 13 | Dishwashing Machines (HS Code: 842211) | Home Electronic Appliances |
| **Cotton** | | |
| 14 | Trousers and Shorts (HS Code: 620462) | Apparel |
| 15 | Bed Linen (HS Code: 630221) | Textile |
| 16 | Footwear (HS 640399) | Footwear |

[5] "MATERIAL" MEANS ANY INGREDIENT, RAW MATERIAL, COMPONENT OR PART, ETC., USED IN THE MANUFACTURE OF THE PRODUCT.

The research methodology, overview of the diagonal cumulation as a system, the identified sectors and value chains, as well as respective materials and products are described in detail in the report.

## METHODOLOGY

To achieve the research goals, PMCG used qualitative and quantitative research methods. Based on the analysis of relevant studies, carried out by governmental and donor organizations, in-depth oral and written group and individual interviews and surveys of representatives of public and private sectors, and analysis of macroeconomic indicators from open sources, econometric analysis using open online tools and an econometric model, PMCG has developed for the purpose of this study.

The study consists of three main components:

I. *Component:* Transferring production of current Turkish export goods to Georgia
II. *Component:* Use of Turkish intermediate raw materials by industries/clusters developed in Georgia.
III. *Component*: Company selection methodology

Under the first component, at the first stage, the research team analyzed the export of Turkish goods manufactured mainly using Turkish raw materials and intermediate products to the EU market and developed the list of potential products that have been selected using a model specifically designed for the present study. The model was based on the following criteria:

- Top exported HS 6-digit level products from Türkiye to the EU in 2016-2020
- Share of these exports (in total imports of similar products to the EU)
- Annual growth of these exports in the EU market (CAGR)
- The EU customs tariff for these products (MFN Average, WTO)
- Revealed comparative advantage of the product (oec.world)

At the second stage, the research team identified the key products from the abovementioned list of selected products using the following criteria (using the internet research method, to the extent available):

- Product origin criteria
- Raw materials needed to manufacture the product
- Important factors for the production of a good, at the level of the industry/value chain and a specific product if relevant information is available.

At the third stage, PMCG identified the existing producers of the mentioned products or related industries in Georgia using the internet research method and carried out the survey and in-depth structured interviews.

As part of the second component of the methodology, at the first stage, the Program and the Ministry of Economy and Sustainable Development of Georgia organized a Trade Advisory Group meeting, facilitated by the Deputy Minister of Economy and Sustainable Development of Georgia. The purpose of the meeting was to inform the private sector about the project and conduct an initial survey on the current state and potential of industrial cooperation with Türkiye. The research team analyzed the information obtained during the meeting and used it for preparing an online survey. At the second

stage, PMCG conducted the online survey of companies - members of the Trade Advisory Group and other enterprises operating in Georgia, that have been identified for the purpose of this study, using an online structured questionnaire.

At the next stage, the research team analyzed the available studies on the production potential of industrial goods in Georgia (USAID, UNIDO, GIZ, etc.) and compared the findings of the desk research with the results obtained under the first component to identify correlations.

Under the third component, the PMCG used its database to select Georgian companies, which was further updated as a result of consultations with the Trade Advisory Group, the Ministry of Economy and Sustainable Development of Georgia, and the USAID Economic Security Program.

To select Turkish companies, the research team mainly used internet research methods, and based on sectoral studies that are available online, studied associations and clusters active in the industrial sector of Türkiye. PMCG compiled the lists of companies based on information about member companies published by these associations and clusters. While selecting the companies, the preference was given to international experience, production potential, women entrepreneurs, and managers.

# DIAGONAL CUMULATION

To ensure that readers can easily understand the results of the study and the principles of diagonal cumulation, the following questions should be answered:

- **What are the rules of origin for goods?**

In international trade in goods, it is important to establish the "economic" origin of goods to determine customs duties and equivalent measures or any other restrictions or obligations related to goods in international trade. A free trade agreement between two or more countries establishes the rules of origin of goods, which determine the regime for the importation of goods: preferential or non-preferential.

- **What do the preferential rules of origin mean?**

Rules of preferential origin defines the criteria that must be met for goods produced in one of the countries, which is a party of the agreement, to receive a preferential treatment when imported into another country. The criteria for preferential origin of goods mainly relate to specific requirements to manufacturing processes. Goods fully originating from the country also receive the preferential treatment.

- **What does cumulation mean?**

Final goods are often produced using raw materials and/or intermediate products from different countries. If the countries have uniform rules of origin and free trade agreements, the final export product combines their origins, which grants this product a preferential status. In the case of cumulation, specific requirements to manufacturing processes do not apply, although the production operations must exceed the minimum operations established by the rules of origin.

There are different types of cumulation: bilateral, diagonal, and full.

- **What is diagonal cumulation?**

Diagonal cumulation operates between more than two countries. Therefore, as Georgia, Türkiye and the EU have established free trade regimes between each other and recognize the same rules of origin for processing non-preferential raw materials, the goods originating in Georgia will receive the benefits of preferential trade when imported into Türkiye or the EU. For example, goods originating in Türkiye and the European Union may be used to produce a final product in Georgia, and this product is considered to originate in Georgia (the agreement applies only to non-agricultural products).

**Georgia ⇆ EU**

⇅ ⇅

**Türkiye**

# BRIEF OVERVIEW OF THE PRODUCTION AND TRADE OF INDUSTRIAL GOODS IN GEORGIA-TÜRKIYE-THE EU

## Türkiye

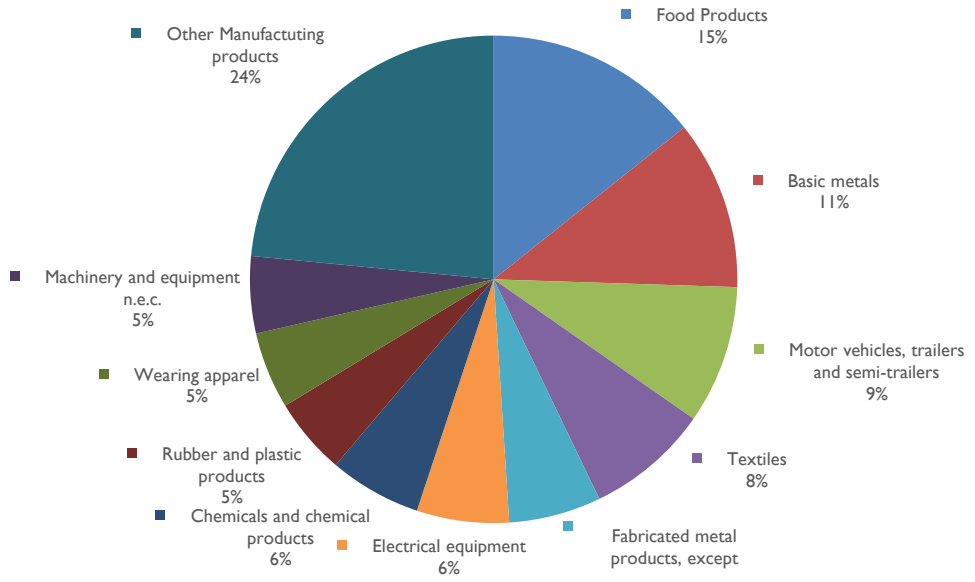
**Production.** Türkiye's industrial output in 2020 amounted to € 358 billion, accounting for 47% of the total economic output, and the value added created by this sector accounted for 39% (€ 81 billion) of the total value added for Türkiye. The industrial sector employed 4.3 million people in 2020, making 27% of the total employment in the country's economy.

In 2016-2020 the average growth of industrial production was 23%. During this period the fastest growth was observed in computer, electronic and optical products manufacturing (30%), paper and paper products manufacturing (29%), chemicals and chemical products manufacturing (29%), basic metals manufacturing (27%), fabricated metal products, machinery and equipment repairing (26%), machinery and equipment manufacturing (25%) and motor vehicle manufacturing (25%).

Food products[6] (14%), basic metals (11%), vehicles (9%), textile (8%), metal products (6%), electronic products (6%), chemicals and chemical products (5%), rubber and plastic products (5%), clothing (5%) and machinery and equipment (5%) account for the largest share in the manufacturing output. The distribution of value added created in the industrial sector is similar across the main product groups produced - the three main products with the largest share are food products (10%), textile (10%) and basic metals (9%).

[6] FOOD PRODUCTS ARE NOT CONSIDERED FOR THE PURPOSES OF THIS STUDY.

**Diagram 1: Manufacturing output in Türkiye in 2020 by product groups**




*Source: Turkstat*

Table 1 lists main products from product groups with the largest share in manufacturing output according to the Economic Activity Classifier, NACE Rev. 2 (the table includes the products of the respective division[7], whose share in this division is 10% or more). Main products with the largest share in manufacturing output include basic iron, steel, and ferro-alloys (share in total manufacturing output – 19%), motor vehicles (17%), outerwear (7%), electric household appliances (7%) and motor vehicle parts and accessories (7%). It should be noted that the average annual increase in the output of the first four products in 2016-2020 exceeds the average growth rate of the sector (23%) and amounts to 28%, 26%, 25% and 24% respectively.

**Table 2: Products with the largest manufacturing output in Türkiye.**

| NACE Rev. 2 | | Value of Product (Thousand EUR) | Share in the Manufacturing | Compound Annual Growth Rate (CAGR) |
|---|---|---|---|---|
| **13 Manufacture of textiles** | | | | |
| 1310 | Preparation and spinning of textile fibers | 6,756,785 | 5% | 23% |
| 1320 | Weaving of textiles | 5,821,908 | 5% | 18% |
| 1330 | Finishing of textiles | 3,684,817 | 3% | 20% |
| 1392 | Manufacture of made-up textile articles, except apparel | 4,056,457 | 3% | 24% |
| 1393 | Manufacture of carpets and rugs | 2,921,101 | 2% | 27% |
| **14 Manufacture of wearing apparel** | | | | |
| 1413 | Manufacture of other outerwear | 8,985,631 | 7% | 20% |
| 1414 | Manufacture of underwear | 6,297,618 | 5% | 18% |
| **20 Manufacture of chemicals and chemical products** | | | | |
| 2013 | Manufacture of other inorganic basic chemicals | 2,377,898 | 2% | 30% |
| 2016 | Manufacture of plastics in primary forms | 4,330,651 | 3% | 29% |
| 2030 | Manufacture of paints, varnishes and similar coatings, printing ink and mastics | 2,642,735 | 2% | 25% |
| **22 Manufacture of rubber and plastic products** | | | | |

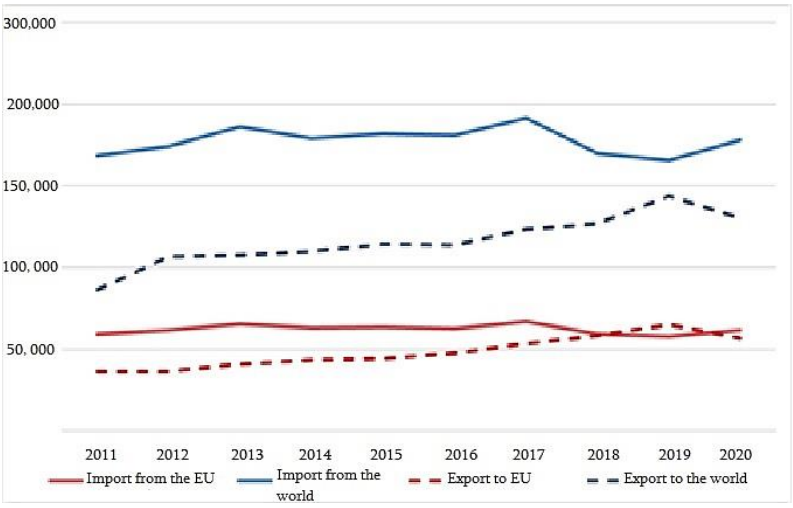
[7] A GROUP WITH A 2-DIGIT CODE.

| | | | | | |
|---|---|---|---|---|---|
| 2211 | Manufacture of rubber tires and tubes; retreading and rebuilding of rubber tires | 1,972,827 | 2% | 26% | |
| 2219 | Manufacture of other rubber products | 2,115,964 | 2% | 21% | |
| 2221 | Manufacture of plastic plates, sheets, tubes, and profiles | 5,728,302 | 5% | 22% | |
| 2222 | Manufacture of plastic packing goods | 4,336,243 | 3% | 26% | |
| 2229 | Manufacture of other plastic products | 4,024,650 | 3% | 27% | |
| **24 Manufacture of basic metals** | | | | | |
| 2410 | Manufacture of basic iron and steel and of ferro-alloys | 24,341,208 | 19% | 28% | |
| 2442 | Aluminium production | 4,592,052 | 4% | 27% | |
| **25 Manufacture of fabricated metal products, except machinery and equipment** | | | | | |
| 2511 | Manufacture of metal structures and parts of structures | 2,954,982 | 2% | 16% | |
| 2562 | Machining | 3,028,468 | 2% | 27% | |
| **27 Manufacture of electrical equipment** | | | | | |
| 2711 | Manufacture of electric motors, generators and transformers | 2,136,601 | 2% | 20% | |
| 2712 | Manufacture of electricity distribution and control apparatus | 2,216,589 | 2% | 21% | |
| 2732 | Manufacture of other electronic and electric wires and cables | 3,338,374 | 3% | 24% | |
| 2751 | Manufacture of electric domestic appliances | 8,349,738 | 7% | 25% | |
| **28 Manufacture of machinery and equipment n.e.c.** | | | | | |
| 2811 | Manufacture of engines and turbines, except aircraft, vehicle and cycle engines | 2,012,972 | 2% | 27% | |
| 2825 | Manufacture of non-domestic cooling and ventilation equipment | 2,556,112 | 2% | 24% | |
| 2830 | Manufacture of agricultural and forestry machinery | 2,333,091 | 2% | 20% | |
| **29 Manufacture of motor vehicles, trailers and semi-trailers** | | | | | |
| 2910 | Manufacture of motor vehicles | 21,271,557 | 17% | 26% | |
| 2932 | Manufacture of other parts and accessories for motor vehicles | 9,286,333 | 7% | 24% | |

*Source: Turkstat*

**Trade.** Türkiye's exports to the world and the EU in 2011-2020 increased with an average annual growth rate of 5%. Until 2017 a slight increase in imports from the world and the EU was observed, however in subsequent years imports declined and, eventually in 2011-2020 the average annual growth rate of imports from the world dropped to 0.6%, and from the EU countries - to 0.5%. It should be noted that in 2020 the opposite trend was observed - slightly increased imports from both the world and the EU, and slightly decreased exports from Türkiye (Diagram 2).

**Diagram 2: Trade of Türkiye with the EU and the world (€ million), 2011-2020.**

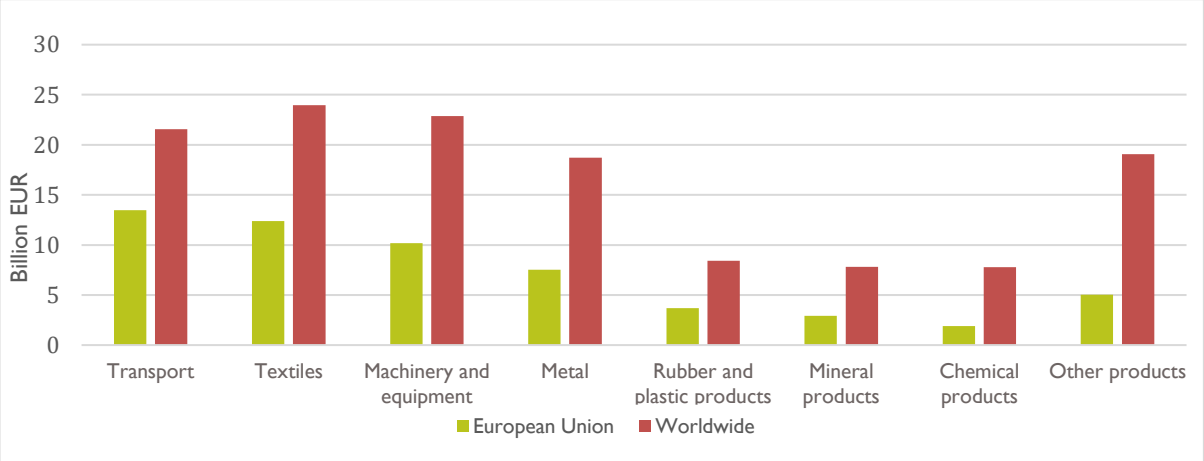



*Source www.trademap.org*

The EU is Türkiye's biggest trade partner (as well as its main source of investments). In 2020, 33.4% of Türkiye's imports came from the EU and 41.3% of the country's exports went to the EU. Türkiye is the EU's 6th biggest trade partner. In 2020, 3.6% (€ 70 billion) of exports of the EU went to Türkiye (with this index Türkiye is between Russia (4.1%) and Japan (2.8%)), and 3.6% (€ 63 billion) of imports of the EU came from Türkiye (with this index, Türkiye is between Russia (5.6%) and Japan (3.2%))[8].

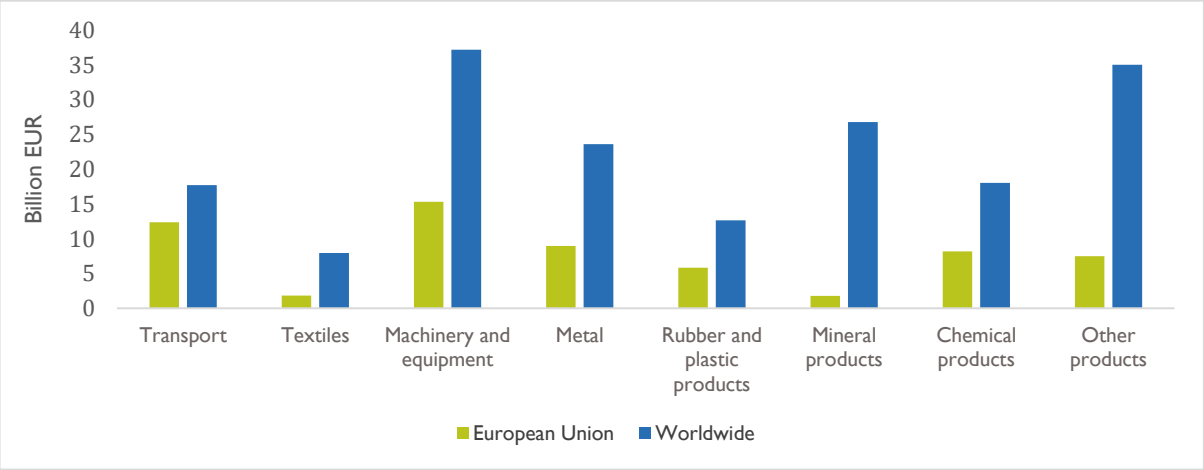
Diagrams 3 and 4 show the main groups of goods that Türkiye trades with the EU and the world. The structure of exports and imports for the largest groups of trade goods is almost similar for the EU and the world - Türkiye's main exports are motor vehicles, textiles, machinery, metals, rubber and plastic products, and main imports – motor vehicles, machinery and equipment, metals, chemical and mineral products. The share of the latter is significantly higher in imports from the world (Diagrams 3 and 4).

**Diagram 3: Imports (€ billion) of industrial goods (HS 25-96) from the EU and the world to Türkiye, 2020.**




*Source: www.trademap.org*

**Diagram 4: Exports (€ billion) of industrial goods (HS 25-96) from Türkiye to the EU and the world, 2020.**



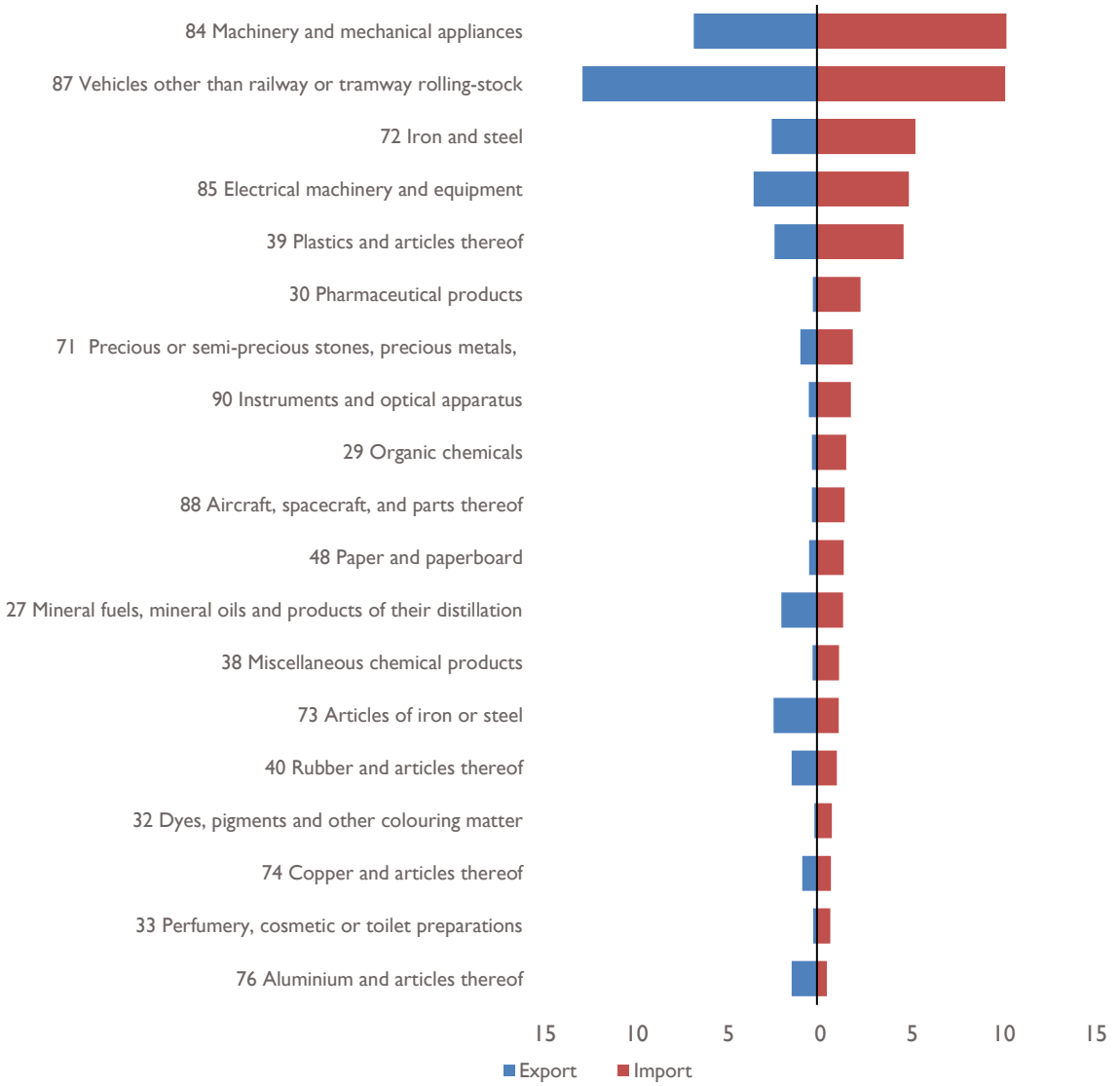

*Source: www.trademap.org*

The top exports of Türkiye to the EU are motor vehicles (the share in exports of industrial goods in the EU 22%), nuclear reactors, steam boilers, machinery and mechanical devices (12%), electrical machinery and appliances (6%), ferrous metals (4.3%), plastics and plastic products (4%), while the top imports from the EU include land transport equipment (16.7%), nuclear reactors, steam boilers,

[8]HTTPS://EC.EUROPA.EU/EUROSTAT/STATISTICS-EXPLAINED/INDEX.PHP?TITLE=TÜRKIYE-EU_-_INTERNATIONAL_TRADE_IN_GOODS_STATISTICS

machinery and mechanical devices (16.6%), ferrous metals (9%), electrical machinery and appliances (8.1%), plastics and plastic products (7.6%).

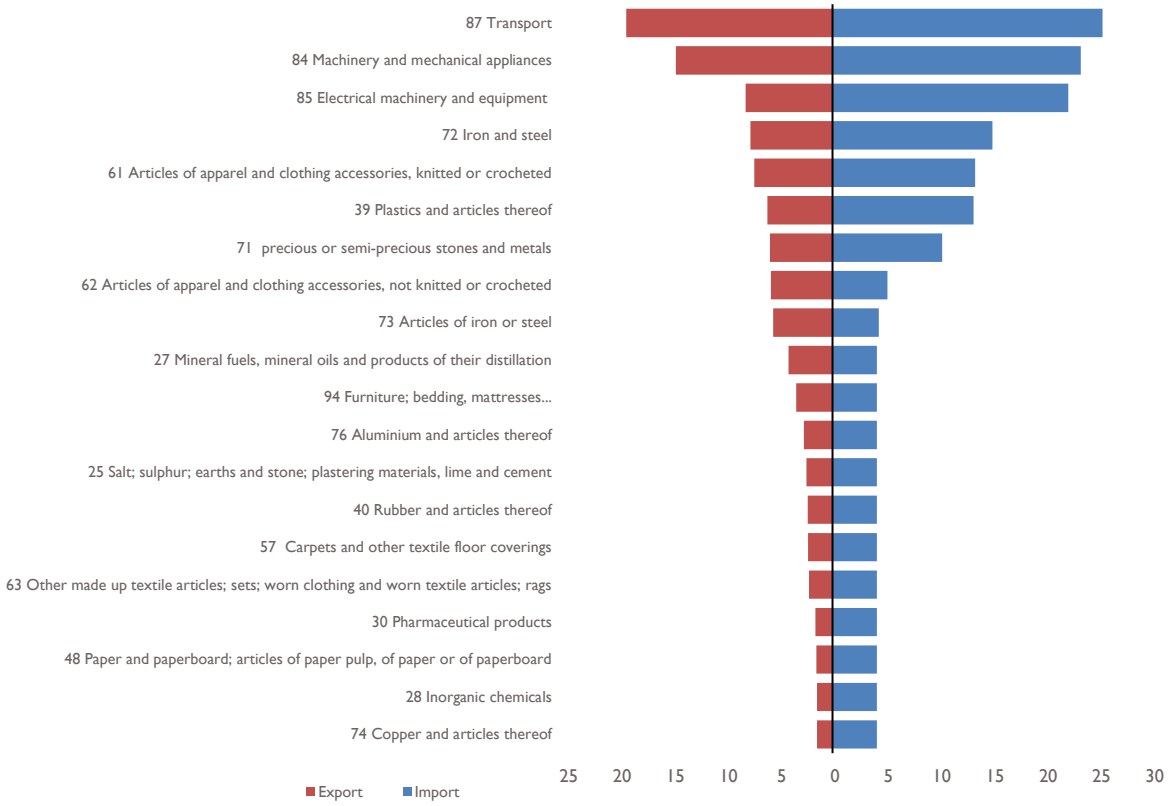
**Diagram 5: The most traded industrial goods between Türkiye and the EU (€ billion), 2020.**




*Source: www.trademap.org*

The structure of top export goods from Türkiye to the world is similar to the structure of top export goods to the EU, however, in this case, knitted wearing apparel is among the top 5 export goods. Among the top 20 export products are furniture, clothing, and other textiles. As for imports from the world to Türkiye, its structures significantly differ from the structure of imports from the EU and includes mainly raw materials and intermediate products. Top imported goods are mineral fuels and oil (the share the imports of industrial goods from the world - 19%), precious and semi-precious stones and metals (28%), machinery and mechanical devices (16%), electrical machinery and appliances (11%), land transport equipment (10%), ferrous metals (9.7%), plastic products (7.6%).

**Diagram 6: The most traded industrial goods between Türkiye and the world (€ billion), 2020.**




*Source: www.trademap.org*

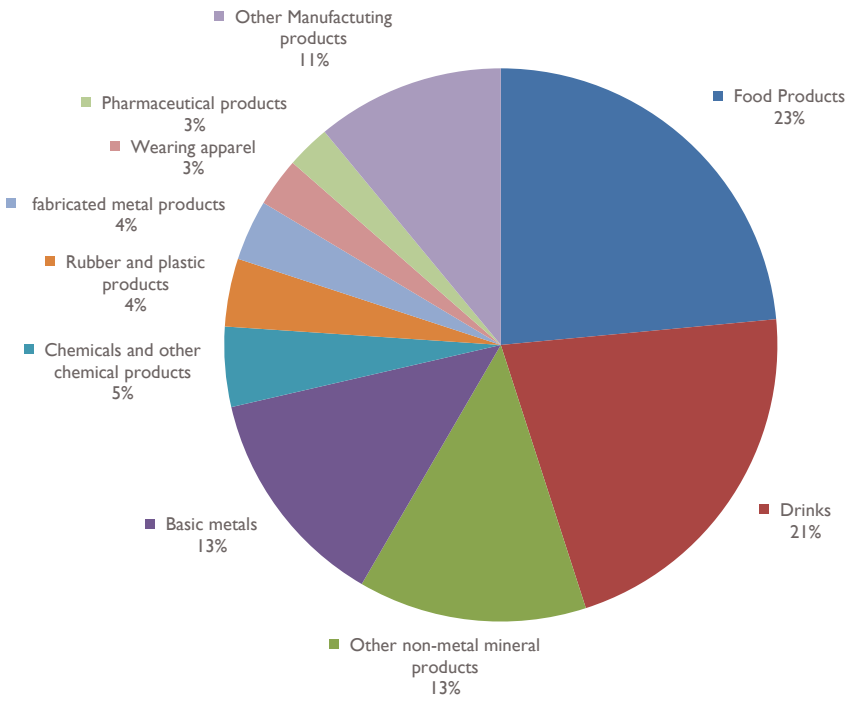
## Georgia

**Production.** Georgia's industrial output in 2020 amounted to € 3 billion, with average annual growth rate of 11% in 2016-2020. During this period the fastest growth was observed in production of electrical appliances (27%), motor vehicles (25%), clothing (24%), machinery and equipment (20%), paper products (17%) and basic metals (17%).

Food products (23%), beverages (21%), other non-metallic mineral products (13%), basic metals (11%), chemicals and chemical products (5%), rubber and plastic products (4%), finished metal products[9](4%), clothing (3%) and pharmaceutical products (3%) account for the largest share in the manufacturing output. The distribution of value added created in the industrial sector is similar across the main product groups produced - the three main products with the largest share are food products (16%), beverages (24%) and other non-metallic mineral products (14%).

[9] EXCEPT FOR VEHICLES.

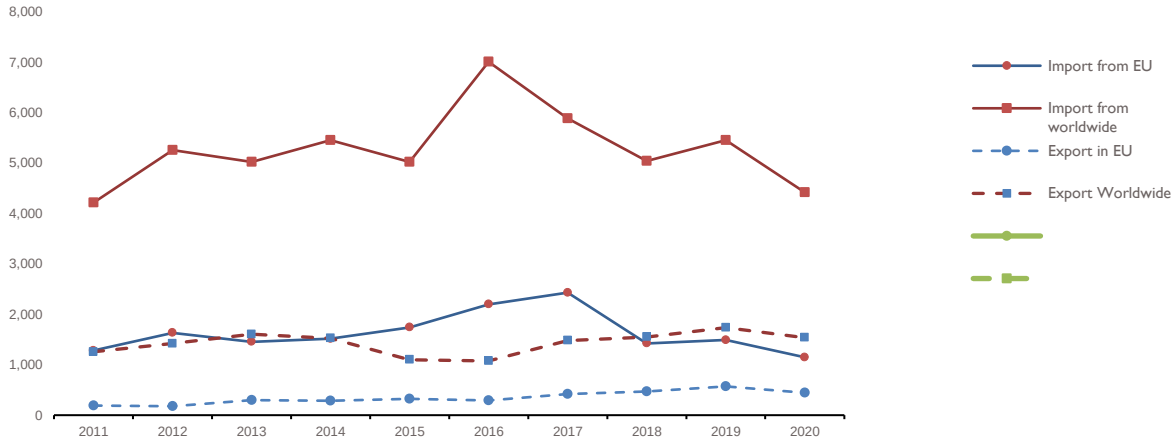
**Diagram 7: Manufacturing output and value added in Georgia in 2020 by product groups.**




*Source: National Statistics Office of Georgia*

**Trade.** Diagram 8 shows the dynamics of Georgia's trade with the European Union, the world and Türkiye in 2011-2020. Georgia's exports to the EU and the world have been growing since 2016, however, they show a slight decrease in 2020. The value of imports from the world and the EU peaked in 2016 and 2017, respectively, and is characterized by a downward trend in subsequent years. Imports from Türkiye to Georgia have been growing since 2011, however, in 2020 they decreased as compared to the previous year. Exports from Georgia to Türkiye have been slightly growing since 2012, however in 2020 they decreased, like other trade flows.

**Diagram 8: Trade (€ million) of Georgia with the EU, the world and Türkiye, 2011-2020.**




*Source: www.trademap.org*

Diagrams 9 and 10 show the main groups of goods that Georgia trades with the EU, the world and Türkiye. Top goods imported from the EU and the world in 2020 include mineral products, basic metals, chemicals, and chemical products, while the three largest groups of products imported from Turley are chemicals and chemical products, precious stones and metals and mineral products.

**Diagram 9: Imports (€ million) of industrial goods (HS 25-96) from the EU, the world and Türkiye to Georgia, 2020.**

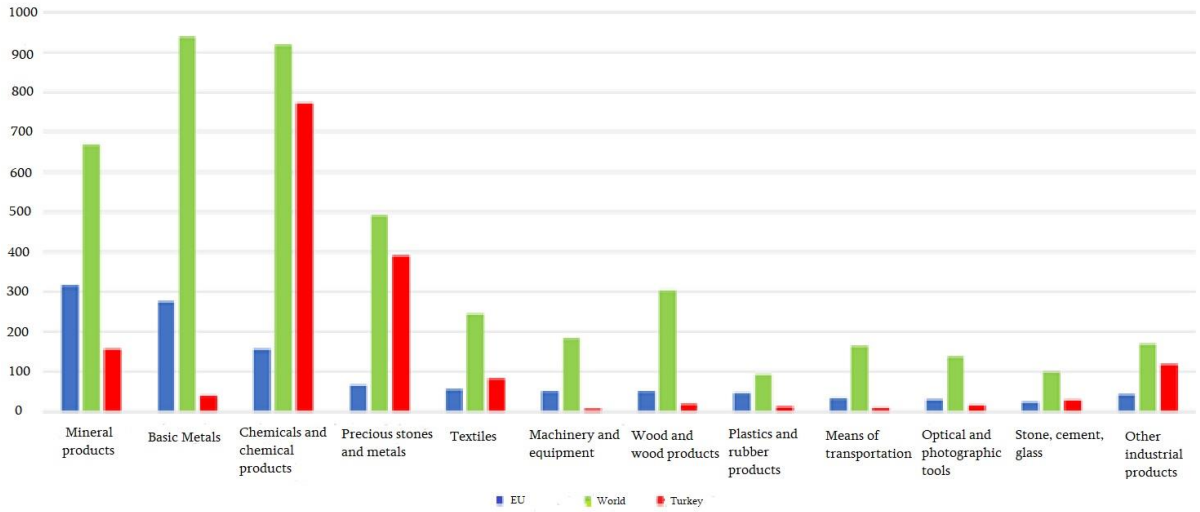
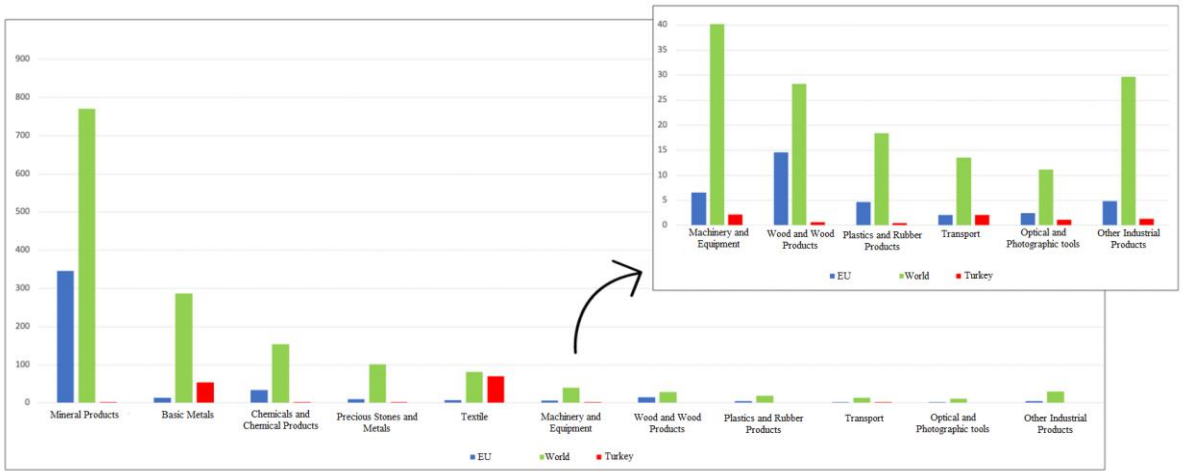



**Diagram 10: Exports (€ million) of industrial goods (HS 25-96) from the EU, the world and Türkiye to Georgia, 2020.**

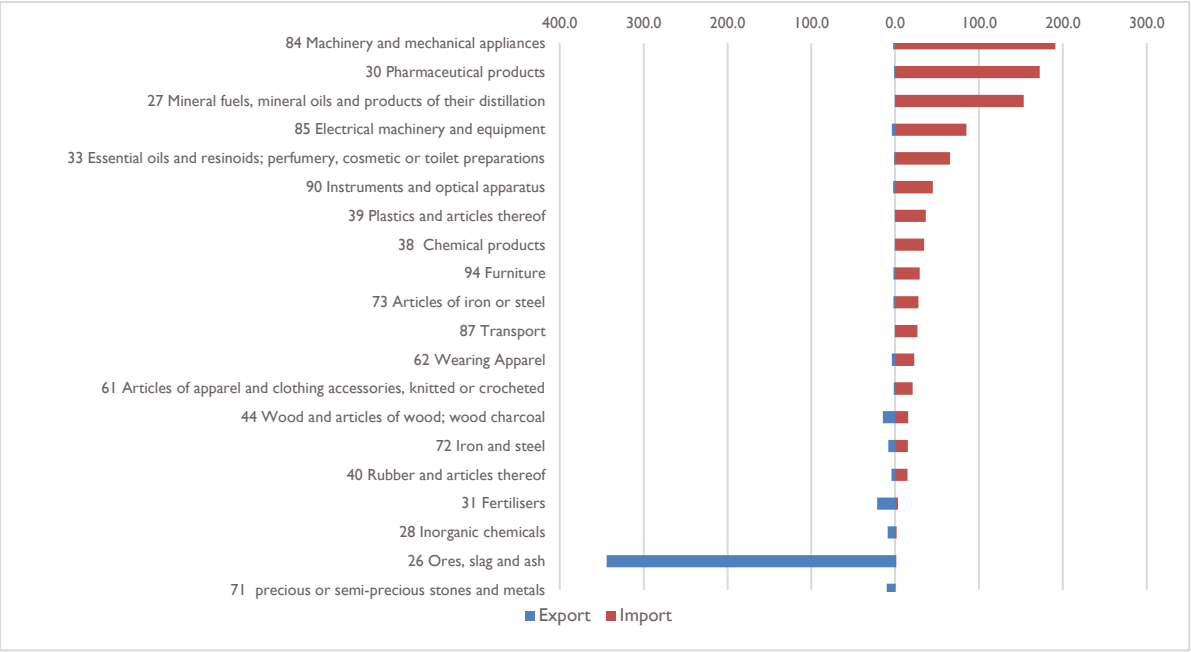



*Source: www.trademap.org*

The structure of export goods from Georgia to the EU and the world are similar, while main groups of products exported from Georgia to Türkiye in 2020 are textiles, basic metals and mineral products.

Top industrial goods exported from Georgia to the EU include ores, slag and ash, fertilizers, timber and wood products, natural and precious stones and metals, ferrous metals and inorganic substances, while main products imported from the EU to Georgia are machinery and mechanical devices, pharmaceutical products, mineral fuels, oil and their products, electrical machinery and appliances.

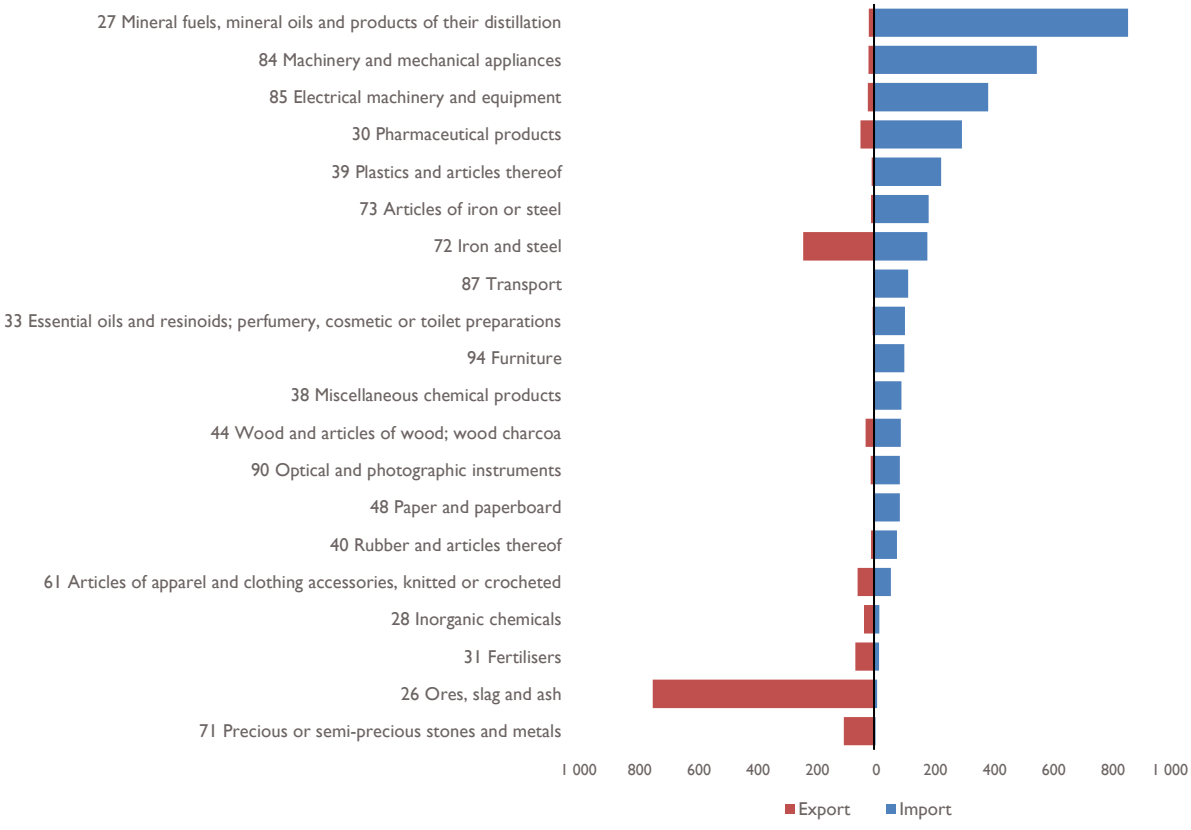
**Diagram 11: The most traded industrial goods between Georgia and the EU (€ million), 2020.**




*Source: www.trademap.org*

Top industrial goods exported from Georgia to the world include ores, slag and ash, ferrous metals, natural and precious stones and metals, fertilizers, knitted wearing apparel and pharmaceutical products, while the largest contributors in imports to Georgia in 2020 were mineral fuels and oil, machinery and mechanical devices, electrical machinery, pharmaceutical products, plastics, iron items and ferrous metals.

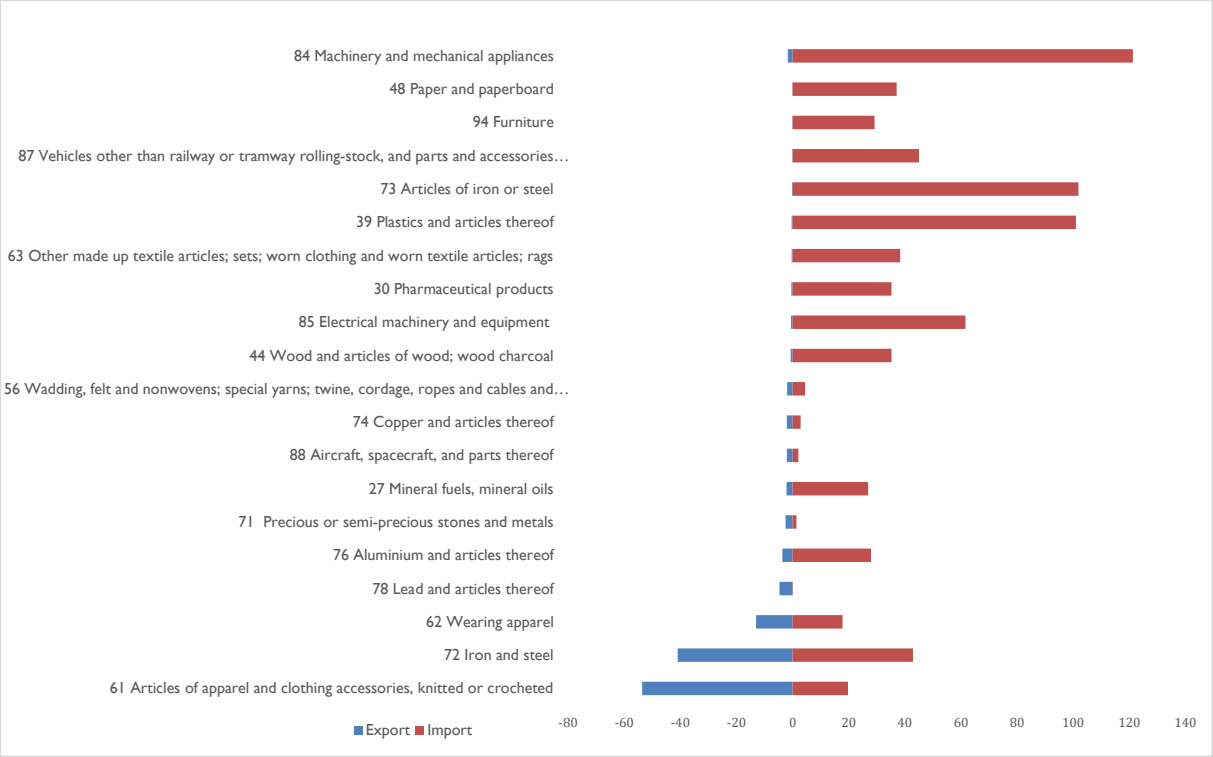
**Diagram 12: The most traded industrial goods between Georgia and the world (€ million), 2020.**




*Source: www.trademap.org*

The list of products exported from Georgia to Türkiye differs from the list of goods exported to the EU and the world. Top three exported goods include knitted wearing apparel and clothing made of materials other than knitwear (as well as ferrous metals). Most of the products imported from Türkiye are machinery and mechanical devices, iron and steel products, plastics and plastic products, electrical machinery and appliances, other textile products, timber, and wood products.

**Diagram 13: The most traded industrial goods between Georgia and Türkiye (€ million), 2020.**




*Source: www.trademap.org*

# POTENTIAL EXAMPLES OF PRODUCTION DEVELOPMENT OF EXPORT PRODUCTS THROUGH DIAGONAL CUMULATION IN GEORGIA

## 1. VALUE CHAIN OVERVIEW: PLASTIC

Türkiye is the second largest plastic producer in Europe and the seventh largest producer in the world[10]. The raw materials used for plastic products are polyethylene (PE), polypropylene (PP) and polyvinyl chloride (PVC). The levels of domestic consumption of these raw materials are given in Table 1.1. The table reveals a high level of dependency on raw materials imports. Import dependency creates the following problems in terms of competitive pricing: fluctuation of exchange rates makes pricing difficult and can lead to losses in sales.

It is expected that this dependence on imports may be reduced by a new petrochemicals investment in the Ceyhan Mega Petrochemistry Industry Zone located in Adana's province[11]. The petrochemical facility is planned to have 450 tonnes of polypropylene production capacity and will decrease the country's dependency on imports of polypropylene. The completion of the facility is expected by 2023[12].

**Table 1.1: Turkish Domestic Consumption of Plastics Raw Materials.**

| Year | Production (tonnes) | Imports (tonnes) | Exports (tonnes) | Domestic Consumption (tonnes) | Net Generation / Domestic Consumption | Import / Domestic Consumption |
|---|---|---|---|---|---|---|
| 2014 | 545.511 | 4.289.520 | 127.423 | 4.707.608 | 9% | 91% |
| 2015 | 629.000 | 4.375.000 | 94.444 | 4.909.556 | 11% | 89% |
| 2016 | 651.200 | 4.489.027 | 71.908 | 5.068.319 | 11% | 89% |
| 2017 | 646.000 | 4.810.000 | 163.000 | 5.293.000 | 9% | 91% |
| 2018 | 678.000 | 4.958.000 | 74.836 | 5.561.164 | 11% | 89% |

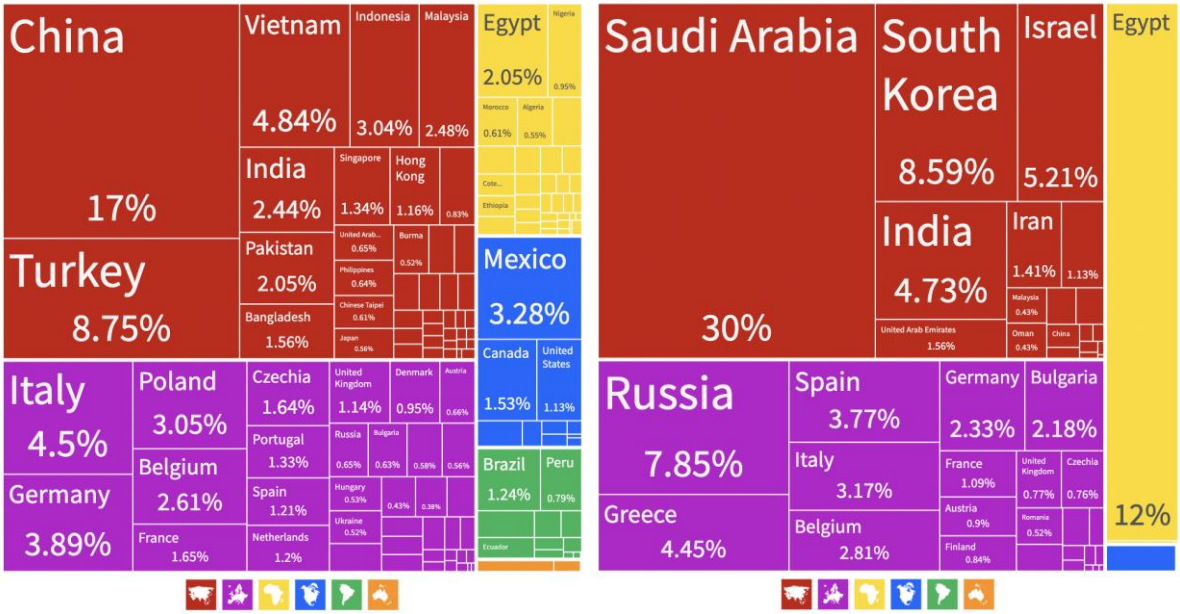
*Source: Sectoral Roadmaps: Plastic Sector in Türkiye, 2020. UNDP*

Polypropylene is the most common material for three products analyzed below. Nowadays, Türkiye is the second biggest importer of polypropylene in primary forms[13] (HS 390210) accounting to 8,75% of worlds import in 2020 (Figure 1.1, left). Türkiye imports polypropylene in primary (PP) forms mostly

[10] THE PLASTICS SECTOR SUPPLIES PRODUCTS TO SECTORS SUCH AS AUTOMOTIVE, AGRICULTURE, DOMESTIC APPLIANCES, ELECTRONICS, TEXTILES AND CONSTRUCTION.
[11] IBID.
[12] HTTPS://WWW.AA.COM.TR/EN/ENERGY/INVESMENTS/-12B-INVESTMENT-FOR-POLYPROPYLENE-FACILITY-IN-TÜRKIYE/22517
[13] POLYPROPYLENE IS USED IN EVERYTHING FROM FIBERS AND PACKAGING MATERIALS TO PACKAGING AND PLASTIC CONTAINERS.

from Saudi Arabia, Egypt, South Korea, Israel and India, accounting to 30%, 12%, 8.59%, 5.21% and 4.73%, of total PP import to Türkiye[14] (Figure 1.1, right).

**Figure 1.1: Importers of polypropylene in primary forms - HS 390210 (left) and exporter of polypropylene in primary forms to Türkiye (right), 2020.**




*Source: www.oec.world*

Polypropylene was ranked 8th in Türkiye's most imported products in 2020 with the value of 1,8 bln Euros. PP import value has decreased by 7% in 2020 compared to a previous year; however, on average it has increased by 3% annually from 2016 to 2020[15].

## PRODUCT: NONWOVEN SINGLE-USE SURGICAL GOWNS

**HS Code:** 62101092 - Garments of fabrics of heading 5603 (Nonwovens), Single-use gowns, of a kind used by patients or surgeons during surgical procedures

**EU MFN Tariff:** 12%

**Rules of Origin:**

Manufacture from yarn or Manufacture from uncoated fabric, provided that the value of the uncoated fabric used does not exceed 40 % of the ex-works price of the product.

Gowns are examples of personal protective equipment used in health care settings. They are used to protect the wearers from the spread of infection or illness if they come into contact with potentially infectious liquid and solid material. They may also be used to help prevent the gown wearer from transferring microorganisms which could harm vulnerable patients, such as

[14] WWW.OEC.WORLD
[15] WWW.TRADEMAPS.ORG

those with weakened immune systems. Gowns are made from technical textile and nonwovens, intermediate products made from plastics.

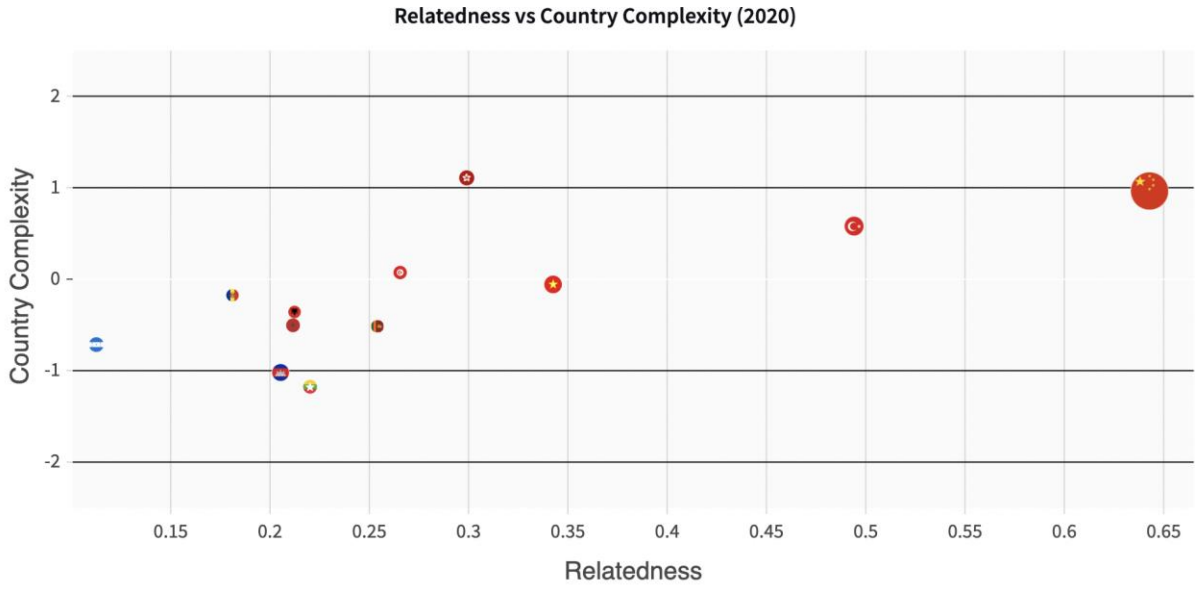
## Trade Statistics:

| | |
|---|---|
| TR Exports CAGR (2016-2019[16]): | 10% |
| TR Exports Share in EU Imports in 2020: | 12% |
| TR Exports in 2020 (HS 62101092): | €290,962,758 |
| GE Exports to EU27 in 2020: | €0 (€40,000 to the world) |
| World Exports in 2020: | €13,265,998,000 |

## Revealed Comparative Advantage (RCA) & Product Complexity[17]:

Relatedness vs Country Complexity for **HS 621010**

**RCA > 1**




*Source: https://oec.world/*

### *Production: Major materials used in production*

Single-use gowns are typically constructed of nonwoven materials or in combination with materials that offer increased protection from liquid penetration. They can be produced using a variety of nonwoven fibre-bonding technologies (thermal, chemical, or mechanical) to provide integrity and strength. The basic raw materials typically used for disposable isolation gowns are various forms of synthetic fibres such as polypropylene and polyethylene. The most common materials in single-use isolation gowns are Polypropylene Spunbond and Polypropylene Spunbond-Meltblown-Spunbond

[16] EXPORT OF HS 621010 HAS INCREASED BY UP TO 300 TIMES FROM 1.7 MLN EURO IN 2019 TO 514 MLN EURO IN 2020 AS A RESULT OF INCREASE THE DEMAND ON PERSONAL PROTECTIVE GARMENTS DURING THE PANDEMIC.
[17] THE COMPLEXITY-RELATEDNESS DIAGRAM COMPARES THE RISK AND THE STRATEGIC VALUE OF A PRODUCT'S POTENTIAL EXPORT OPPORTUNITIES. RELATEDNESS IS PREDICTIVE OF THE PROBABILITY THAT A COUNTRY INCREASES ITS EXPORTS IN A PRODUCT. COMPLEXITY IS ASSOCIATED WITH HIGHER LEVELS OF INCOME, ECONOMIC GROWTH POTENTIAL, LOWER INCOME INEQUALITY, AND LOWER EMISSIONS.

(SMS), which are 3 layers of non-woven fabrics, are the most common materials in single-use isolation gowns[18].

Manufacturers of nonwoven products, in general, rely on high volume production, which is highly engineered, and, because of competitive pressures, there is a constant need to innovate to ensure high quality, in-specification products are produced at the minimum cost. The industry is driven by technology developments in machinery, process control and materials and, to have a sustainable future, nonwovens enterprises need to be at the forefront of these developments.

Nonwoven fabrics are broadly defined as web structures bonded together by entangling fibres mechanically, thermally fusing the fibres or chemically bonding the fibres. Nonwovens are defined more exactly by various bodies one of the most often quoted is the International Nonwovens & Disposables Association (INDA) definition: Nonwovens are a sheet, web, or bat of natural and/or man-made fibres or filaments, excluding paper, that have not been converted into yarns, and that are bonded to each other by any of several means.

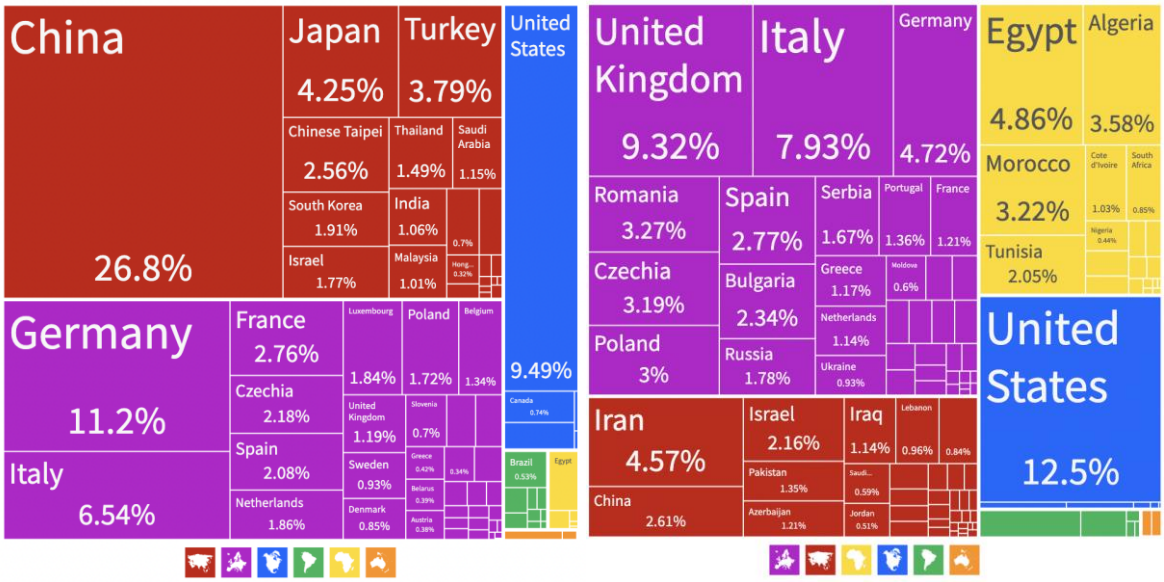
Nonwovens are not made by weaving or knitting and do not require converting the fibres to yarn. Nonwoven fabrics are engineered fabrics that may be single-use disposable or a very durable fabric. They are used in numerous applications, including single-use gowns and surgical drapes, baby diapers, adult incontinence products, wet wipes, liquid cartridge and bag filters, face masks, air-conditioning filters, soil stabilizers and roadway underlayment, erosion control, drainage systems, insulation (fiberglass batting), pillows, cushions, and upholstery padding, carpet backing, automotive headliners and upholstery, house wraps, and disposable clothing (foot coverings, coveralls).[19]

There are over 150 companies in Türkiye manufacturing technical textiles and nonwovens, of which more than 20 large companies produce nonwoven roll goods. Istanbul, Bursa, Gaziantep, Kocaeli and Tekirdağ are the major cities in the production of technical textiles and nonwovens[20].

Despite rapid growth and the requirements in the automotive, construction, filtration, agriculture and chemical industries have stimulated demand for technical textiles and nonwovens, Türkiye still remains as one of the biggest exporter (3.79% of total world import of HS 5603 in 2020) of nonwoven materials (HS 5603: Nonwovens, whether or not impregnated, coated, covered or laminated). The biggest share of Türkiye's nonwovens export goes to Europe[21] (Figure 1.2, right).

[18] HTTPS://MUNGLOBAL.COM.AU/RESOURCES/KNOWLEDGE-BASE/PERSONAL-PROTECTIVE-EQUIPMENT/MEDICAL-GOWN-MATERIALS/
[19] HTTPS://WWW.TECHNICALTEXTILE.NET/ARTICLES/NONWOVEN-MANUFACTURING-7188
[20] HTTPS://BLOG.BIZVIBE.COM/BLOG/TEXTILES-AND-GARMENTS/TÜRKIYE-TECHNICAL-TEXTILE-NONWOVEN
[21] WWW.OEC.WORLD

**Figure 1.2: Exporters of nonwovens – HS 5603 (right) and importers of Turkish nonwovens (left), 2020.**

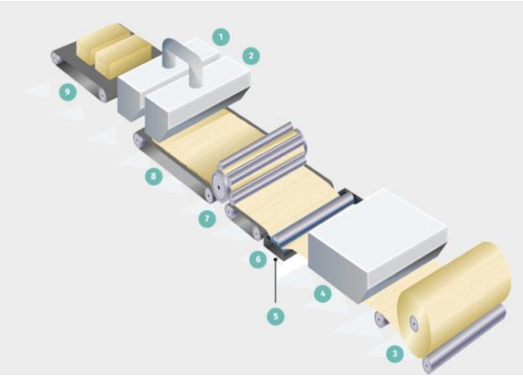



*Source: www.oec.world*

There is a suitable infrastructure for technical textiles and nonwovens which is growing and developing in terms of technology, human resources, and know-how in Türkiye. The technical textile industry in Türkiye has the benefit of a well-established textile infrastructure, strong textile educational and research institutions, a skilled workforce, the availability of raw materials and a large domestic market. The Scientific & Technological Research Council of Türkiye (TUBiTAK) and its subsidiary organizations, the Marmara Research Center (MAM) and the Bursa Test and Analysis laboratory (BUTAL) provide technical, testing, and scientific assistance to the sector. TUBiTAK provides research and development aid to support the companies which are conducting R&D projects, regardless of the size of the company. In addition, a National Nano-technology Center has started operating at Silkent University, Ankara[22].

## *The Manufacturing Process*

### Nonwoven fabric roll-good production



Surgical gown or other finished goods, wet-wipe for instance, is seldom produced by the nonwoven fabric roll-goods producer. The roll-goods producer will make the basic material (roll-goods) fabric (see photo below) for the surgical gown or the wet-wipe and then send it to a converter who is more focused on making the final product attractable to the audience, be it in terms of number of pieces in the pack, the brand of the pack, or the smell of the wet-wipe, etc.

The process of manufacturing non-woven fabrics involves the following stages: forming the fibrous web; entangling or bonding the fibers in the web to impart mechanical integrity to the structure of the product; and finishing the fabric to obtain the special properties required for the PPE to be produced.

[22] HTTPS://TECHNICALTEXTILE.NET/ARTICLES/TECHNICAL-TEXTILES-AND-NONWOVENS-INDUSTRY-IN-TÜRKIYE-3818

**Converting**

Nonwoven manufacturing ends usually with large rolls of product. After the fabric has been finished, it is cut into the desired size for the final product – a process known as converting. The machines used in the production of gowns are:

- single-needle lockstitch machines
- three-thread overlock machines
- hot air seam sealing machines and straight knife cutting machines.

There are also fully automatic gown machines on the market.

## *Technology, Certification & Quality Control*

The manufacturing quality control system should encompass the whole of the manufacturing process from the input of the raw or semi-finished materials to the manufacturing itself and the packaging of the finished product. All the processes that form part of this manufacturing lifecycle need to be empowered, managed, and monitored in such a way as to achieve a robust manufacturing process and ensure the quality of the product. There are number of international standards for management systems which manufacturers may adopt with a view to ensuring the quality of their manufacturing processes and products. The most widely used and accepted international standards are listed below:

- ISO 9001:2015 Quality Management Systems
- ISO 14001:2015 Environmental Management Systems
- ISO 45001:2018 Occupational Health and Safety Management Systems
- ISO 26000:2010 Guidance on Social Responsibility
- ISO 13485:2016 Medical Devices — Quality Management Systems — Requirements for Regulatory Purposes GMP Good Manufacturing Practices

WHO standards for surgical gowns (including single-use):

- AAMI PB70 and ASTM F2407
- EN 13795
- EN 13034 - Type PB [6] (stitched gown), with minimum hydrostatic head of 50 cm H2O
- YY/T 0506 or alternative equivalent set of standards
- EN 556, if sterile or alternative equivalent set of standards

## *Capital requirements*

IFC has created a cost calculator for manufacturers to determine capital expenditure (CapEx), working capital, and revenue & EBIT (Earnings before interest & tax) for a PPE production line. According to IFC's calculation manufacturing of 200.000 pieces of surgical gowns per month requires production line with 100 sewing machines, 2 spreading machines, 1 automatic cutters and 304 operators. Total cost of setting up a factory with this capacity would be 910,000 USD. Detailed calculations are provided to the following link:
https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/manufacturing/priorities/ppe+production

A report by Istanbul International Center for Private Sector in Development program (UNDP) provides a Turkish example of PPE manufacturing costing based on the IFC's template: https://www.ushas.com.tr/wp-content/uploads/2021/01/USHAS_GuidelineReport.pdf

### *Direct manufacturing costs*

**Labor** - Although full automation is theoretically possible, in the primary proportion of PPE manufacturing lines, manual labor is still required as most available machines are unable to complete all aspects of production. This makes manufacturing of PPE a labor-intensive exercise, which offers opportunities for SMEs in lower-cost markets to have a competitive advantage. The manufacturing processes for each category of PPE product will be explained below[23].

**Energy -** Electricity is a major input to a disposable surgical gown manufacturing factory.

**Logistics -** Suitable for both land and marine transportation.

## Useful links:

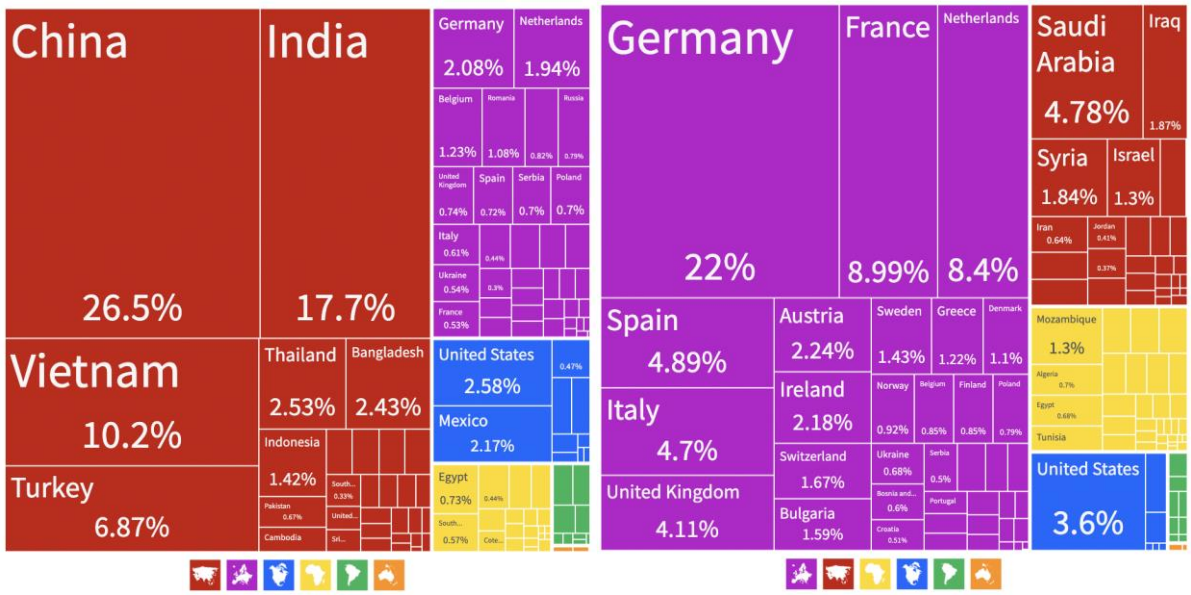
- FDA on surgical gowns: https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/medical-gowns#g5
- How nonwovens are made? https://www.edana.org/nw-related-industry/how-are-nonwovens-made
- US Food and Drug Administration: Medical Gowns - https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/medical-gowns#:~:text=A%20surgical%20gown%20is%20a,body%20fluids%2C%20
- Thomasnet: How to Make Protective Gowns for COVID-19 https://www.thomasnet.com/articles/other/how-to-makeprotective-gowns-for-coronavirus-covid-19/
- Points to consider when launching production of PPE by IFC: https://www.ifc.org/wps/wcm/connect/cdb117e4-6de2-4946-9a1f-79db16766bbf/Steps+in+starting+PPE+manufacturing.pdf?MOD=AJPERES&CVID=n7L.VCw

[23] HTTPS://WWW.USHAS.COM.TR/WP-CONTENT/UPLOADS/2021/01/USHAS_GUIDELINEREPORT.PDF

## PRODUCT GROUP: PP WOVEN PACKING BAGS

Woven packing bags (HS 6305) are the world's 471st most traded product. In 2020, the top exporters of packing bags were China ($1.32B), India ($885M), Vietnam ($520M), Türkiye ($345M), and United States ($139M). Europe is the largest importer of packing bags from Türkiye with Germany dominating by 22% of total packing bags imports, followed by France (8.99%), Netherlands (8.4%)[1].

**Figure 1.3: Exporters of packing bags – HS 6305 (left) and importers of packing bags from Türkiye (right) in 2020.**




*Source: https://oec.world/*

## PRODUCT: FLEXIBLE INTERMEDIATE BULK CONTAINERS

**HS Code:** 63053219 - Flexible intermediate bulk containers of polyethylene or polypropylene strip or the like, Other.

**EU MFN Tariff:** 7.2%

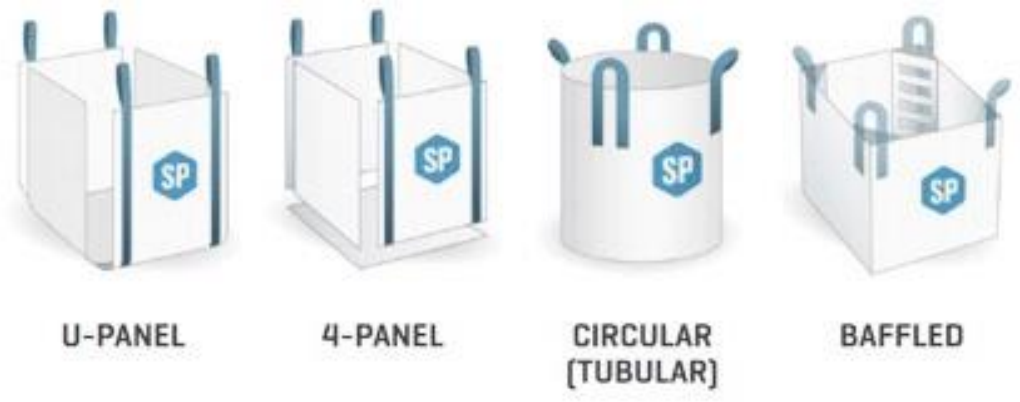
### Rules of Origin:

Manufacture from materials of any heading, except that of the product, and in which the value of all the materials used does not exceed 40 % of the ex-works price of the product; Or Manufacture in which the value of all the materials used does not exceed 30 % of the ex-works price of the product.

### Trade Statistics:

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 3% |
| TR Exports Share in EU Imports in 2020: | 17% |
| TR Exports in 2020: | € 147,429,282 |
| GE Exports to EU27 in 2020: | € 1,688,000 (€1,752,000 to the world) |
| World Exports in 2020: | € 2,041,384,000 |

Flexible intermediate bulk containers (FIBCs) are made of flexible woven material typically polypropylene (PP) and possess the capacity to hold 500 kg to 2,000 kg of weight. They are commonly used to store dry and flowable products such as grains, seeds, salts, chemicals, sands, clays, cement, and others. FIBC majorly finds application in various end-use industries including food, chemical, pharmaceutical, building & construction, mining, and others.




Countries in North America and Europe are the largest consumers of FIBC. Key product manufacturing countries are China, Türkiye, and India. The global market players for flexible intermediate bulk containers majorly compete on the basis of price per unit[2].

The FIBC market is highly fragmented with the presence of a large number of players across the regions that compete primarily on the basis of pricing. The global FIBC market size is projected to reach USD 6.4 billion by 2026, progressing at a CAGR of 5.9% over the forecast period, according to a new report by Grand View Research, Inc. Growing food and pharmaceutical industries across the world and increasing need to reduce overall weight of bulk packaging are among the key factors driving the demand for flexible intermediate bulk containers.

The demand for flexible intermediate bulk containers in developed countries including the U.S., Japan, Germany, France, and others, is mainly driven by rising pharmaceutical industry owing to increasing aging population. In emerging countries, the demand for FIBCs is majorly driven by rising food processing and agricultural industries. Steady growth rate of chemical industry and significant growth rate of pharmaceutical industry across the world are also expected to positively impact the global demand for flexible intermediate bulk containers.

## PRODUCT: PACKING BAGS AND SACKS

**HS Code:** 63053390 - Packing bags and sacks, other, of polyethylene or polypropylene strip or the like:

**EU MFN Tariff:** 7.2%

**Rules of Origin:**

Manufacture from materials of any heading, except that of the product, and in which the value of all the materials used does not exceed 40 % of the ex-works price of the product Or Manufacture in which the value of all the materials used does not exceed 30 % of the ex-works price of the product

## Trade Statistics (for HS 630533)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 7% |
| TR Exports Share in EU Imports in 2020: | 20% |
| TR Exports in 2020: | € 147,429,282 |
| GE Exports to EU27 in 2020: | € 45,000 (€493,000 to the world) |
| World Exports in 2020: | € 1,697,149,000 |

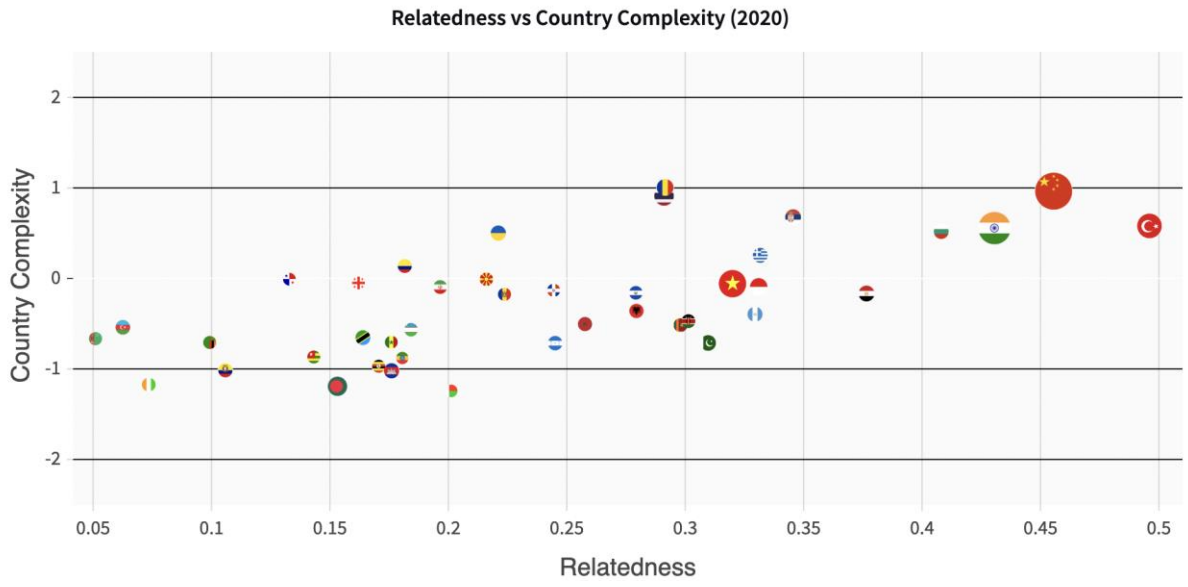
PP woven bags and sacks are largely used in storing and transporting agricultural products such as aquatic products, feeds, fruits, vegetables, etc. PP woven bags are increasingly used to pack food. Common food woven bags include rice PP woven bags, flour PP woven bags, maize woven bags, etc.


Turkish Packaging Manufacturers Association brings together packaging manufacturers (including manufacturers of FIBCs and polypropylene sacks) in Türkiye was established in 1992. The association services include participation in local and foreign fairs, training and e-learning, industry publication and other networking activities.

## Revealed Comparative Advantage (RCA) & Product Complexity:

Relatedness vs Country Complexity for **HS 6305**

**RCA > 1**




*Source: https://oec.world/*

## *Production: Major materials used in production*

Woven fabrics obtained from strip or the like HS Code 540720

HS Code 3926909790
https://trade.ec.europa.eu/access-to-markets/en/results?product=3926909790&origin=TR&destination=DE

Virgin polypropylene and polyethylene are used for making woven fabric for FIBCs and sacks and bags for packing goods.

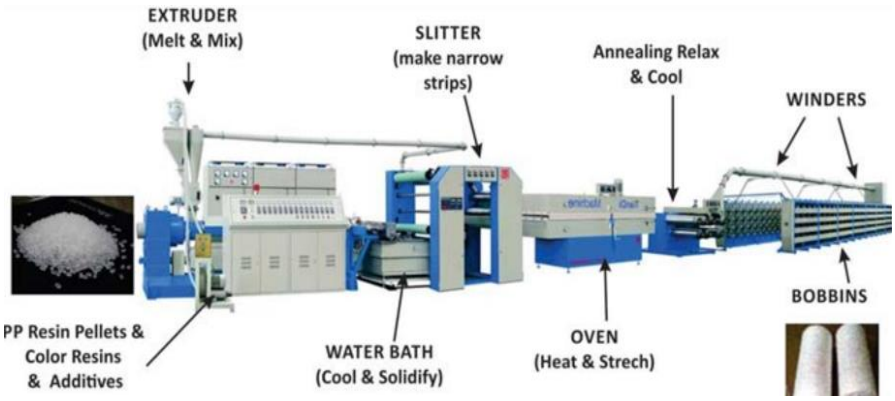
Certain FIBCs also include an inner lining made of low-density polyethylene for added moisture resistance (LDPE). Furthermore, polyethylene contributes to ensuring that no moisture from the air enters through the material and absorbs the contents Polypropylene fabric is a generic term that refers to any textile material made from the thermoplastic polymer polypropylene. It is possible to transform polypropylene, or Olefin into a textile that is suitable for upholstery and performance materials.

## *The Manufacturing Process*

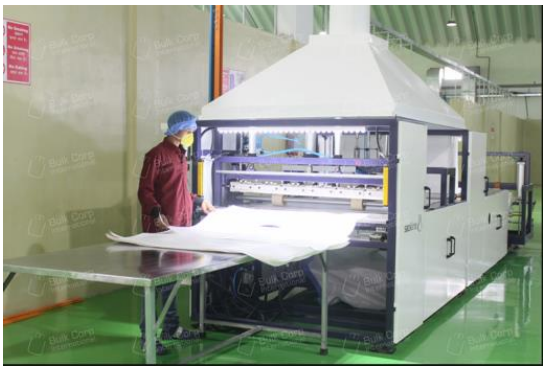
The manufacturing process of PP woven packing bags consists of 10 key stages.

**Extrusion** - The initial stage is extrusion, which melts a mixture of virgin components and forms tapes of specific measures. This procedure utilizes polypropylene (PP) granules, a trace amount of calcium carbonate, UV inhibitors, and maybe color pigments. The assessment of the durability of the tapes is pretty necessary at this point. Then, during the preparation for the weaving step, it is necessary to load the tapes onto industrial bobbins.

**Weaving** - On weaving looms are loaded the tapes made by PP granules. In this case, the polypropylene fabric that makes up the body is woven into shape for a bulk bag. The material is sufficiently sturdy to convey a wide range of industrial goods and consumables. It is "breathable," though, and hence vulnerable to moisture transition. The woven PP material is also utilized for loading and unloading components and the material for bulk bags.




**Moisture** – proofing (optional)- By coating the fabric with a special lamination, it is possible to make each bag humidity resistant. But this totally depends on the customer's demands. Lamination is the technique that is perfect for the humidity resistance of bulk bags. Moreover, moisture proofing is essential for bulk bags that carry granular items and for any product that should not be exposed to humidity. The un-laminated material of polypropylene comprises small strands with microscopic pores in each fabric. The material is essentially breathable. The transport and storage of diverse materials can be acceptable quality, however not suitable for selected products. For example, sugar and salt, including water absorbed in the air, should never be exposed to water. However, laminated bulk bags help transport light powdered materials such as flour that would normally sieve through the weaving gaps of the polypropylene fabric when moved or shaken. The loss could be significant during a large-scale flour transport. Flour is kept contained in laminate-coated bulk bags until it reaches its destination.



**Cutting** - Firstly, the polypropylene fabric is placed into a slicing machine and cut into precise shapes. The dimensions are determined by whether the process produces sides, edges, or bottoms. Automatic measuring assures exact lengths for each cut. Whether the bulk bag line is square, tubular, or vertically rectangular, the necessary cuts are made at this phase.


**Printing** - After cutting the polypropylene fabric into shape, it is passed into a printing machine. Imprints are made on the fabric here. Printing happens at this phase if a corporation wishes to apply the brand name or logo to a line of bags. Depending on the brand, a variety of colors may be used. A heavy-duty printer is required for this method to produce the best impressions possible.

**Webbing** - This stage involves the production of the bulk bag's handle sections. Moreover, this procedure consists of twisting thicker polypropylene fabric tapes into webbing material. Then, strips of this material are precisely trimmed to fit the dimensions of the bags being made. These strips serve as the bag's handles or lifting loops. On most bulk bags, the webbing strip runs around all four sides, with handle loops over each end.


**Sewing** – A team of experienced individuals sews together massive numbers of bulk bags under the cautious eye of technical supervisors. This unit is responsible for the numerous components of a bulk bag — including the square and rectangular polypropylene fabric pieces, as well as the heavier lifting-loop strips — It is essential to use industrial sewing machines for this process. Every seam must be straight, secure, and free of wrinkles or bends along the sides or bottom ends.

**Inspection** - After sewing a line of bulk bags together, quality control inspectors scrutinize each bag. The goal is to guarantee that each bag fulfils the requisite strength and durability standards for a bulk bag product line. Any bags found to be inadequately stitched are removed.

**Packing** - At the end of the mass-manufacturing process of bulk bags, it is time to compress and organizing into specific numbers for bulk distribution. Compression takes place in a bale press, which enables the bags to be packed neatly and efficiently.

**Storage** - After everything is completed, the bulk bags are baled, packed, and transported to a storage area Distribution of the bulk bags to various customer premises is the next step. Once customers receive the packed bulk bags, they are ready to be opened and used for transportation or storage of building materials, waste, food products, or chemicals.

## *Technology & Quality Control*

A random sample of bulk bags is placed in a testing ring to determine if they pass the Safe Working Load (SWL) test. Typically, it is necessary to undertake this procedure before the general manufacture of bulk bags. Once the production process has been completed, random bags are burst tested to confirm whether the SWL has been reached or not. This procedure assists in ensuring that the bags produced are sturdy enough for their intended use.

## *Certification*

- EN ISO 21898 Packaging - Flexible intermediate bulk containers (FIBCs) for non-dangerous goods
- IEC 61340-4-4 Electrostatics - Part 4-4: Standard test methods for specific applications - Electrostatic classification of flexible intermediate bulk containers (FIBC)
- UN Recommendations for on the Transport of Dangerous Goods (ADR, RID, IMDG-Code, Orange Book, Chapter 6.5)
- TRBS 2153 – Avoidance of ignition hazards due to electrostatic charge (Vermeidung von Zündgefahren infolge elektrostatischer Aufladungen), applies for Germany.[5]

## *Capital requirements*

The minimum number of machines required to set up the plant of packaging textile was in between the range of 10 to 20.[6]

A sample list of machines used throughout the FIBC manufacturing process:

BCS machine - This machine is capable of converting plain woven (uncoated or coated) and leno fabric into bags. It is a high-speed conversion line that combines cross-cutting, bottom folding, sewing, and lastly, stacking of finished HDPE/PP woven fabric bags. Additionally, special attachments are available for manufacturing gusseted bags, perforated bags, and bags with an easy-open topstitch.

Features – High working speed, the design that is user-friendly, energy consumption is minimal, low-cost maintenance.

BCS-liner machine - The manual method of insertion into the woven bags is automated and replaced. These liner bags are ideal for packaging hygroscopic materials, such as sugar, salt, chemicals, and minerals.

Features – Dimensional Valve Precision, improved packing efficiency, low usage of energy, low cost of maintenance.

LM-650 machine - It is the world's first high-speed "Back Seam Sack" manufacturing machine. It is constructed entirely of woven polypropylene tape fabric laminated with reverse BOPP film and utilizing integrated tube and bag manufacturing procedures.

Features – Environmentally friendly and light bags, savings on materials, low manufacturing costs, simple processing, packaging that is both robust and appealing

Woven Sack Gusseting & Cutting Machine - The Gusseting & Cutting Machine for Woven Sacks creates woven sacks of various lengths and diameters. When considering the machine, it has a servo motor that allows you to cut bags and bags precisely. Moreover, the device has a high-quality alloy steel cutter, made according to advanced technological standards, and completes the process with precision and exquisite finish.

Jumbo Bag Fabric Cutting Machine - Bag Cutting Machine for Jumbo Bags plays a huge role in various packing processes. It is backed by cutting-edge technology and the usage of quality-tested elements and machine parts to ensure that they operate optimally in associated operations. On the other hand, these machines can process bags with a width of 400 to 1800 mm and a length of 600 to 9999 mm and produce 22 bags per minute. These are efficient in terms of utilization and have an easy-to-use interface, and require little maintenance.

Features – effective Sturdy appearance, easy to maintain, low-cost maintenance.

Liner Insertion Machine - The BCS-liner is an automated solution for cutting/sealing and accurately inserting PE liner into woven bags, integrated into a bag conversion system, for packaging all types of hygroscopic products such as sugar, salt, fertilizer, feed mineral, and chemicals. The machine can stitch liners to the woven fabric's bottom fold or let the liner loose inside the bag. Precision engineered to meet the unique requirements of each customer.

## *Costs*

The largest cost component of PP packing bags is polypropylene and polyethylene which are derivatives of petroleum-based resins. Consequently, the price of raw materials fluctuates in accordance with oil and gas prices.

There are 13 major parameters of a bulk bag that determine the overall cost (Table 1.2).

**Table 1.2: 13 Major parameters of a bulk bag**

| Parameter | Description |
|---|---|
| Bag Type | There are 4 main bag types that play a role in the overall bulk bag cost. When selecting a bag type Circular is the cheapest option followed by U-Panel, 4-Panel, and Baffled in that order. |
| Bag Size | The bigger the bag, the bigger the cost. |
| Fabric Weight | The heavier the fabric used the more expensive the bulk bag can be. |
| Fabric Type | Type A < Type B < Type C < Type D |
| Fabric Lamination | Uncoated < Coated7 |
| Safe Working Load / SF Requirements | Safe Working Load is a function of fabric weight. As SWL increases the fabric weight required to support the load must increase resulting in a more expensive bag.<br>5:1 SF < 6:1 SF |
| Top Style & Size | Open top < Spout Top < Duffle Top<br>For spout tops, price is determined based on the size of the spout requested. |
| Bottom Style & Size | Flat < Spout Discharge < Full Open Dump<br>For spout discharges, price is determined based on the size of the spout requested. |
| Seams | Standard < Sift Proof < Double Sift Proof < Triple Sift Proof (Felt) |
| Lift Loops / Stevedore Straps | For lift loops, price is determined based on the size and amount of webbing required.<br>Stevedores are an additional cost if required |
| Liner | • PE < PP < Foil<br>• Mil Thickness<br>• Color<br>• Loosely Inserted < Tabbed In < Sewn In < Glued in |
| Document Pouches | Document Pouches<br>• Standard Open < Zip Lock<br>• Quantity |
| Clean Level | Industrial Grade < Food Grade < Pharmaceutical Grade |

### Labor

Bag production is a **labor-intensive** process requiring a high level of skill and experience. While resin extrusion and fabric weaving are fully automated, bag stitching remains a manual process. In a typical production line, 10-20 workers will handle cutting, stitching, quality control, and packing. Large plants can employ hundreds to thousands of workers[8].

**Energy**

PP woven packaging bags manufacturing (that include extrusion, weaving, and sewing machines) uses natural gas and electricity.

The Utilities Used in The FIBC Manufacturing Process[9]

- Compressor: Capacity Pressure-165 CFM, 6-7 bar, Separate air tank of capacity 1,000 liters is recommended for tape line & winders (excluding tape guns)
- Air Drying Unit: Capacity 165 CFM, Pressure 6-7 bar, Dew point 3-degree Centigrade
- Chilled War Requirement: Process Requirement 58 TR, flow rate: 42,686 L/hr, Intel Temp: 18 degrees centigrade
- Water pressure: 4 bar
- Filament/Tape Winder: Three-phase voltage with mains supply of 3X 415 V/50 Hz or 3X 415V/50 Hz or
- 3X420V/50 Hz with separate neutral and earth Admissible fluctuations
- Voltage- 10% to +5%
- Frequency: +/- 2%

## Useful links:

- FIBC association (global): https://fibca.com/
- http://icpp.org/content/5-publications/ik_broschuere_f-a_ipcc_fibc_engl_170504-2-1.pdf?1493971470
- UN certification - https://www.southernpackaginglp.com/blog/un-certified-fibc-testing-procedures
- 5 most common types of FIBCs - https://www.southernpackaginglp.com/blog/the-5-most-common-types-of-fibcs-explained
- European Flexible Intermediate Bulk Container Association, Questions & Answers Concerning the Use of FIBCs - https://efibca.com/content/4-user-resources/2-questions-and-answers/efibca_q_a_eng_final_a_.pdf
- Turkish Packaging Manufacturers Association - https://ambalaj.org.tr/en/about-us-about-us

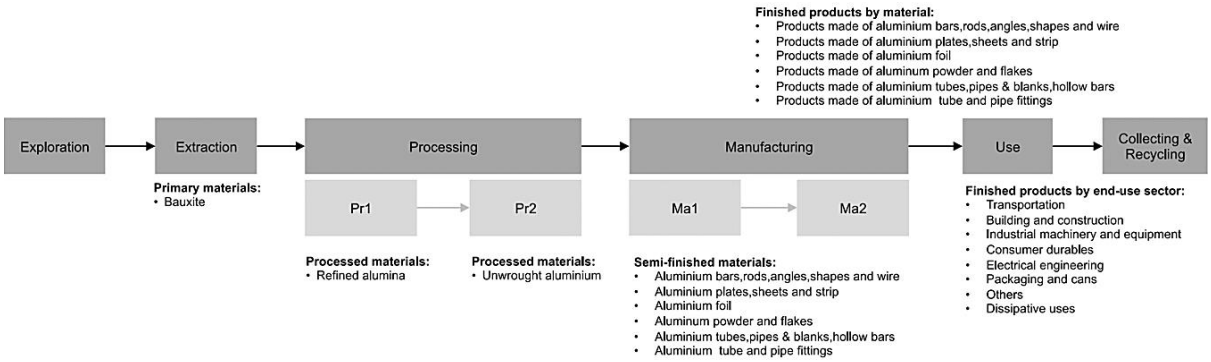
# 2. VALUE CHAIN OVERVIEW: ALUMINIUM

Aluminium, the third most abundant element on the earth's crust after oxygen and silicon, is extracted from an ore called Bauxite1. The main production route for aluminium from bauxite includes alumina refining (i.e., Bayer process) and electrolysis of alumina to aluminium metal (i.e., Hall-Héroult process). Intermediate processing stages are autoclave digestion, clarification, precipitation and calcination.

Unwrought aluminium is then wrought to produce semi-finished products such as aluminium bars, rods, angles, shapes, wires, plates, sheets, stripes, foil, tubes, pipes, blanks, hollow bars, tube fittings, powder and flakes. Part of the aluminium is remelted for adding alloying elements.

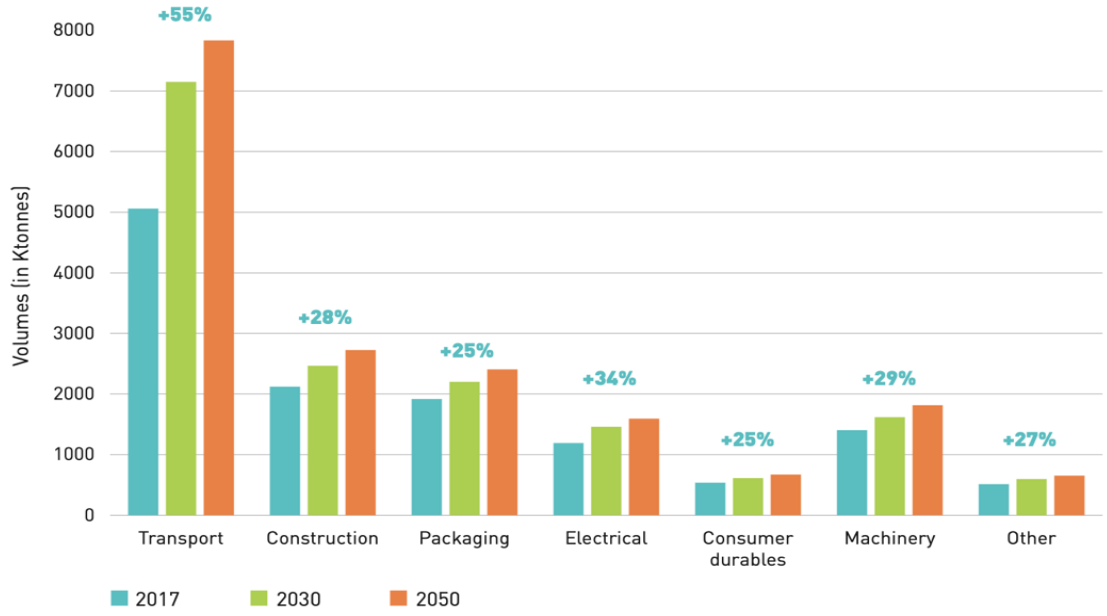
Aluminium semi-finished products are incorporated into finished products. The main end-uses of aluminium include transportation, building and construction, industrial machinery and equipment, consumer durables, electrical engineering, packaging and cans, dissipative uses (e.g., the employment of aluminium for deoxidation purposes in steelmaking) and other miscellaneous applications (Figure 2.1).

**Figure 2.1: Aluminium Value Chain**




Aluminium use has increased over the last twenty years, and it is still increasing – according to European Aluminium projection, aluminium use will continue to grow, leading to a 40 percent increase in demand in Europe by 2050. Estimates show that 16 million tonnes of aluminium will be used in 2030 and 18 million tonnes in 2050. Some of the predicted growth in demand is expected to be generated by aluminium replacing other materials (like steel, copper, plastics, PVC, wood depending on the markets). Key drivers of this growth are automotive, construction, packaging industries (Figure 2.2).

**Figure 2.2: Demand for semi-finished aluminium in Europe per sector (Mton aluminium in year 2017, 2030, 2050)**




*Source: European Aluminium.*

Türkiye's aluminium sector, which has grown by 10% in the last ten years, makes export to more than 180 countries. There are approximately 1.500 active companies and employ more than 30.000 employees. Turkish Aluminium is:

- 6th in the world and 4th in Europe in the export of aluminium bars and profiles in 2019 with 883 million dollars.
- 5th in the world and 3rd in Europe in the export of aluminium household and kitchenware in 2019 with 175 million dollars.
- 6th in the world and 3rd in Europe in aluminium foil export in 2019 with 391 million dollars.
- 10th in the world and 6th in Europe in aluminium construction materials export in 2019 with 315 million dollars.
- 7th in the world and 4th in Europe in the aluminium container export in 2019 with 21 million dollars.
- 6th in the world and 1st in Europe in aluminium braided rope export in 2019 with 39 million dollars.
- 9th in the world and 6th in Europe in aluminium pipe fittings export in 2019 with 22 million dollars.

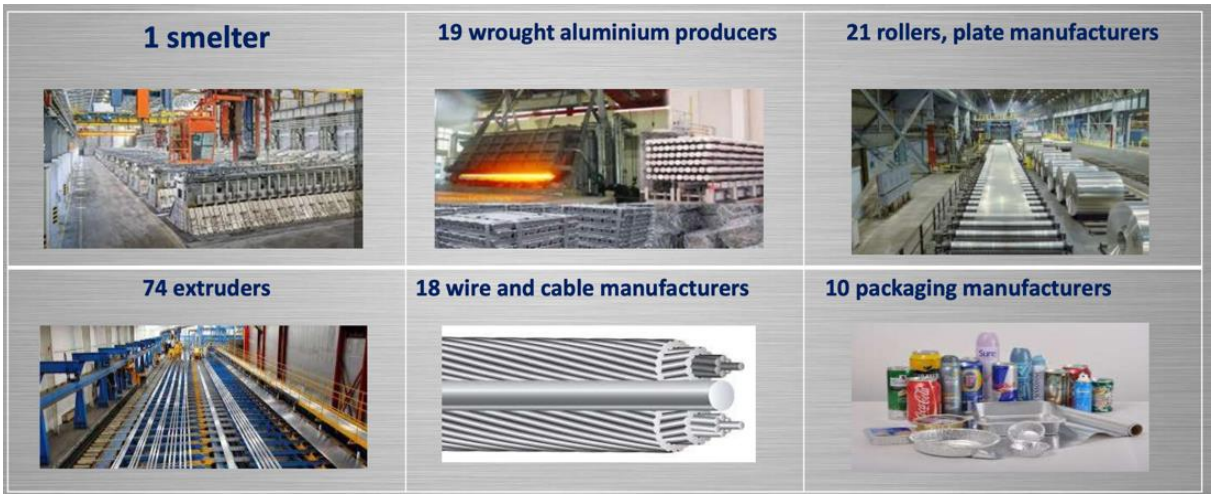
Turkish Aluminium market is characterized by high import dependency, mainly on primary aluminium, and widespread manufacturing base to serve whole world.

Local aluminium consumption has shown significant and stable growth since 2005. Automotive and construction industries are the main drivers of the aluminium growth in the Turkish market.

Turkish aluminium industry is widespread in the whole value chain.

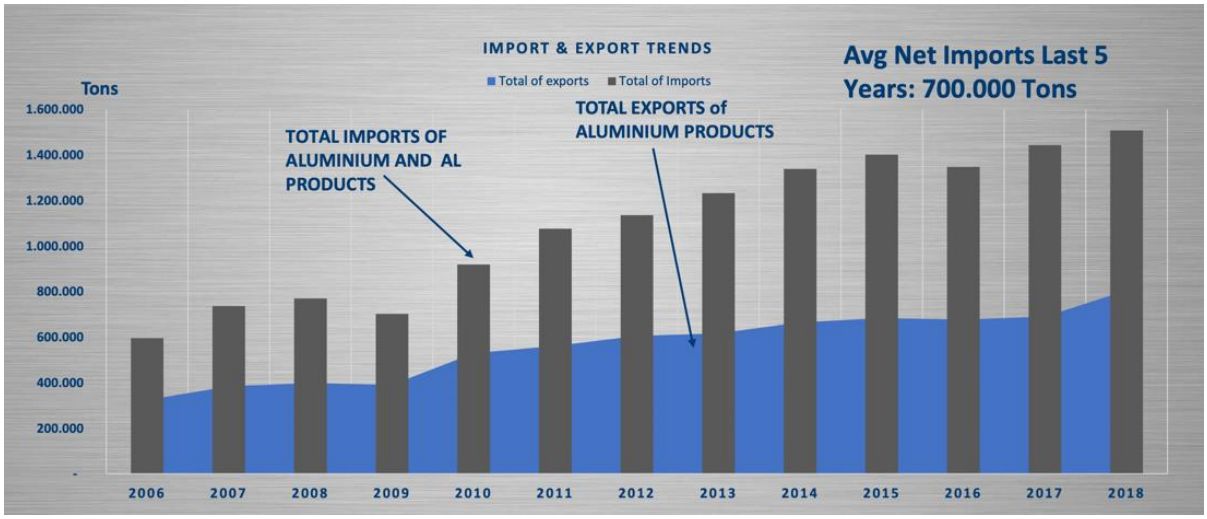
Türkiye is a net importer of aluminiums.

**Figure 2.3: Representation of Turkish aluminium industry in the whole value chain**



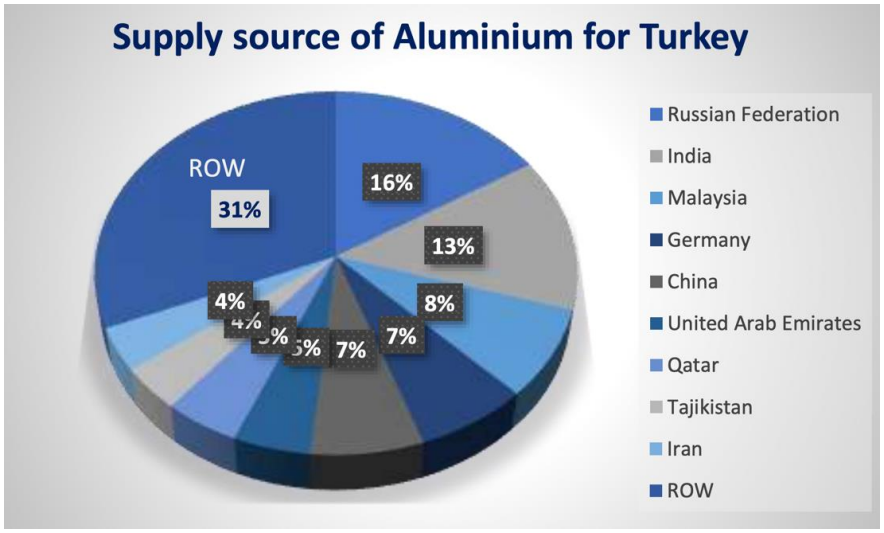

*Source: TALSAD, Turkish Aluminium Industrialists Association*

**Figure 2.4: Aluminium import and export trends in Türkiye**




*Source: TALSAD, Turkish Aluminium Industrialists Association*

**Figure 2.5: Supply source of Aluminium for Türkiye**




*Source: TALSAD, Turkish Aluminium Industrialists Association*

Istanbul Ferrous and Non-Ferrous Exporters Association (IDDMIB) occupied with executing activities to inform, support and raise cooperation among members through organizing actions to raise member companies as global leaders. The activities belong to aluminium sector have represented Türkiye in international organizations, executed technical seminars, buy trade committee actions and supported R&D activities to enable sustainable growth of ferrous and non-ferrous metals industry.

TALSAD works for sustainable growth and development of the aluminium industry in local and regional markets, development and implementation of new and advanced technologies, implementation of good practices in health, safety and environment and works to develop strong local and international partnerships. TALSAD is a member of the European Aluminium Association, and a member of professional industry organizations such as DEİK and İMSAD. Türkiye's leading Aluminium companies (55 in total) and industrialists are members of TALSAD.

## SEMI-FINISHED PRODUCT: ALUMINIUM PROFILES

### HS Code: 76042990

### EU MFN Tariff: 7.5%

### Rules of Origin:

Manufacture from materials of any heading, except that of the product, and in which the value of all the materials used does not exceed 50 % of the ex-works price of the product.

### Trade Statistics (HS 760429)

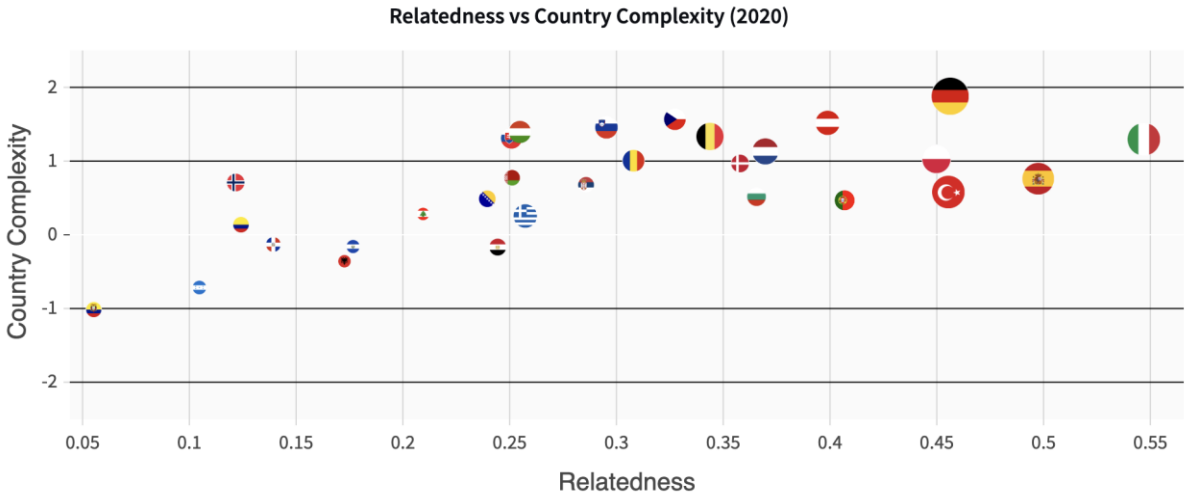
| | |
|---|---|
| TR Exports CAGR (2016-2020): | 13% |
| TR Exports Share in EU Imports in 2020: | 8% |
| TR Exports in 2020 (HS 76042990): | € 263,034,572 |

| | |
|---|---|
| GE Exports to EU27 in 2020: | € 1,000 (€257,000 to the world) |
| World Exports in 2020: | € 88,466,996,000 |

## Revealed Comparative Advantage (RCA) & Product Complexity

(**HS 760429** | Bars, rods and other profiles, aluminium alloyed)[24]:

**RCA > 1**



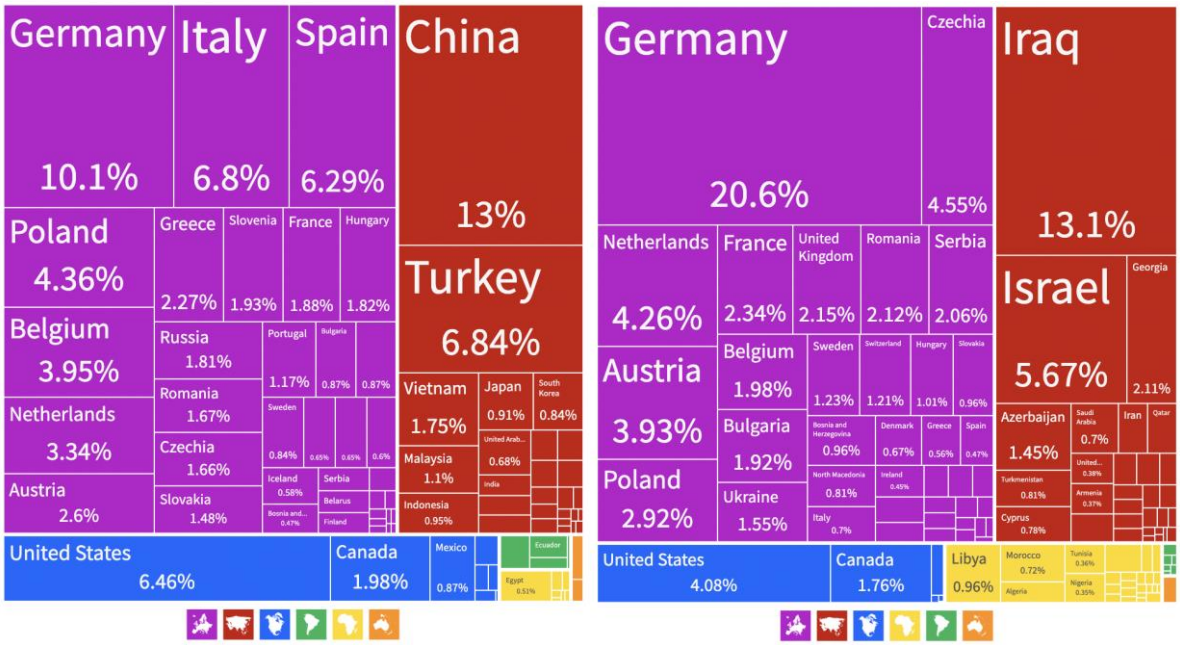

*Source: https://oec.world/*

Türkiye ranked 3rd as the world's exporter of bars, rods and other profiles, aluminium alloyed (HS 760429) with a share of 6.84% of worlds total export in 2020. 62% of Türkiye's total export goes to Europe. The biggest importer of Türkiye's bars, rods and other profile in Europe is Germany (20.6%), followed by Netherlands (4.26%), Czechia (4.55%), Austria (3.93%), e, France (2.34%) and Poland (2.92%)[25].

[24] THE COMPLEXITY-RELATEDNESS DIAGRAM COMPARES THE RISK AND THE STRATEGIC VALUE OF A PRODUCT'S POTENTIAL EXPORT OPPORTUNITIES. RELATEDNESS IS PREDICTIVE OF THE PROBABILITY THAT A COUNTRY INCREASES ITS EXPORTS IN A PRODUCT. COMPLEXITY IS ASSOCIATED WITH HIGHER LEVELS OF INCOME, ECONOMIC GROWTH POTENTIAL, LOWER INCOME INEQUALITY, AND LOWER EMISSIONS.

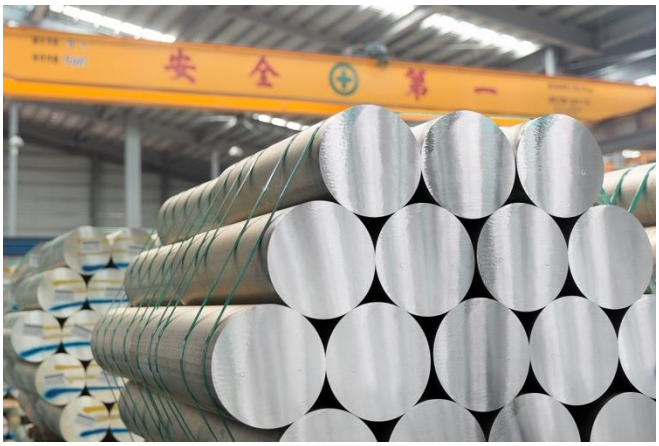
[25] HTTPS://OEC.WORLD/

**Figure 2.6: World's top exporters of Bars, rods and other profiles, aluminium alloyed - HS760429 (left) and importer from Türkiye's (right) in 2020.**




*Source: https://oec.world/*

## *Production: Materials Used in Manufacturing*



Profiles are made from aluminium billets, intermediate castings, which are to go through further extrusion processes before the good is produced.

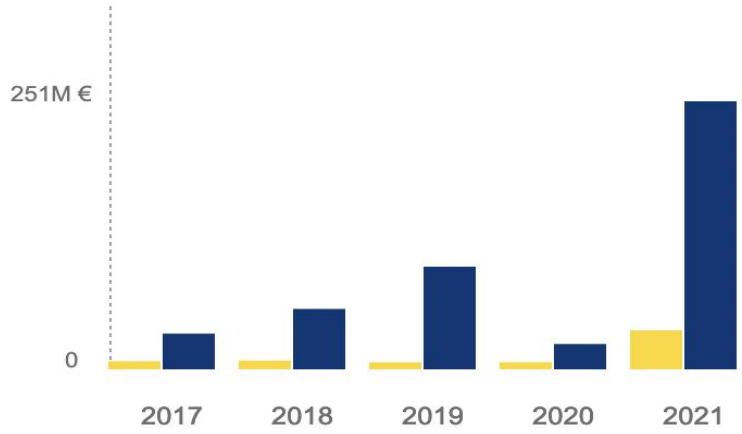
Billets are solid cylinders that can be manufactured in different length and diameter.

Notably, Türkiye is one of the biggest importer of Aluminium unwrought, alloyed – HS 760120 (includes aluminium ingots and billets) accounting to 2.76% (739 mln USD in 2019) of world's total imports of this product[26]. In 2019, the top exporters of Aluminium unwrought, alloyed to Türkiye were Qatar (27.2%), Uniter Arab Emirates (23.1%), Bahrain (15.5%) and Russia (12.1%)[27]. Türkiye exports Aluminium unwrought, alloyed – HS 760120 too (0.4% of the world's total export with a value of 80 mln USD in 2020).

After a sharp contraction of Türkiye's export to EU27 in 2020 (21,872,025 €) compared to 2019 (94,766,717 €), it increased dramatically to 250,670,462 € in 2021 (Figure 2.7).

[26] N 2019, THE TOP EXPORTERS OF **ALUMINIUM UNWROUGHT, ALLOYED (HS 760120)** WERE UNITED ARAB EMIRATES ($3.94B), NORWAY ($2.8B), CANADA ($2.45B), RUSSIA ($1.59B), AND BAHRAIN ($1.24B).
[27] HTTPS://OEC.WORLD/

**Figure 2.7: Trade with Aluminium Slabs and Billets (76012020) between Türkiye and EU27 (Türkiye's export in blue and EU27's import to Türkiye in yellow)**




*Source: https://trade.ec.europa.eu/access-to-markets/*

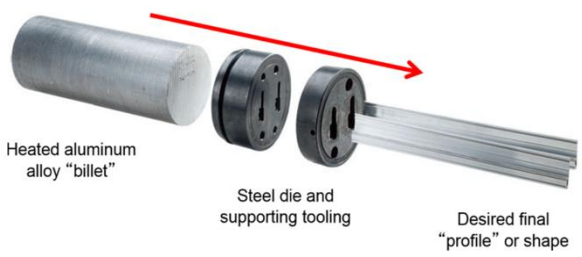
## *Manufacturing Process*

Aluminium extrusion is a process by which aluminium alloy material is forced through a die with a specific cross-sectional profile.

There are three main categories of extruded shapes:

1. **Solid**, with no enclosed voids or openings (i.e. a rod, beam, or angle).
2. **Hollow**, with one or more voids (i.e. square or rectangular tube).
3. **Semi-hollow**, with a partially enclosed void (i.e. a "C" channel with a narrow gap)

Extrusion has innumerable applications across many different industries, including the architectural, automotive, electronics, aerospace, energy, and other industries.




**Step 1: The Extrusion Die is Prepared and Moved to the Extrusion Press** - First, a round-shaped die is machined from H13 steel. Or, if one is already available, it is pulled from a warehouse. Before extrusion, the die must be preheated to between 450-500 degrees Celsius to help maximize its life and ensure even metal flow. Once the die has been preheated, it can be loaded into the extrusion press.

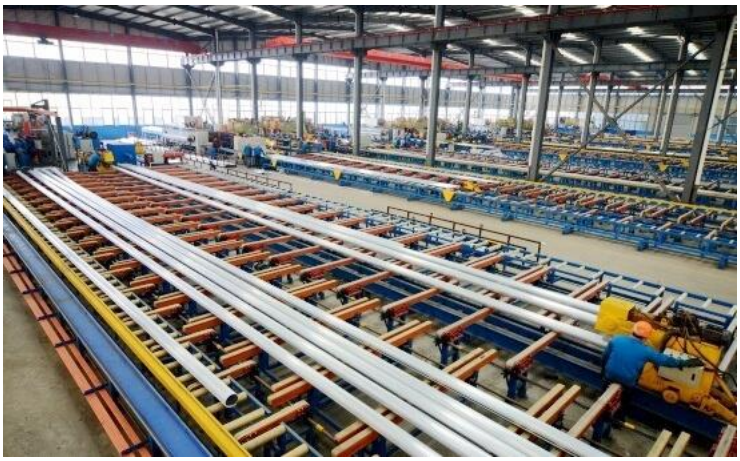
**Step 2: An Aluminium Billet is Preheated Before Extrusion** - Next, a solid, cylindrical block of aluminium alloy, called a billet, is cut from a longer log of alloy material. It is preheated in an oven, like this one, to between 400-500 degrees Celsius. This makes it malleable enough for the extrusion process but not molten.

**Step 3: The Billet is Transferred to the Extrusion Press** - Once the billet has been preheated, it is transferred mechanically to the extrusion press. Before it is loaded onto the press, a lubricant (or release agent) is applied to it. The release agent is also applied to the extrusion ram, to prevent the billet and ram from sticking together.

**Step 4: The Ram Pushes the Billet Material into the Container** - The malleable billet is loaded into the extrusion press, where the hydraulic ram applies up to 15,000 tons of pressure to it. As the ram applies pressure, the billet material is pushed into the container of the extrusion press. The material expands to fill the walls of the container.

**Step 5: The Extruded Material Emerges Through the Die -** As the alloy material fills the container, it is now being pressed up against the extrusion die. With continual pressure being applied to it, the aluminium material has nowhere to go except out through the opening(s) in the die. It emerges from the die's opening in the shape of a fully-formed profile.

**Step 6: Extrusions are Guided Along the Runout Table and Quenched -** After emerging, the extrusion is gripped by a puller, like the one you see here, which guides it along the runout table at a speed that matches its exit from the press. As it moves along the runout table, the profile is "quenched," or uniformly cooled by a water bath or by fans above the table.



**Step 7: Extrusions are Sheared to Table Length** - Once an extrusion reaches its full table length, it is sheared by a hot saw to separate it from the extrusion process. At every step of the process, temperature plays an important role. Although the extrusion was quenched after exiting the press, it has not yet fully cooled.

**Step 8: Extrusions are Cooled to Room Temperature** - After shearing, table-length extrusions are mechanically transferred from the runout table to a cooling table, like the one you see here. The profiles will remain there until they reach room temperature. Once they do, they will need to be stretched.

**Step 9: Extrusions are Moved to the Stretcher and Stretched into Alignment -** Some natural twisting has occurred in the profiles and this needs to be corrected. To correct this, they are moved to a stretcher. Each profile is mechanically gripped on both ends and pulled until it is fully straight and has been brought into specification.

**Step 10: Extrusions are Moved to the Finish Saw and Cut to Length -** With the table-length extrusions now straight and fully work-hardened, they are transferred to the saw table. Here, they are sawed to pre-specified lengths, generally between 8 and 21 feet long. At this point, the properties of the extrusions match the T4 temper. After sewing, they can be moved to an aging oven to be aged to the T5 or T6 temper.

**Heat Treatment, Finishing, and Fabrication -** Once extrusion is completed, profiles can be heat treated to enhance their properties. Then, after heat treatment, they can receive various surface

finishes to enhance their appearance and corrosion protection. They can also undergo fabrication operations to bring them to their final dimensions.

## *Quality Control & Certification*

An example of quality control procedure of extrusion products[28]:

### EXTRUSION MATERIALS INSPECTION:

**Aluminium Alloy Check** - This verifies that the right type of aluminium billets are used for your extrusions. Some of the alloys specified by the International Alloy Designation System used for aluminium extrusions are 6063, 6463, 6005A, and 6061.

**Extrusion Dye Check** - As important as the materials is ensuring that extrusion dies follow buyer's designs and specifications. Extrusion dies are evaluated in a variety of areas including hardness, dimensional measurements, bearing lengths and squareness, clearance, and support for thin parts.

**Additives Check** - Color, stabilizers, flame retardants, finishing materials, and approved fillers are just some of the additives used for extruded products.

### EXTRUSION VISUAL INSPECTION:

- Visual Defects Check
- Color and Glossiness Check
- Dimensional Inspection
- Coating and Finishing Check
- Weight and Density Check

### EXTRUSION PERFORMANCE INSPECTION:

**Tensile Test** - verifies that extruded profiles do not exceed industry limits on ultimate tensile strength, yield tensile strength, and percentage of elongation.

**Weldability Check** - checks the parameters applicable to your product are agreed upon beforehand.

**Workability Check** - verifies that extrusions may be worked to produce other products using processes specified by the buyer such as machining, threading, grinding, brazing, etc.

**Corrosion Resistance** - subjects the product to the appropriate test methods to determine its ability to resist corrosion.

**Flammability Testing** - mostly applies to flammable extrusions such as rubber and plastic as well as metal profiles that have received flammable coatings.

**Hardness Test** - verifies that aluminium and other extruded profiles possess the required hardness specific to product type.

**Weathering Resistance Testing** - verifies that extruded profile is suitable for outdoor applications.

Abrasion Resistance - checks that the abrasion coefficient value of coating for extrusions does not fall below standard limits.

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[28] HTTPS://WWW.INTOUCH-QUALITY.COM/BLOG/EXTRUSIONS-INSPECTION-PROCESS

**Chemical Resistance** - determines their ability to resist chemical decomposition.

## *Certification*

ISO 9001 and ISO 14001 are the main quality certificates for aluminium extrusion products manufacturers.

## *Capital requirements*

Specification of extrusion line depends on the size of the aluminium profile that is produced - larger the aluminium profiles size, the bigger tonnage capacity the extrusion press will be applied.

According to the shape and size of the section of an aluminium profile, the size of the extrusion mold is determined, and it is determined whether the extrusion mold is a flat die or a porthole die. If the mold size is known, the tonnage capacity of the extrusion machine is basically determined.

Below are given costs of setting up a new aluminium extrusion factory of different tonnage capacity:

- 600T aluminium extrusion press, billets heating furnace with hot log shear, mold heating oven, cooling bed and run out table, puller and aging furnace, the estimated cost is 250,000-500,000 USD based on different brand extrusion machine and auxiliary equipment;
- 800T aluminium extrusion press, billets heating furnace with hot log shear, mold heating oven, cooling bed and run out table, puller and aging furnace, the estimated cost is 300,000-600,000 USD based on different brand extrusion machine and auxiliary equipment;
- 1000T aluminium extrusion press, billets heating furnace with hot log shear, mold heating oven, cooling bed and run out table, puller and aging furnace, the estimated cost is 400,000-750,000 USD based on different brand extrusion machine and auxiliary equipment.

These are costs only for aluminium extrusion production line machine. Shipping and installation cost should be added. for a new factory, the gas connection and installation, the environmental impact assessment and forklift should be considered as well.

A complete aluminium profile production line generally consists of the following equipment (if a factory does not produce aluminium billets):

- **Aluminium extrusion workshop**
  - Aluminium extrusion press
  - Aluminium billets heating furnace
  - Mold heating oven
  - Cooling fan
  - Cooling bed and run out table
  - Extrusion line cutting saw
  - Aging furnace
  - Shape correction machine
- **Aluminium profile anodizing workshop**
  - Water chilling unit
  - Coloring machine
  - Refrigeration unit

- Heat exchanger
- Filter press
- Lifter
- Aluminium profile brushing machine
- Aluminium profile polishing machine
- Sand blasting/shot blasting machine

- **Aluminium profile electrophoresis coating workshop**
  - Electrophoresis equipment
- **Aluminium profile powder coating workshop**
  - Powder-coated equipment
  - Thermal break aluminium profile production line
  - Wood grain effect sublimation machine
- **Aluminium profile mold workshop**
  - Nitriding oven
  - Machining Center
  - Lathe
  - Milling machine
  - Wire cutting
  - Electric spark
  - Mold quenching furnace
- **Laboratory**
  - Spectrometer
  - Hydrogen meter
  - Metallographic equipment
  - Laboratory equipment, consumables
- **Packaging Equipment**
  - Aluminium profile wrapping machine
  - Aluminium profile film applicator machine
  - Aluminium profile hot shrink packaging machine
  - Aluminium profile automatic bagging machine
- **Environmental protection facilities and other auxiliary equipment**
  - Wastewater treatment equipment
  - Dust removal equipment
  - Crane
  - Water pump
  - Cooling Tower
  - Forklift
  - Air compressor
  - Boiler
- **Power distribution equipment**
- **Molds and consumables**
  - Extrusion die and tooling
  - Release oil
  - Felt strip
  - Hydraulic oil
  - Cutting oil
  - Mold repair tools Etc

**Finished products of aluminium profiles** include doors, windows and their frames and thresholds for doors, heating radiators and others.

## PRODUCT: DOORS, WINDOWS AND THEIR FRAMES AND THRESHOLDS FOR DOORS

### HS Code: 761010

### EU MFN Tariff: 6%

**Aluminium** door frame is made from **aluminium profile** and the door panel from aluminium sheet. Aluminium has high corrosion resistance, weather resistance, heat resistance, alkali resistance and impact resistance. **Inner structure is** stone wool and polyurethane. **Surface finishes can be** available in anodized, electrophoresis, wood grain, and powder coated.

### Rules of Origin:

Manufacture: from materials of any heading, except that of the product, and in which the value of all the materials used does not exceed 50 % of the ex-works price of the product.

### Trade Statistics (HS 761010)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | %15 |
| TR Exports Share in EU Imports in 2020: | %4 |
| TR Exports in 2020: | € 46,877,709 |
| GE Exports to EU27 in 2020: | € 1,000 (€9,000 to the world) |
| World Exports in 2020: | € 4,076,882,000 |

## PRODUCT: ALUMINIUM HEATING RADIATORS

### HS Code: 7616991091

### EU MFN Tariff: 6%

### Rules of Origin:

Manufacture: from materials of any heading, except that of the product, and in which the value of all the materials used does not exceed 50 % of the ex-works price of the product.

## Trade Statistics (HS 761699)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 0.43% |
| TR Exports Share in EU Imports in 2020: | 3% |
| TR Exports in 2020 (HS 7616991091): | € 60,455,268 |
| GE Exports to EU27 in 2020: | € 6 (€ 119,000 to the world) |
| World Exports in 2020: | € 14,367,895,000 |

## PRODUCT: PLATES, SHEETS AND STRIP, OF ALUMINIUM ALLOYS

of a thickness of > 0,2 mm, square or rectangular

**HS Code:** 760612

**EU MFN Tariff:** 7.5%

**Rules of Origin:**

Manufacture from materials of any heading, except that of the product, and in which the value of all the materials used does not exceed 50 % of the ex-works price of the product.

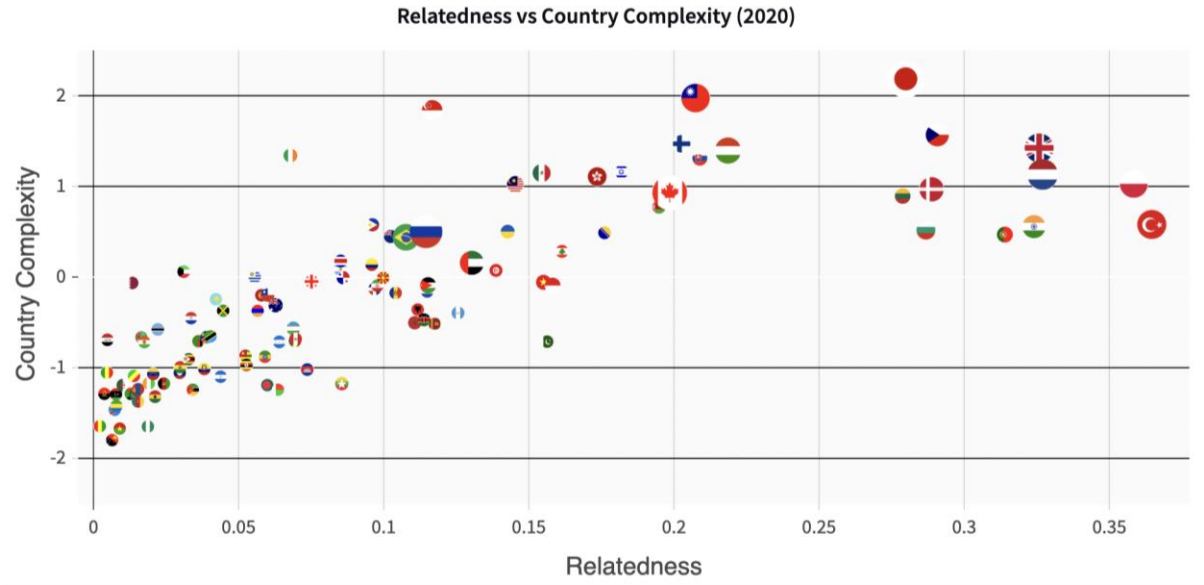
## Trade Statistics (HS 760612)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | -6 % |
| TR Exports Share in EU Imports in 2020: | 1% |
| TR Exports to EU27 in 2020: | € 95,859,000 |
| GE Exports to EU27 in 2020: | € 0 (€ 7,000 to the world) |
| World Exports in 2020: | € 20,226,898,000 |

## Revealed Comparative Advantage (RCA) & Product Complexity

(**HS 760612** | Plates, sheets, and strip, of aluminium alloys, of a thickness of > 0,2 mm, square or rectangular)[29]:

**RCA≤1**




*Source: https://oec.world/*

### *Production: Materials Used in Manufacturing*

Aluminimium plates, sheets and strips are made from aluminium ingots and slabs, intermediate castings, which are to go through further processing before the finished good is produced.

Aluminium ingots and slabs are produced by pouring molten aluminium into special molds. These molds come in a variety of sizes and shapes. As mentioned in previous chapter, Türkiye is one of the biggest importer of Aluminium unwrought, alloyed – HS 760120 (includes aluminium ingots and billets).

### *Manufacturing Process*

**Hot rolling:** In the production of aluminium plates, the sheet ingots or slabs are first smoothed for these to get that mirror-like shine that aluminium is known for. These are then rolled through a rolling machine after being heated to 400°C and this comes out as a thin sheet of metal. This process is called hot rolling. The sheets produced here are rolled into coils in preparation for the next stage.

[29] THE COMPLEXITY-RELATEDNESS DIAGRAM COMPARES THE RISK AND THE STRATEGIC VALUE OF A PRODUCT'S POTENTIAL EXPORT OPPORTUNITIES. RELATEDNESS IS PREDICTIVE OF THE PROBABILITY THAT A COUNTRY INCREASES ITS EXPORTS IN A PRODUCT. COMPLEXITY IS ASSOCIATED WITH HIGHER LEVELS OF INCOME, ECONOMIC GROWTH POTENTIAL, LOWER INCOME INEQUALITY, AND LOWER EMISSIONS.

**Cold rolling:** At this stage sheets are flattened into different thicknesses to suit the many applications these are to be used for and to suit the needs of various clients. These are also stored in rolls, just like the rolls that were produced after hot rolling.

**Finishing:** These rolls undergo different finishing processes where different types of aluminium are produced. This is where annealing, surface treatments and many more are done. Before these are shipped out to the respective companies that ordered them, inspection is conducted to ensure that these aluminium plates and sheets are of the right quality[30].

## *Quality Control & Certification*

ISO 9001 is a typical certification aluminium plate manufacturers possess.

Important norms and literature:[31]

Cold rolled products:

EN 485-1: Technical conditions for inspection and delivery

EN 485-2: Mechanical properties

EN 485-4: Tolerances on dimensions and form cold rolled products

Deep-drawn parts:

EN 1669: Earing test for sheet and strip Usages:

EN 602: Usage in the food industry Chemical composition:

EN 573-3: Chemical composition

## *Capital requirements*

Hot rolling mill and cold rolling mill are two main machineries for aluminium plate and sheet production. Size of machines is big (see photos below) and require a large space in the factory.

[30] HTTPS://NAMEPLATESDIV.COM/HOW-ALUMINIUM-PLATES-AND-SHEETS-ARE-MADE/
[31] HTTPS://WWW.ALUMECO.COM/KNOWLEDGE-TECHNIQUE/ALUMINIUM-DATA/DATASHEETS/FILES/ALUMINIUM?S=0

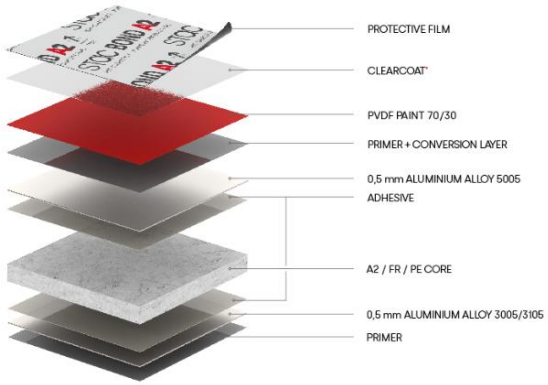
## PRODUCT: ALUMINIUM COMPOSITE PANEL

**HS Code:** 76169990

**EU MFN Tariff:** 6%

**Rules of Origin:**

Manufacture: from materials of any heading, except that of the product, and in which the value of all the materials used does not exceed 50 % of the ex-works price of the product




### Trade Statistics (HS 761699)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 0.43% |
| TR Exports Share in EU Imports in 2020: | 3% |
| TR Exports in 2020 (HS 76169990): | € 96,045,971 |
| GE Exports to EU27 in 2020: | € 6,000 (€ 119,000 to the world) |
| World Exports in 2020: | € 14,367,895,000 |

The popularity of aluminium composite panel has not stopped growing over the past few years. Its use has been expanding under the cover of energy efficiency, low price and construction possibilities. This type of material is specially designed for the **construction of ventilated facades, their renovation or rehabilitation**. It provides solutions that can be adapted to all fields of architecture.

**Aluminium can be easily combined** with other materials to produce new materials such as those used in bricks or in the composite panel.

### *Production[32]: Major material used in manufacturing*

Composite panel is composed of two aluminium sheets and an inner thermoplastic base core that can hold mineral charge. It is specially designed for new construction ventilated facades as well as for renovation or rehabilitation. Its manufacturing standard is composed of an outer sheet of 5005 aluminium alloy and an inner sheet of 3105.

It is divided into two groups depending on the mineral load of its core and can be incombustible or fireproof and (according to UNE 13501-1:2007) classified as A2-s1, d0 and B-s1, d0.

### *Manufacturing Process*

The composite panel is produced by a **continuous lamination process**, in which a sheet of the material that will make up the core is extruded and compacted between two aluminium sheets that

[32] HTTPS://STACBOND.COM/

are unwound at the same time. Finally, the flatness of the material is compacted and perfected and a protective film is applied.

### Customized Finishes

Depending on the finish that is sought, the panel can receive multiple types of treatments and coats. Among the most common finishing paints there are:

**PVDF** (Fluorinated polyvinyl) **is the most popular finish for architectural applications**. In a 70/30 proportion of resin it has a higher folding capacity, as well as a better resistance to ageing and protection against UV rays.

**FEVE** (Lumiflon) is a type of coating with a very similar structure to PVDF, but with greater hardness and less flexibility. It allows to achieving a greater gloss range.

**HDPE** (High Durability Polyester) paint allows a high range of gloss and some special finishes such as textured surfaces.

### Solid, metallic and special finishes

The aluminium composite panel allows a large number of different finishes. In addition, it can be adapted to **any colour from the RAL colour chart**. Over time, special finishes have been added with **texture effects**, imitating wood or **concrete**, or iridescent with special lighting effects.

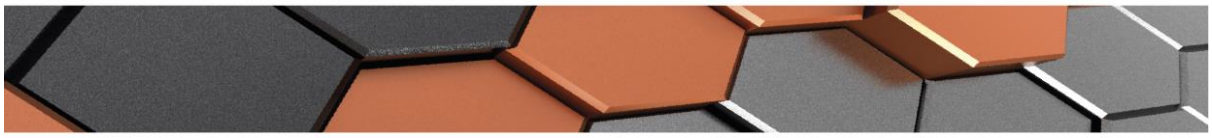
### Solid and metallic colors

The solid finishes are homogeneous and hardly suffer the variation of their tonality with the incidence of light. They provide a sensation of solidity to the facade and are easily combined with other finishes.

Metallic colours, very similar to those used in the automotive sector, vary their shade with respect to the incidence of sunlight and are very popular for large facades and outstanding projects.

### Other special finishes

Textured effects, matte or high-gloss surfaces, iridescent and wood finishes are some of the special finishes.



## PRODUCT: BICYCLES WITH BALL BEARINGS

**HS Code:** 87120030

**EU MFN Tariff:** 14%

**Rules of Origin:**

Manufacture from materials of any heading, except those of heading 8714; Manufacture in which the value of all the materials used does not exceed 30 % of the ex-works price of the product

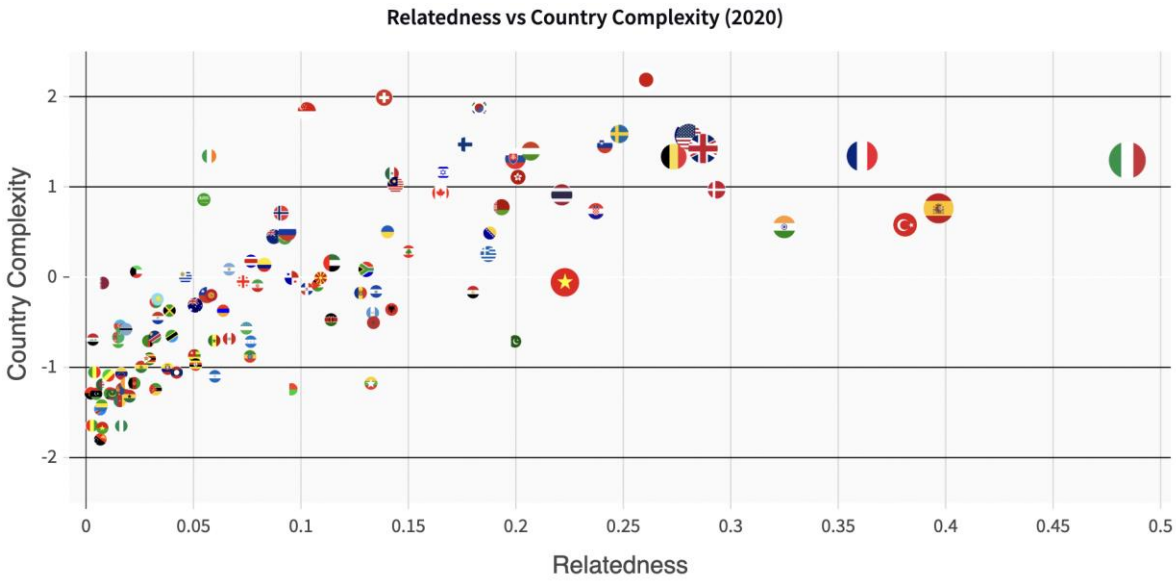
### Trade Statistics (HS 871200)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 2% |
| TR Exports Share in EU Imports in 2020: | 1% |
| TR Exports in 2020 (HS 87120030): | € 39,465,461 |
| GE Exports to EU27 in 2020: | € 0 (€15,000 to the world) |
| World Exports in 2020: | € 8,673,263,000 |

### Revealed Comparative Advantage (RCA) & Product Complexity

**(HS 871200** | Bicycles, other cycles, not motorized):

**RCA ≤1**



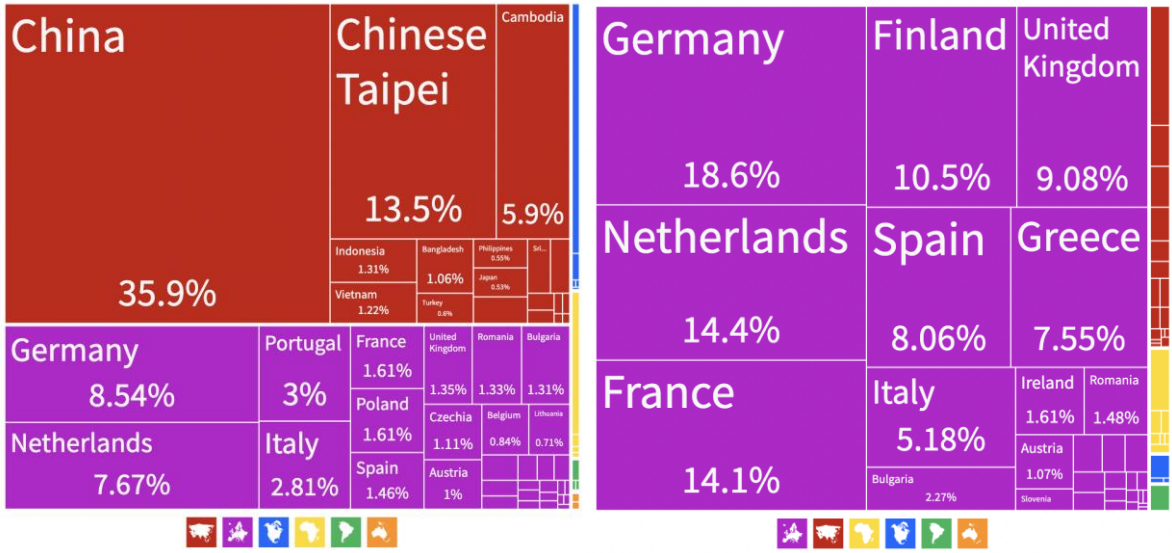

*Source: https://oec.world/*

The global market for Bicycles estimated at US$29.2 Billion in the year 2020, is projected to reach a revised size of US$34.6 Billion by 2027, growing at a CAGR of 2.4% over the analysis period 2020-2027[33].

[33] HTTPS://WWW.SCIENCEDIRECT.COM/SCIENCE/ARTICLE/PII/S2212827121010428

Turkish bicycle industry is rapidly growing, and biggest part of the country's bike export goes to Europe (figure 2.8, right). Türkiye exported approximately 280,000 bicycles in 2018 which was a 58 percent increase compared to 2017 total. Most of the bikes that are exported by Turkish makers go to Germany (18.6%), Netherlands (14,4%), France (14.1%), Finland (10.5%), United Kingdom (9.08%), and Spain (8.06%)[34]. These bicycles are of entry to medium level standards with an average value of 121 Euro for an exported bicycle[35].

**Figure 2.8: Exporters of HS 871200 | Bicycles, other cycles, not motorized (left) and importers from Türkiye (right) in 2020.**




*Source: https://oec.world/*

Accell Bisiklet A.S. is by far Turkish biggest bike exporter (67% of the country's total 2018 bicycle export). The company is a Turkish subsidiary of Dutch Accell Group. Accell Bisiklet established in 1992 in Manisa, close to İzmir, is the biggest bicycle producer in Türkiye. The company produces Carraro, Ghost, Lapierre and other licensed branded bikes for the Turkish market and a wide range of bicycles for the European market.

Another big producer is Korel Elektronik Sanayi ve Ticaret (produces bicycles and bicycle frames under the brand „Corelli[36]") which also produces aluminium parts and products for the white goods industry and the automotive sector. In addition to finished bikes, the company is also one of the big producers of alluminium bike and e-bike frames (million units annually). Most of its frames are sold to OEM[37] customers, particularly ones based in the EU member states as it can export (import) duty free[38].

Bicycle industry is represented by Turkish bicycle industry association, BİSED, established in 2008. BISED works to develop the sector and helps its members and sector representatives on technical,

[34] HTTPS://OEC.WORLD/
[35] HTTPS://WWW.BIKE-EU.COM/PRODUCTION/NIEUWS/2020/01/PRODUCTION-RELOCATION-WHAT-ABOUT-TÜRKIYE-AS-COUNTRYS-BIKE-EXPORT-GROWS-RAPIDLY-10137234
[36] HTTPS://WWW.CORELLI.COM.TR/EN/
[37] ORIGINAL EQUIPMENT MANUFACTURER
[38] HTTPS://WWW.BIKE-EU.COM/PRODUCTION/NIEUWS/2020/01/PRODUCTION-RELOCATION-WHAT-ABOUT-TÜRKIYE-AS-COUNTRYS-BIKE-EXPORT-GROWS-RAPIDLY-10137234

economic and executive issues in related to production and export of bicycle, electric bicycle and related sub-industries.

BİSED also represents the industry within the body of CONEBI (Confederation of the European Bicycle Industry) in order to have a voice and representation in international initiatives[39].

## *Production: Major Material Used in Manufacturing*

The most important part of the bicycle is the diamond-shaped frame, which links the components together in the proper geometric configuration. The frame provides strength and rigidity to the bicycle and largely determines the handling of the bicycle. The frame consists of the front and rear triangles, the front really forming more of a quadrilateral of four tubes: the top, seat, down, and head tubes. The rear triangle consists of the chainstays, seatstays, and rear wheel dropouts. Attached to the head tube at the front of the frame are the fork and steering tube[40].

Bicycle frame can be made from steel, aluminium, carbon fiber and titanium (less commonly used); however, aluminium bike frames are the most common in the modern bicycle industry (it is also widely used for various components). Aluminium as a material isn't very dense so it can be formed into lightweight structures, and with its corrosion resistance aluminium is argued to be the best material for bike frames. In addition, aluminium frames are relatively cheap to manufacture, especially compared to carbon fibre frames which take approximately 14 times longer to produce[41].

Aluminium comes in forms of different alloys with a small percentage of other metals and minerals added. Grade 6061 and 7005 are the most used aluminium alloys in cycling industry because of their availability and their properties. 6061 is an alloy that consists of aluminium, magnesium and silicone and is considered to be superior to 7005, made of aluminium and zinc, although the latter appears to be more resistant[42].

**Semi-finished material:**

In 2021, Türkiye exported to the EU 2,185,871 € aluminium frames (HS Code 87149110) and 1,562,867 € Hubs, other than coaster braking hubs and hub brakes, and free-wheel sprocket-wheels (87149300).

[39] HTTP://WWW.BISED.ORG.TR/
[40] HTTP://WWW.MADEHOW.COM/VOLUME-2/BICYCLE.HTML#IXZZ7LMY5PK7S
[41] HTTPS://WWW.BIKEEXCHANGE.COM.AU/BLOG/BIKE-FRAME-MATERIALS-EXPLAINED (MORE INFORMATION ABOUT THE PROS AND CONS OF DIFFERENT MATERIALS)
[42] HTTPS://WWW.BIKE-ADVISOR.COM/ALUMINIUM-FRAMES-6061-VS-7005-WHICH-IS-THE-BEST/

**Bicycle production may include other materials[43]:**


- Plastics
- Foam (for grips and saddle padding)
- Leather (for grips and saddles)
- Rubber (primarily for tires and brake pads)
- Liquids (like brake fluid, suspension oil, and various greases/lubricants)
- Magnesium (sometimes in pedals and suspension forks; very rarely in frames)
- Wood (now a novelty for frames, but common many decades ago)

## *The Manufacturing Process*

### Assembling the Frame

Tailoring the tubes

1. The metal is annealed, or softened by heating, and hollowed out to form "hollows," or "blooms." These are heated again, pickled in acid to remove scale, and lubricated.
2. The hollows are measured, cut, and precision mitered to the appropriate dimensions. Frame sizes for adult bicycles generally run from 19-25 inches (48-63 cm) from the top of the seat post tube to the middle of the crank hanger.
3. Next, the hollows are fitted over a mandrel, or rod, attached to a draw bench. To achieve the right gauge, the hollows pass through dies which stretch them into thinner and longer tubes, a process called cold drawing.
4. The tubes may be shaped and tapered into a variety of designs and lengths. The taper-gauge fork blades may have to pass through more than a dozen operations to achieve the correct strength, weight, and resilience.

Brazing, welding, and gluing

5. Tubes can be joined into a frame either by hand or machine. Frames may be brazed, welded, or glued, with or without lugs, which are the metal sleeves joining two or more tubes at a joint. Brazing is essentially welding at a temperature of about 1600°F (871°C) or lower. Gas burners are arranged evenly around the lugs which are heated, forming a white flux that melts and cleans the surface, preparing it for brazing. The brazing filler is generally brass (copper-zinc alloy) or silver, which melt at lower temperatures than the tubes being joined. The filler is applied and as it melts, it flows around the joint, sealing it.

Aligning and cleaning

6. The assembled frames are placed into jigs and checked for proper alignment. Adjustments are made while the frame is still hot and malleable.
7. The excess flux and brazing metals are cleaned off by pickling in acid solutions and by washing and grinding the brazing until it is smooth.

[43] HTTPS://TWOWHEELSBETTER.NET/BICYCLE-MATERIALS/

8. After the metals have cooled, further precision alignments are made.

Finishing

9. The frames are painted, not only to create a more finished appearance, but also to protect the frame. The frame is first primed with an undercoat and then painted with a colored enamel. Paint may be applied by hand-spraying or by passing the frames through automatic electrostatic spraying rooms. The negatively charged frames attract the positively charged paint spray as the frames rotate for full coverage. Finally, transfers and lacquer are applied to the frame. Chrome plating may also be used instead of paint on components such as the fork blades.

**Assembling the Components**

- **Derailleurs and gear shift levers -** Depending on the style of bicycle, the gear shift levers are mounted either on the down tube—popular on racing bikes—on the stem, or on the handlebar ends. A cable is attached, which extends to the front and rear derailleurs. Front derailleurs, which move the chain from one drive sprocket to another, may be clamped or brazed onto the seat tube. Rear derailleurs may be mounted with bolt-on hangers or integral hangers.
- **Handlebars, stems, and headsets -** Handlebars may be raised, flat, or I dropped. They are bolted to the bicycle stem which is then fitted into the head tube. The headset components, including bearings, cups, and locknuts, are attached to the head tube. The headset allows the fork to turn inside the head tube and thus makes steering easier.
- **Brakes -** The brake levers are mounted to the handlebars. Cables extend to the brakes and are fastened to the calipers. Tape, made of plastic or cloth, can then be attached to the handlebars and the ends are plugged.
- **Saddles and seat posts -** Seat posts are generally steel or aluminium alloy and are bolted or clamped into position. The saddle is generally made of molded padding and covered with nylon or plastic materials. Although leather was the norm for saddles for a long time, it is less commonly used today.
- **Cranksets** - The crankset supports the pedals and transfers power from the pedals to the chain and rear wheel. Cranksets consist of steel or aluminium alloy crank arms, chain rings, and the bottom bracket assembly of axle, cups, and bearings. They are attached with bolts and caps into the bottom bracket of the bicycle frame. The pedals are then screwed to the ends of the crank arms.
- **Wheels, tires, and hubs** - Wheel manufacturers conform to the A J International Standards Organization (ISO) system for wheel diameter and tire sizes. Wheels may be constructed by machines, which roll steel strips into hoops that are welded into rims. The rims are drilled to accept spokes, which are laced one round at a time between the rim and hub flange. A wheel must be trued, or straightened, in radial and lateral directions to achieve uniform tension. Next, the rim liner, tire, and inner tube are attached. The chain may also be fitted onto the bicycle. Rear wheels are fitted with a free-/ wheel, consisting of several cogs and spacers, which frees the rear wheel from the crank mechanism when the rider stops pedaling. Wheels are attached to the bicycle frame by means of an axle which runs through the hub of the wheel. The axle may be tightened with bolts at the ends or with quick-release skewers[44].

[44] HTTP://WWW.MADEHOW.COM/VOLUME-2/BICYCLE.HTML#IXZZ7LQOIGHHD

## *Quality Control & Certification*

A bicycle is made up of several components and various accessories that need to be put together to form a final product that is safe for use. Moreover, many of these components come from different, specialized manufacturers, means that constant quality inspections are required throughout the final assembly process. Each production step requires an in-process inspection to ensure the manufacturing process is correct and that it enables all the parts to integrate effectively. Also referred to as an 'IPI', in-process inspections are conducted by a quality inspection engineer who is fully knowledgeable about the bicycle parts industry. The inspector will walk through the process, inspecting every component from the incoming raw materials until the packaging of the final product. The end-goal is to ensure that the product is compliant with all regulations. Through the step-by-step process, any anomaly or defect can be identified from the source and corrected quickly. If there are any major or critical problems, the customer can also be notified much faster. In-process inspections also serve to update the customer at all points – whether the factory continues to follow the original specifications for the e-bike or bicycle, and whether the production process remains on schedule[45].

On 30 April 2015, the EU's Official Journal published Commission Implementing Decision 2015/681 on the publication of the references of standard EN ISO 4210, parts 1-9, for city and trekking bicycles, mountain bicycles and racing bicycles, and of standard EN ISO 8098 for bicycles for young children. Bicycle manufacturers may need to become familiar with these standards, numbering ten in all, in order to conform to the EU legislation Europe-wide.[46]

The new European standards had been prepared within the framework of Commission Decision 2011/786/EU on the safety requirements to be met by the European standards for bicycles, bicycles for young children and luggage carriers for bicycles ("Decision 2011/786/EU").

Decision 2011/786/EU sets out the essential safety requirements with regard to bicycles, including the particular safety requirements regarding physical properties such as handling, stability, durability, braking systems, sharp edges, entrapment and protrusions; mechanical properties such as adjustability and controls, folding mechanisms and fasteners; as well as chemical properties and testing methods.

Further and more specific technical details are adopted in the form of harmonized standards by the European Committee for Standardization (CEN) within the framework of standardization mandate M/508 issued by the European Commission for the development of harmonized standards covering bicycles.

The Official Journal publication of 30 April 2015 provides that the new European standards adopted by CEN fulfil mandate M/508 and comply with the general safety requirements set out in Directive 2001/95/EC on general product safety, and therefore, their references should be published in the EU's Official Journal.

The following titles are named in the Official Journal publication of 30 April 2015 as new European standards covering bicycles:

- EN ISO 4210-1:2014 - Cycles - Safety requirements for bicycles - Part 1: Terms and definitions;

[45] HTTPS://PROQC.COM/BLOG/E-BIKE-MANUFACTURING-QUALITY-CONTROL-IN-PROCESS-INSPECTIONS/
[46] HTTPS://HKMB.HKTDC.COM/EN/1X0A2E0U/HKTDC-RESEARCH/NEW-EUROPEAN-SAFETY-STANDARDS-NAMED-COVERING-BICYCLES

- EN ISO 4210-2:2014 - Cycles - Safety requirements for bicycles - Part 2: Requirements for city and trekking, young adult, mountain and racing bicycles;
- EN ISO 4210-3:2014 - Cycles - Safety requirements for bicycles - Part 3: Common test methods;
- EN ISO 4210-4:2014 - Cycles - Safety requirements for bicycles - Part 4: Braking test methods;
- EN ISO 4210-5:2014 - Cycles - Safety requirements for bicycles - Part 5: Steering test methods;
- EN ISO 4210-6:2014 - Cycles - Safety requirements for bicycles - Part 6: Frame and fork test methods;
- EN ISO 4210-7:2014 - Cycles - Safety requirements for bicycles - Part 7: Wheels and rims test methods;
- EN ISO 4210-8:2014 - Cycles - Safety requirements for bicycles - Part 8: Pedal and drive system test methods;
- EN ISO 4210-9:2014 - Cycles - Safety requirements for bicycles - Part 9: Saddles and seat-post test methods;
- EN ISO 8098:2014 - Bicycles for young children - Safety requirements and test methods.

Bicycle manufacturers should be warned that the abovementioned European standards will replace the following former standards adopted by CEN:

- EN 14764:2005 - City and trekking bicycles - Safety requirements and test methods;
- EN 14766:2005 - Mountain bicycles - Safety requirements and test methods;
- EN 14781:2005 - Racing bicycles - Safety requirements and test methods.

All ten standards may be purchased from a national member of CEN. CEN members are obliged to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving these new European standards the status of a national standard without any alteration.

**Labor**

Bicycle production consists mainly of a manual labor-intensive assembly process. Although materials and production processes, and production locations have changed since the early days of bicycle production, the assembly process still looks very similar to the early days of bicycle production, and requires specially trained, skilled personnel, performing manual tasks that also include heavy loads[47].

## PRODUCT: ROAD WHEELS OF ALUMINIUM

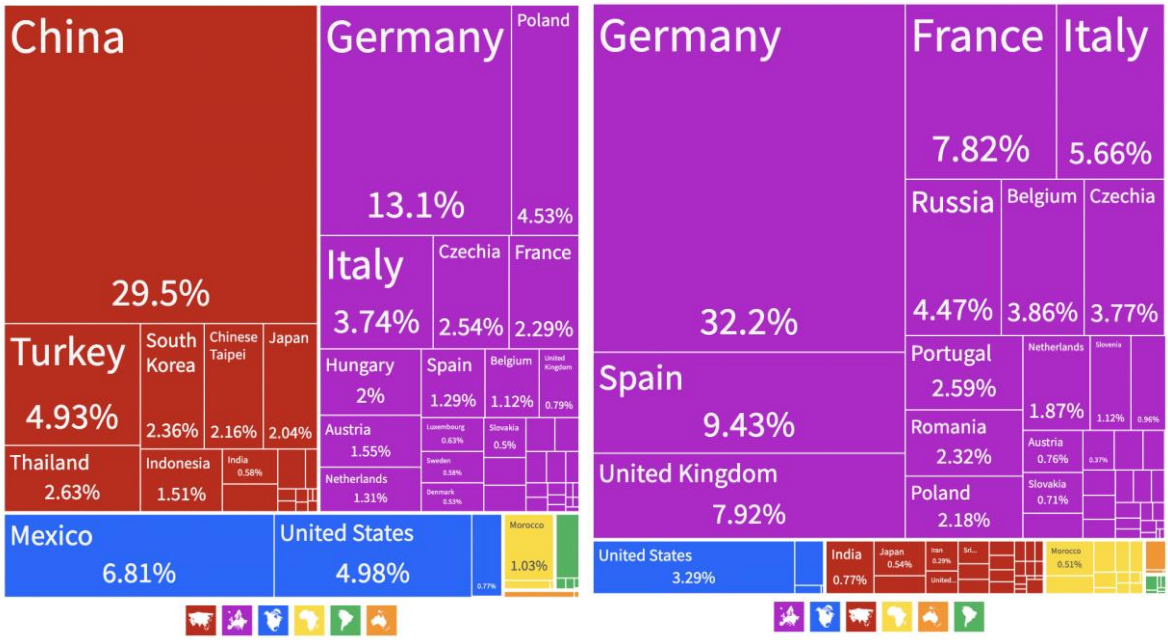
### HS Code: 8708705050

### EU MFN Tariff: 3.8%

Türkiye is one of the biggest exporters of wheels including parts/accessories for motor vehicles (HS 870870) accounting to 4.93% of worlds total export in 2020, while 91% of Türkiye's export goes to European countries (Figure 2.9, right).

[47] HTTPS://WWW.SCIENCEDIRECT.COM/SCIENCE/ARTICLE/PII/S2212827121010428

**Figure 2.9: Exporters of wheels including parts/accessories for motor vehicles - HS 870870 (left) and importers of from Türkiye (right) in 2020.**




*Source: https://oec.world/*

With an annual capacity of more than seven million steel, as well as 4.5 million aluminium wheels, the Maxion İnci Wheel Group is the largest single-location aluminium and steel wheel producer for passenger, light commercial and heavy commercial vehicles in Europe. The Turkish team serves major global vehicle manufacturers and Tier One Suppliers such as BMW, Continental, Daimler, Ford, General Motors, IVECO, Jaguar Land Rover, Michelin, PSA, the Volkswagen Group and Volvo amongst many others.[48]

During the last decades aluminium wheels are more commonly used than steel wheels. The main advantage of cast aluminium wheels over steel is its possibility to obtain diverse design, high dimensional accuracy, and optimal static and dynamic mechanical characteristics. Lightweight of aluminium wheels is another advantage over steel, but often not decisive. In some cases, weight cast aluminium wheels is equal to or only slightly lighter than standard steel with a simple design[1].

Almost all modern aluminium wheels are made by one of two technologies: casting and forging (discussed in detail below). The main advantage of cast aluminium wheels is the high styling versatility, while forged wheels are usually lighter and stronger, but also more expensive than cast wheels. **A cast wheel** is made by pouring molten aluminium into a mold where it is formed to the correct shape and sits there until it cools down. Once the wheel cools down, they perform trimming and drilling[2]. **Forged aluminium wheels** are one-piece wheels formed from a single block of metal by hot forging, followed by hot or cold spinning and the necessary machining operations[3]. According to European Aluminium Association's report, cast aluminium wheels are most common with a market share of more than 80% in North America, more than 90% in Europe and close to 100% in Japan. In North America, the share of forged wheels is about 15%, in Europe only 5%.

[48] HTTPS://WWW.MAXIONWHEELS.COM/LOCATIONS/MANISA-TÜRKIYE

## Rules of Origin:

Manufacture in which the value of all the materials used does not exceed 40 % of the ex-works price of the product

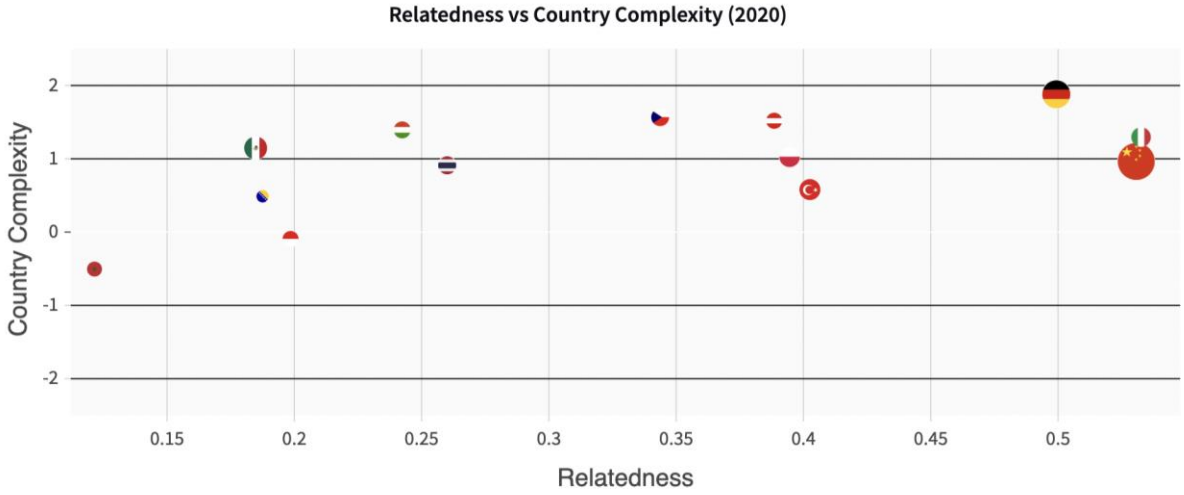
## Trade Statistics (HS 870870)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 9% |
| TR Exports Share in EU Imports in 2020: | 11% |
| TR Exports in 2020 (HS 87087050): | € 349,524,576 |
| GE Exports to EU27 in 2020: | € 12,000 (€ 192,000 to the world) |
| World Exports in 2020: | 14,464,214,000 |

## Revealed Comparative Advantage (RCA) & Product Complexity:

Relatedness vs Country Complexity for **HS 870870**

**RCA > 1**




*Source: https://oec.world/*

### *Production: Major Materials used in Manufacturing*

Hypoeutectic Al-Si casting alloys with a silicon content of 7 to 12%, varying levels of magnesium (to achieve a good strength elongation compromise) as well as low iron and other minor impurity concentrations.

This alloy is required to meet the following requirements:

- Good casting characteristics while using metal moulds (excellent mould filling, no adherence to mould, little susceptibility to hot tearing and shrinkage)
- Strong ability to withstand physical impact (crash worthiness, ductility, impact strength)
- Excellent corrosion resistance (in normal and saline atmospheres)
- High fatigue resistance[4]

## *Manufacturing Process*

### Cast wheels manufacturing process

Different aluminium casting technologies are suitable for wheel production. Depending on the applied casting process, also the quality of the cast aluminium wheels varies. The selection of the specific casting methods largely determines the quality of the as-cast microstructure (e.g. porosity) and influences the choice of the applicable types of alloys and heat treatments. Thus, it determines not only the strength and durability of the wheel, but also affects the quality level which can be achieved in the various surface preparation steps and thus the final appearance. Consequently, the selection of the optimum casting methods depends on many different factors.

The main casting processes used for the production of aluminium wheels are:

- low-pressure die casting (mainly)
- gravity permanent mould casting (less used)
- squeeze-casting process (marginally used)

In addition, a few other casting processes have been or are used:

- counter pressure die casting
- casting-forging (Cobapress)
- thixocasting.

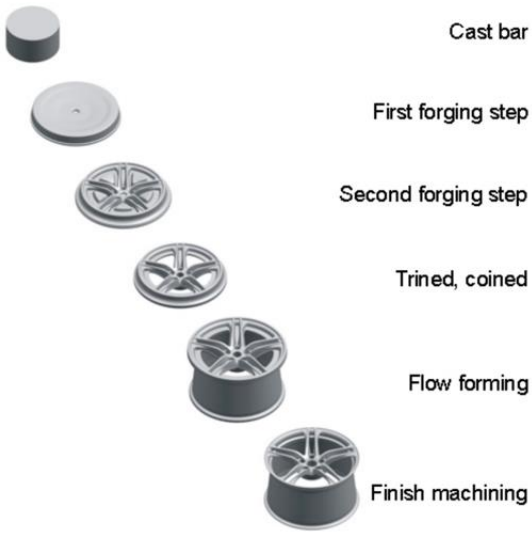
Most cast aluminium wheels are produced by low pressure die casting using a multi-part mould. Low pressure die casting is the standard process approved for aluminium wheels sold to the OEM market, but it offers a good value for the aftermarket as well. Low pressure die casting uses a relatively low pressure (around 2 bar) to achieve a fast mould filling and to produce a dense microstructure resulting in a finished product that has improved mechanical properties compared to a gravity cast wheel. On the other hand, it results also in slightly higher production cost than gravity casting.

After casting, the cast wheels are 100% **X-ray inspected** and then eventually heat-treated prior to machining. This step is followed by a **pressure tightness testing** before drilling valves and bold nut holes.

After an additional visual inspection, the wheels are **surface finished** (e.g. painted or varnished, this operation including an appropriate pre-treatment). 3D dimensional controls, dynamic balance checking, bending and rim roll fatigue as well as impact tests are statistically performed.

**Forged wheels manufacturing process**

The traditional wheel forging concept included several forging operations, rough machining, splitting, flow turning, heat treatment, final machining and numerous additional finishing steps, depending on design requirements.




The wheel is forged as a disk with a centre and a flange of metal around the outside, which is then split and rolled outward to form the rim halves. This step is similar to the flow forming (rim rolling) process used for cast wheels (see above). The centre is formed by coining and piercing in line with the forging process. The formed wheel is then solution heat treated and aged. Finishing steps include machining, drilling, deburing, optionally diamond turning and finally surface pre-treating and painting.

The production process includes the following steps:

The wheel is forged as a disk with a centre and a flange of metal around the outside, which is then split and rolled outward to form the rim halves. This step is similar to the flow forming (rim rolling) process used for cast wheels (see above). The centre is formed by coining and piercing in line with the forging process. The formed wheel is then solution heat treated and aged. Finishing steps include machining, drilling, deburing, optionally diamond turning and finally surface pre-treating and painting.

Surface finishing - Cast and forged wheels are often painted or polished and lacquered with a clear coat after a chemical conversion surface treatment. But in particular forged wheels can be subjected to a wide range of alternative surface treatments. Extreme care is taken in the machining and finishing processes resulting in a complete wheel that is not only optimally balanced and strong but also superior in appearance and more durable[5].

## *Quality Control & Certification*

Before painting and finishing a manual inspection is completed on the wheel to check for any defects. They measure the individual elements of the wheel to make sure that they meet the design specification. A 'brute force' inspection is also completed, with the wheel put under some immense pressure to find the breaking point.

As the final stage, the wheel is then checked for quality. After it has been painted and protected, an employee will sit by the conveyor belt and check the wheel for any marks or dents that will prevent it from sale[6].

TÜV certification is one of the most highly-respected certifications that guarantees quality and safety for the consumer.

The European Union designated UN/ECE 124 as the safety certification for alloy wheels for automobiles. The UN/ECE 124 regulation is an EU standard, above and beyond each country's individual certifications, and guarantees wheel quality and safety. It is mandatory that UN/ECE 124 certified wheels be the same size as the original wheels provided by the auto maker, and also calls for the same mounting system as the original. Precisely because the sizes are the same as the originals, ECE certified wheels can only be mounted on a limited number of automobiles.

## *Capital requirements*

For a plan with 10,000 pcs/month capacity approximately 4000 sqm area of land is required[7].

A sample list of machines required for a aluminium wheel plant is given below[8]:

| Machine | Quantity |
|---|---|
| Hold Furnace with Testing Machine | 10 |
| Hydraulic Die Casting Machine with Sand Blast Machine | 4 |
| Heavy Duty Precision Lathe Machine with Conveyor | 2 |
| Drilling Machine with Hydraulic Chuck | 2 |
| Solution Furnace with Blower | 1 |
| Structure Unit for Heat Treatment Equipment | 1 |
| Age Furnace with Blower | 1 |
| Shot Hanger Blast Machine | 1 |
| Automatic Turning Machine | 2 |
| Drill Vent Machine | 2 |
| Vertical Copy Lathe Machine with Chuck | 2 |
| Rear Copy Lathe Machine with Chuck | 2 |
| Leakage Testing Machine | 2 |
| Multi-Spindle Drill Machine | 2 |
| Defat Machine with Cooling System | 1 |
| Painting Booth with Compressor | 1 |
| Finish Copy Lathe Machine with Chuck | 1 |
| Oven | 2 |
| Hydraulic Press for Bush Inserting | 1 |
| Painting Booth for Clear with Pallet | 1 |
| Universal Wheel Balancing Machine | 1 |
| Dynamic Radial Fatigue Test Equipment | 1 |
| Universal Tensile Strength Test Equipment | 1 |
| Air Compressor (60HP) | 1 |
| Cantilever Drilling Machine | 1 |
| Vertical Type Universal Milling Machine | 1 |
| Band Saw | 1 |
| Inspecting Graplate | 1 |
| Cooling Tower | 1 |
| Oil Furnace | 1 |
| Impact Test Equipment | 1 |
| Dynamic Corner Fatigue Test Equipment | 1 |

## Labor

Wheel production requires skilled and experienced labor. Labour requirements depend on the extent of manufacturing process automation.

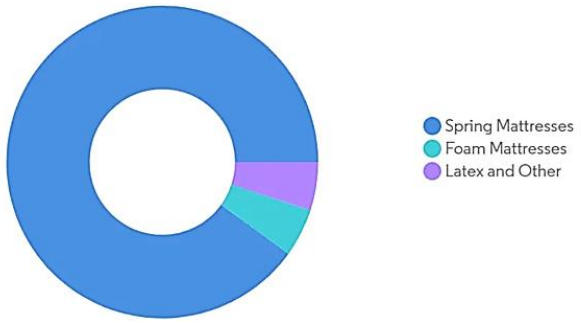
## Energy

Electricity and water are the main inputs in aluminium wheel production. Water consumption a day is about 750 $m^2$ for a plant with a capacity of 10,000 pcs/month[9].

# 3. PRODUCT: MATRASSES

Türkiye is one of the biggest mattress producers. Its market is expected to increase by 6% CAGR during 2021-2026. *Spring mattress dominates the market (and continues to dominate in coming years) – in 2020 they* accounted for around 90% of the mattress market in Türkiye, with foam mattresses accounting for over 5%, whereas Latex and others contributing for the remaining 5% (Figure 3.1).

**Figure 3.1: Production of Spring, foam and other mattrasses in Türkiye in 2020, %**

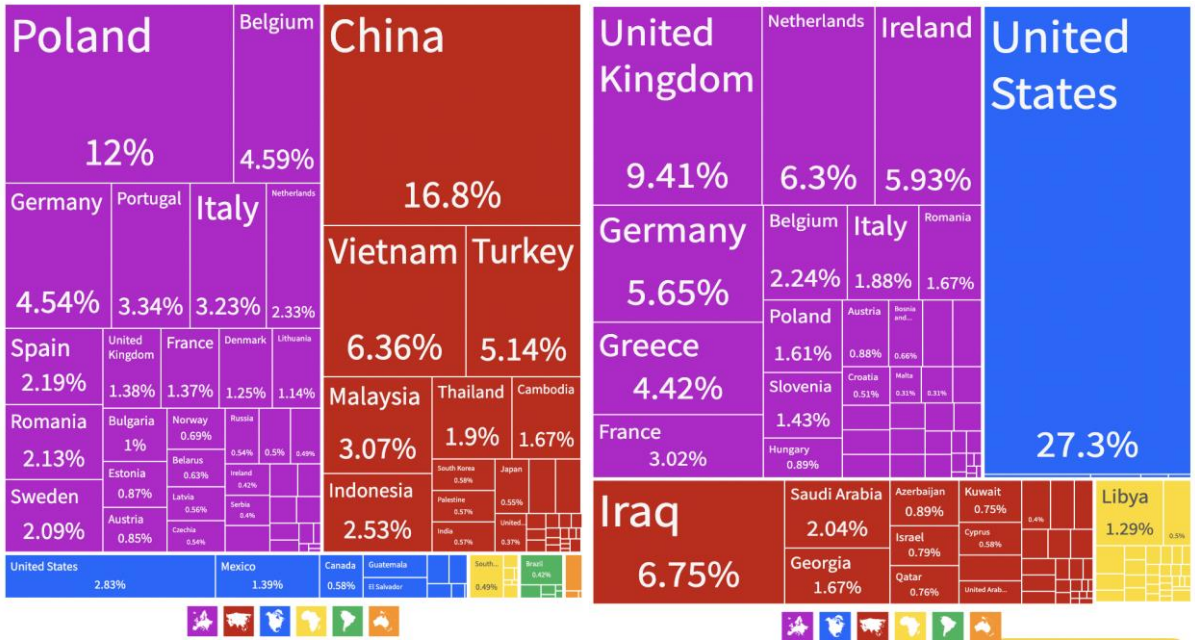



Spring or foam has a significant cost in mattress production, and mattress makers must pay a significant amount for transportation costs, therefore spring shipping is significantly less expensive than foam shipping. Türkiye boasts several high-quality spring producers. While many countries focused on producing standard springs and cutting costs, Turkish spring manufacturers, for example, Iskeceli Yay focused on R&D to create more unique products. The main reason for the increased manufacturing of spring mattresses is that there are numerous spring kinds available for use in mattresses which have been attracting customers at an increased pace. Pocket springs, Bonnel springs, continues springs, LFK Springs, Offset Springs, and Verticoil Springs are examples of these types of springs that add different advantages for mattresses and ultimately benefit the end-users.

Türkiye was fourth biggest exporter of mattresses (HS 940429) in 2020 (Figure 3.2). Türkiye is at a strategic location for mattress production, both geographically and in terms of labour, energy, and raw material availability, which altogether helping the makers to expand their business.

Most Turkish mattress manufacturers have been exporting their products to Europe due to their growing demand. Top European importers of Turkish mattresses in 2019 are United Kingdom (9.41%), Netherlands (6.3%), Ireland (5.93%), Germany (5.65%), and Greece (4.42%).

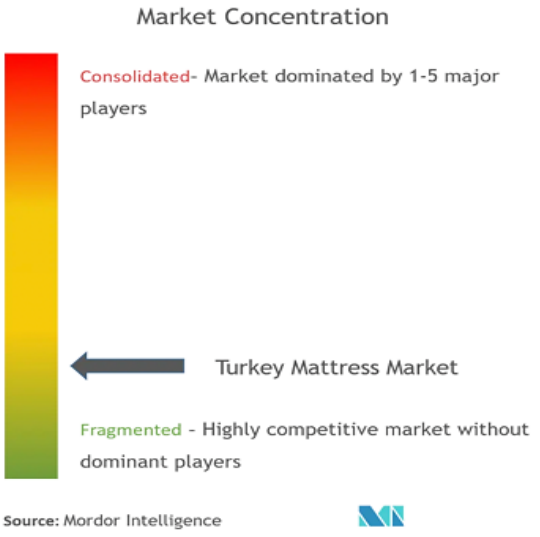
**Figure 3.2: World's top Exporters of HS 940429 | Mattresses (left) in 2020 and Importers from Türkiye (right) in 2019[49].**




*Source: https://oec.world/*

Some of the key players in the Türkiye mattress market are Berfa Group, BedGo, Innova Bedding, Homevs, Sohret, Visko Love, Istikbal, Bellona, Yatas, and Idas. Kayseri[50] takes the lead in export - accounting for over half of the total export value (Istanbul is another important hub for this business) Kayseri is also renowned as a pioneer in mattress production due to its access to raw materials, accessible logistical network, and industrial development. In 2019, Kayseri produced 20 thousand mattresses each day, followed by Istanbul and Izmir. In Kayseri, there are around 400 manufacturers. The mattresses made in Kayseri are primarily shipped to France, Germany, and the Netherlands, as well as other European countries and Middle Eastern countries.

**Figure 3.3: Türkiye mattress market, by type, in %, 2020**




Turkish mattress industry is represented by International Bedding Industry Association (IBIA), a platform that aims to gather the mattress manufacturing industry under one roof. IBIA started its operations in 2021 and currently have 80 member companies that employ 18 thousand people (in total 25 thousand people are employed in mattress industry)[51]. According to Mr. Osman Güler, President of the IBIA, Turkish mattress industry sector aims to export 3 billion dollars in 2023[52].

[49] DATA OF IMPORTS FROM TÜRKIYE IS NOT AVAILABLE FOR 2020.

[50] INDUSTRIAL CITY IN CENTRAL ANATOLIA

[51] HTTPS://WWW.IBIA.ORG.TR/TURKIYE_YATAK_SEKTORUNDE_DUNYADA_14_SIRADA_YER_ALIYOR

[52] HTTPS://WWW.IBIA.ORG.TR/TURKIYE_YATAK_ENDUSTRISI_SEKTORU_2023TE_3_MILYAR_DOLARLIK_IHRACAT_HEDEFLIYOR

## PRODUCT: MATTRESSES WITH SPRING INTERIORS

**HS Code:** 94042910

**EU MFN Tariff:** 7.5%

**Rules of Origin:**

Manufacture from materials of any heading, except that of the product. Manufacture in which the value of all the materials used does not exceed 40 % of the ex-works price of the product.

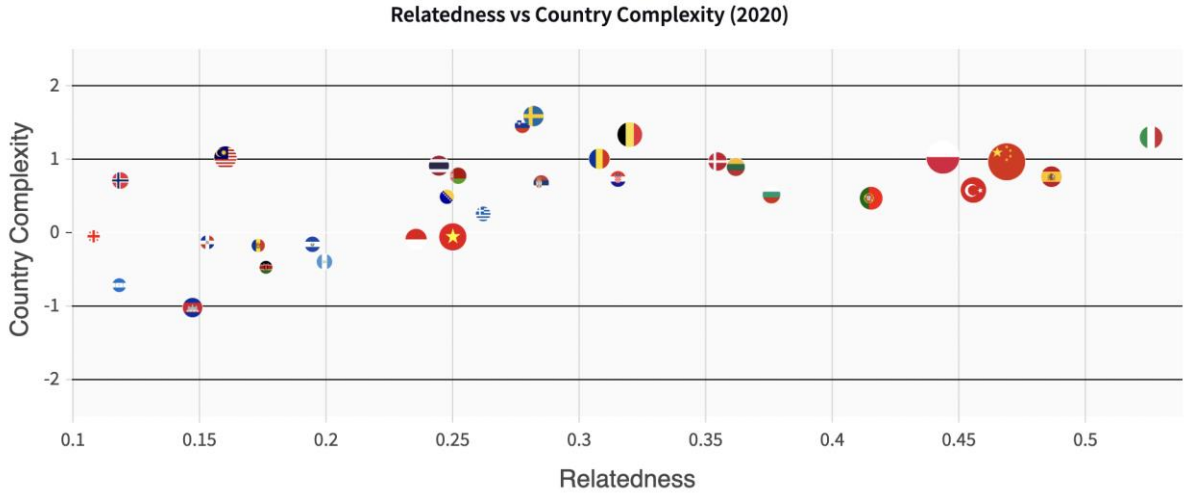
## Trade Statistics (HS 940429)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 25% |
| TR Exports Share in EU Imports in 2020: | 6% |
| TR Exports in 2020 (HS 94042910): | € 43,073,049 |
| GE Exports to EU27 in 2020: | € 607,000 (€621,000 to the world) |
| World Exports in 2020: | € 2,565,440,000 |

## Revealed Comparative Advantage (RCA) & Product Complexity

**(HS 940429 |** Mattresses with spring interiors)[53]:

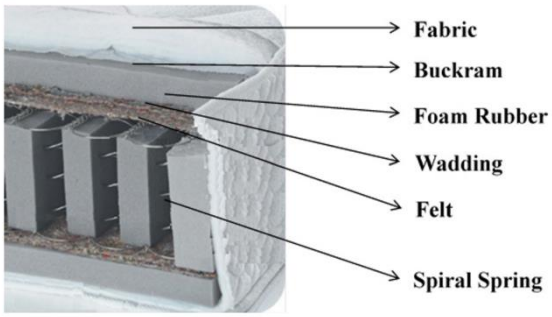
**RCA > 1**




*Source: https://oec.world/*

[53] THE COMPLEXITY-RELATEDNESS DIAGRAM COMPARES THE RISK AND THE STRATEGIC VALUE OF A PRODUCT'S POTENTIAL EXPORT OPPORTUNITIES. RELATEDNESS IS PREDICTIVE OF THE PROBABILITY THAT A COUNTRY INCREASES ITS EXPORTS IN A PRODUCT. COMPLEXITY IS ASSOCIATED WITH HIGHER LEVELS OF INCOME, ECONOMIC GROWTH POTENTIAL, LOWER INCOME INEQUALITY, AND LOWER EMISSIONS.

## *Production: Major materials used in production*




- **Fabric** - A woven cloth of organic or inorganic filaments
- **Mattress frame** - Mattresses are constructed by knitting spiral springs, which are made of high carbon reinforced steel fibre processed with heat treatment
- **Buckram** - A coarse cloth made of linen or hemp, stiffened with size or glue, which is used in garments to keep them in the desired form
- **Felt** - Nonwoven fabric made by stratifying thin sheets of carded wool fibers, which is processed under heat, moisture, and pressure to shrink and compress the fibers into a thick matted cloth that will not ravel or fray. The felt uniformly distributes the weight on bed surface
- **Foam rubber** - Light and spongy rubber which is used as a padding material in the mattress
- **Wadding** - Soft fibrous cotton or wool material which is used for stuffing (wad) between fabric and mattress frame[54].

Türkiye has exported 19,506,357 € Mattress supports, springs (HS Code 94041000) to the EU in 2021.

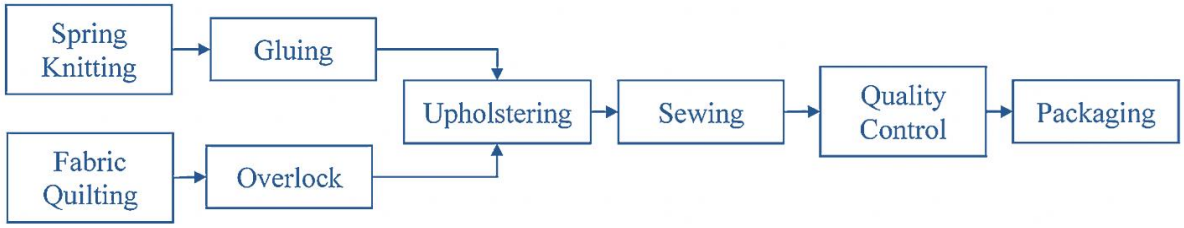
## *The Manufacturing Process*

Spring mattress manufacturing line consists of eight workstations, namely Spring Knitting, Gluing, Fabric Quilting, Overlock, Upholstering, Sewing, Quality control and Packaging.

The mattress manufacturing process starts in two different lines:

(I) Mattress frame is built in the Spring Knitting station at the first line. Then appropriately sized felt and foam rubber are glued up to that mattress frame in the gluing station.

(II) The second branch of manufacturing line consists of Fabric Quilting and Overlock stations. Fabric, buckram, wadding and foam rubber are sewn with appropriate designs (pattern) according to the features of mattress being produced. Afterwards, quilted fabric is overlocked if necessary.




After the completion of processes in these two lines, semi-finished products (mattress frame and quilted fabrics) are combined in Upholstering station. Top and bottom quilted fabrics and lateral fabric (called bordure) are combined with straight binding process in the sewing station. In the quality control

[54] HTTPS://SPRINGERPLUS.SPRINGEROPEN.COM/TRACK/PDF/10.1186/S40064-016-2947-1.PDF

station, scrap suture strands are removed from spring mattresses and physical examination test is carried out. Finally, the spring mattress is packaged automatically in the package station[55].

## *Quality Control & Certification*

Quality control is done at the quality control station, where scrap suture strands are removed from spring mattresses and physical examination tests are carried out.

Manufacturing mattresses for the EU market should comply with

- General Product Safety Directive (GPSD)
- Mattress EN Fire Safety Standards
- EN 16890 – Children's furniture – Mattresses for cots and cribs
- REACH
- EU Ecolabel
- Lab Testing

### Lab Testing

Manufacturers or importers should ensure their mattresses comply with the relevant regulations before entering the EU markets. The verification process could outsource to a third-party lab-testing company, such as: UL, QIMA, Satra, Intertek, TÜV SÜD

### Labor

Mattress industry is labor-intensive and requires specialized and experienced staff.

[55] HTTPS://SPRINGERPLUS.SPRINGEROPEN.COM/TRACK/PDF/10.1186/S40064-016-2947-1.PDF

# 4. PRODUCT: WHITE GOODS

Türkiye is the world's second-largest white goods producer after China, and the leading European manufacturer. Overall, production of white goods in the country hit USD 20.6 bn in the first half of 2021, which means an increase of almost 25% compared to the same period last year.

Sales of white goods by Turkish manufacturers rose by 41% to approximately 17.43m units in the first half of 2021, driven by a 47% rise in exports.[56]

White Goods Industry, included in the scope of electricity appliances as well as durable goods, possesses a wide range of products due to the varying technologies it incorporates. Refrigerator, deep freezer, washing machine, dryer, dishwasher, and oven are regarded as the six main products whereas durable goods such as cookers, vacuum cleaners, toasters, food processors, fruit presses, blenders, and mixers are included in the small home appliances category. Products such as air-conditioners, water heaters and water purifiers are also counted among the electricity home appliances.

With its production capacity of 25 million units and actual production of 21 million units, the white goods industry has become a significant focus of production in the last 10 years and Türkiye has become the leading country in Europe in the white goods sector.

The industry, having achieved 14 million units in exports, is exporting 70% of its manufacture to more than 100 countries in such markets as European countries, neighboring countries, and Africa.

The white goods companies operating in Türkiye are making significant investments in the R&D (Research and Development) area and they are able to achieve success in the world as a result of the competitive power they gain through these investments.

The white goods sector also strikes out with the number of its patent applications. Having assumed a leading position in many white goods categories, Türkiye is making a significant impact in the world with the washing machine that consumes the least water, the dishwasher that washes fastest and consumes the least water, the refrigerator and tumble dryer that consumes the least energy, the most silent washing machine, dishwasher, and oven.[57]

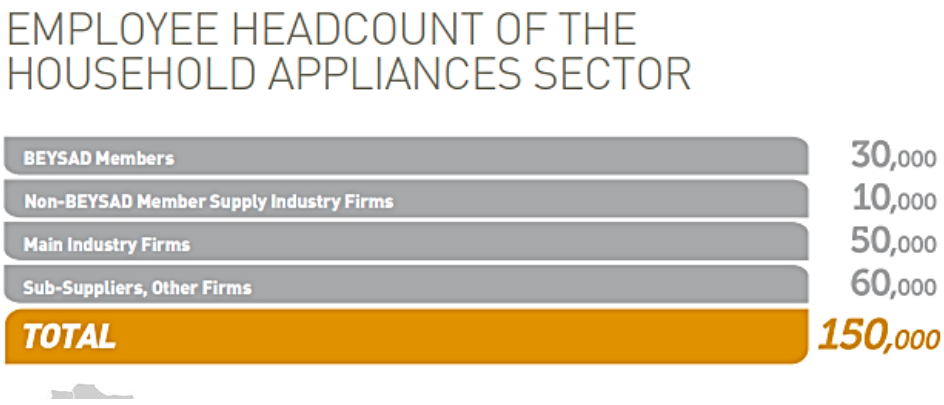
White Goods Manufacturers' Association of Türkiye (www.turkbesd.org) TÜRKBESD, was established in 1986 by the leading white goods companies of the sector. In 1999, it became a member of the European Union's senior organization of the field APPLİA (Home Appliance Europe), Currently,

[56] HTTPS://WWW.PLASTEUROPE.COM/NEWS/WHITE_GOODS_TÜRKIYE_T248404/#:~:TEXT=TÜRKIYE%20IS%20THE%20WORLD'S%20SECOND,SEE%20PLASTEUROPE.COM%20OF%2020.08.

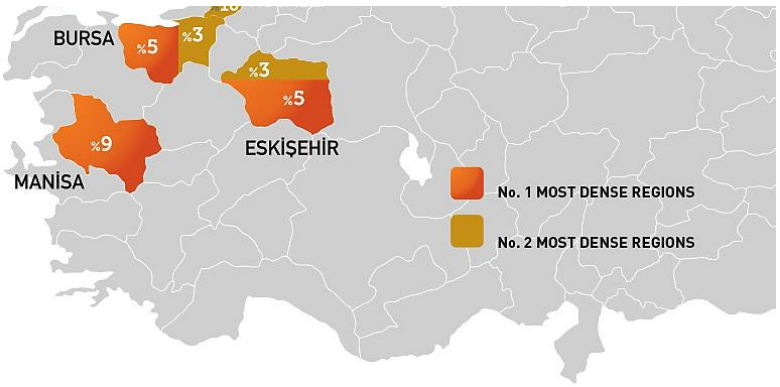
[57] HTTP://WWW.TURKBESD.ORG/BILGILER.PHP?P=3

the association has ten members: Arçelik, Arzum, B/S/H, Candy Group, Dyson, Electrolux, Groupe SEB, Miele,Silverline and Vestel. The association represents approximately 90% of the sector.

Turkish Household Appliances Suppliers (TURKHAS) is a marketing cluster, which has been brought into the life with the support of Ministry of Trade in 2016. The project is carried out by Turkish Electro Technology Exporters' Association (TET) and it consists of 23 leading appliance manufacturing companies, where all of them are also members of The White Goods Suppliers' Association (BEYSAD). The aim of this Cluster Project is to support cluster members to expand overseas and gain recognition in foreign markets by organizing trade & investment missions and participations at international fairs.




**THE REGIONS WHERE THE SECTOR'S SUPPLIERS ARE MOST DENSELY LOCATED**





*Source: www.turkbesd.org*

## PRODUCT: DISHWASHING MACHINES OF THE HOUSEHOLD TYPE

**HS Code:** 842211

**EU MFN Simple Average Tariff:** 2.7%

**Rules of Origin:**

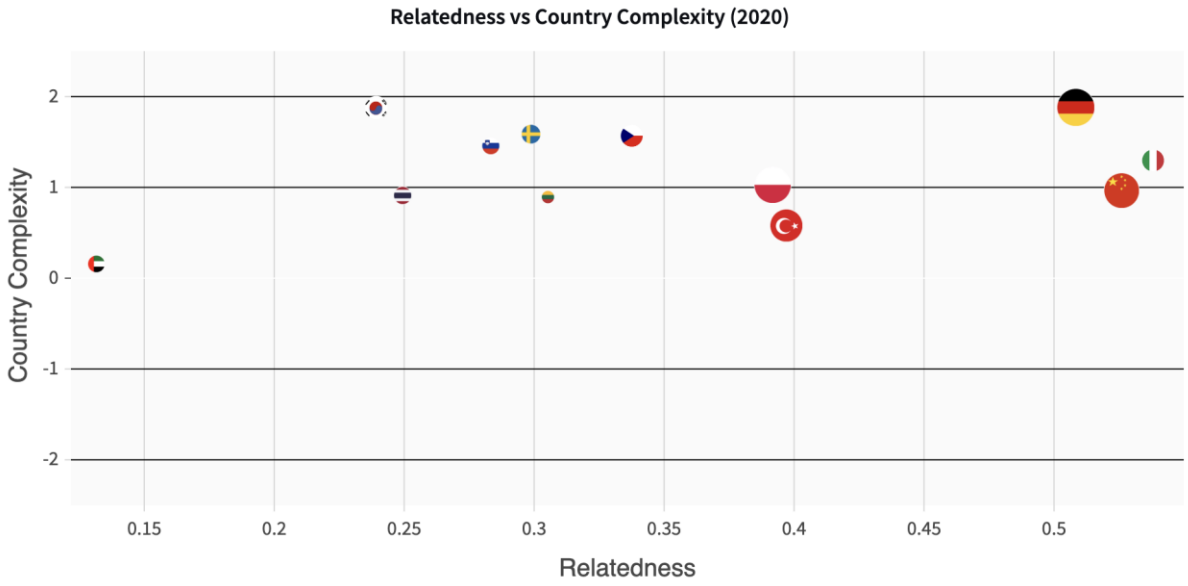
Manufacture from materials of any heading, except that of the product, and in which the value of all the materials used does not exceed 40 % of the ex-works price of the product Or Manufacture in which the value of all the materials used does not exceed 30 % of the ex-works price of the product

### Trade Statistics

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 14% |
| TR Exports Share in EU Imports: | 14% |
| TR Exports in 2020: | € 320,446,000 |
| GE Exports to EU27 in 2020: | € 0 (€ 25 to the world) |
| World Exports in 2020: | € 4,283,641,000 |

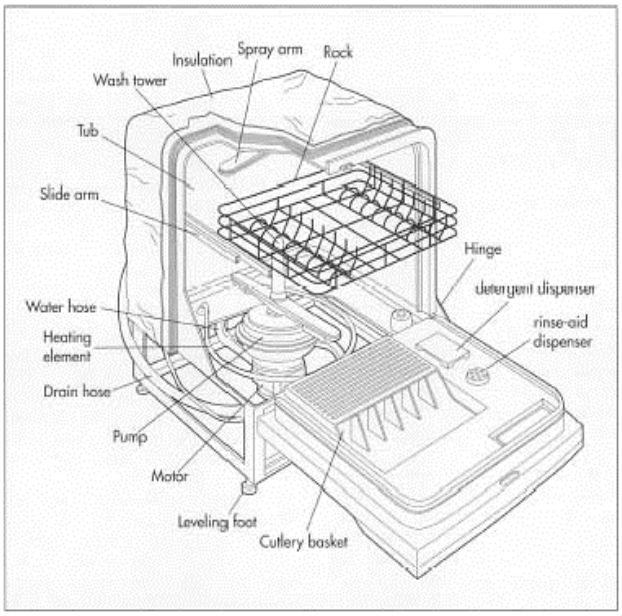
### Revealed Comparative Advantage (RCA) & Product Complexity

**RCA > 1**




*Source: https://oec.world/*

## *Production: Major material used in manufacturing*




The major components of a dishwasher are made of **steel** and **plastic**. The basic structure consists of a steel frame assembly and a steel door panel. **Sheets of stainless steel** are purchased and fabricated in the required pieces and shapes in the factory; both the door and the wrap-around cabinet for standalone models are purchased as **coiled sheet steel** that has been prefinished in several standard colors. Other small steel parts are designed in house but made by suppliers to the manufacturer's specifications.

The racks that hold the dishes are also made of steel, but it is delivered to the factory as **coiled wire**. To coat the rack tines to prevent them from scratching dishes, the racks are dipped in plastic in the form of **powder polyvinyl chloride (PVC) or nylon**.

The inner box that holds the racks and the washer arms is called the tub. It is a single piece (not counting the piece lining the inside of the door) that is injection-molded in the plant. The injection molding is done with **pellets of calcium-reinforced poly-propylene plastic**. This plastic is respected for its strength and for the fact that it is inert; that is, it won't react with chemicals like those in detergents and is resistant to water and heat. Many other parts including the basket for cutlery, containers for detergent, and the wash tower and spray arms are also injection molded.

**Motors**, **pumps**, and **electrical controls and components** are made by subcontractors in accordance with designs by the dishwasher manufacturer.[58]

## *Manufacturing Process*

1. A dishwasher begins to take shape with the injection molding of the tub. Two molds—the cavity relief mold for the outside of the tub and the core relief mold for the inside—have previously been etched into a steel tool, that, when fitted together, contains a void or space that is the shape of the tub. The tool halves are held together in the chamber of the injection molding machine. Pellets of polypropylene are melted in the machine at high temperature and injected by pressure into the void in the tool. The high pressure and liquid state of the plastic forces the plastic into every pocket and crevice in the mold inside the tool. The tool opens to release the tub, which is still hot.

2. The warm tub is conveyed to a cooling area and cooled to a temperature that is easy for assembly workers to handle. Other plastic parts are also made by injection molding, and these smaller pieces are stored in bins (with one kind of part only per bin) that can be moved to the assembly area as needed.

[58] HTTP://WWW.MADEHOW.COM/VOLUME-6/DISHWASHER.HTML#IXZZ7EXZ3JZJP

3. In another part of the plant, the steel components of the dishwasher are made. Outer cabinets for stand-alone models and the doors for all models are cut and stamped into shape from stainless steel in the form of coils that are prefinished on one side. Flat steel bars that will be assembled into the dishwasher's frame are sheared to length. The racks are also formed with tools that trim, de-bur, and shape wire into the racks in two welding steps. The perimeter of the rack is called the "mat," and a tool welds all the wire pieces of the mat together at the same time. Similarly, the little pieces or tines that support the dishes are welded into place simultaneously. The completed rack is taken by conveyor to a cleaning station where it is cleaned and prepared to receive its PVC coating. The PVC is in the form of a fine powder that is baked onto the rack. The coated rack is then cured to finish forming the PVC coating and to allow it to cool.

4. Dishwashers are assembled at workstations along an assembly line. The workers are responsible for sets of pieces that are taken from bins alongside the workers. The frame is assembled first, and the motor or motors are attached to special mounts on the frame. The motors are provided to the line workers as completed assemblies. The tub is fitted and fastened into the frame over the motor or motors.

5. With the tub in place, the interior components are installed beginning with the filtering system. The wash tower and arms are attached followed by sets of rack rollers to support the racks and allow them to be rolled in and out of the machine so that dishes can be loaded easily. The racks are put in place along with the cutlery basket.

6. The door assembly is completed by installing the detergent dispenser and rinse-agent cups and the controls. The door is attached to the front of the dishwasher. The exterior is completed by finishing the electrical connections and feed lines (for clean and dirty water), and the exterior is insulated to reduce noise and the effects of heat that might warp counter tops and cabinets. Insulation is prefabricated with the insulating fibers wrapped in a foil-like covering. Called "bagged insulation," it is wrapped around the machine and packed inside the toe space. Under-counter models are now complete. Stand-alone models are finished by attaching the wrap-around cabinet and wood top. Each completed machine is loaded onto a cart to be moved to the packing area.

7. In the packing area, Styrofoam bumper sections are placed along the edges of the machine and enclosed by a carton. Packets of instructions and other materials are placed on top of the machine in the carton, and the carton is sealed and moved to a storage area for shipping.

## *Quality Control & Certification*

Quality control is assured by three basic processes. First, the assembly line workers are trained in quality issues and can reject parts or partially assembled machines. Second, the assembly process is overseen by line supervisors; when assembly is complete, quality engineers inspect the finished machine and test selected units. The most important part of the quality control process may be a design step that Amana Appliances calls a failure mode effects and analysis (FMEA). As soon as problems are observed during assembly or are reported by customers through the warranty process, corrective steps are taken. The analysis is a highly regimented learning process that continuously cycles improvements, customer feedback, and corrective actions through the marketing and design process so new models and lines benefit from any changes to the old.

With the increasing frequency of electronic parts in white goods, product safety and reliability are essential to consumers. To improve fire resistance, flame retardant additives are commonly infused into plastic parts that encase the circuitry and electronics, such as washing machine shells and refrigerator back panels.

However, from the perspective of the injection molding process, flame retardant additives introduce corrosion risk to hot runners which can lead to defective parts and unplanned downtime. To reduce this risk hot runners' need to incorporate anti-corrosive components.[59]

Eco-design and energy labelling - Dishwashers

Regulation (EU) 2019/2022 and Delegated Regulation (EU) 2019/2017

| Short name: | **Eco-design and energy labelling - Dishwashers** |
|---|---|
| Base: | Commission Regulation (EU) 2019/2022 of 1 October 2019 laying down eco-design requirements for household dishwashers pursuant to Directive 2009/125/EC of the European Parliament and of the Council amending Commission Regulation (EC) No 1275/2008 and repealing Commission Regulation (EU) No 1016/2010 (OJ L 315, 5.12.2019, p. 267<br><br>Commission Delegated Regulation (EU) 2019/2017 of 11 March 2019 supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of household dishwashers and repealing Commission Delegated Regulation (EU) No 1059/2010 (OJ L 315, 5.12.2019, p. 134 |
| Guide for application: | Guidance on CE marking for professionals |

## *Capital Requirements*

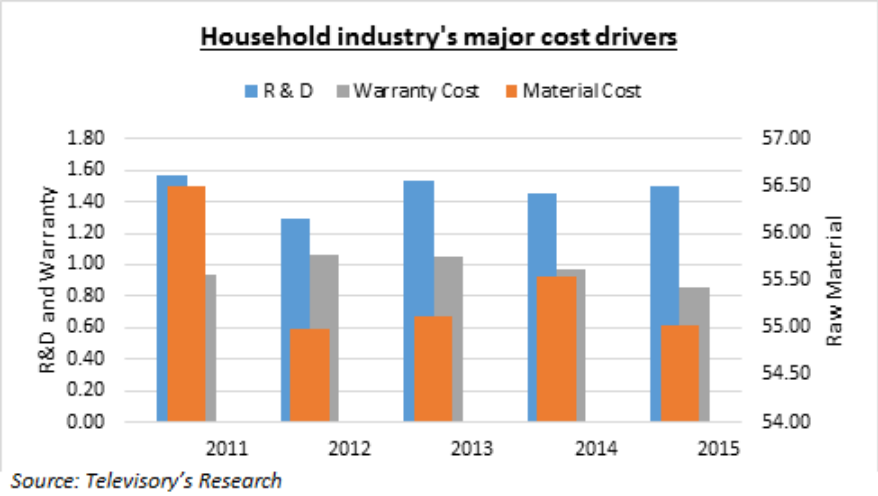
Development of production facility requires high capital investment. The factory in Romania was built on an area of over 70 hectares and required an investment of EUR 150 million.

## *Costs*

The cost structure of household appliance manufacturers is primarily dominated by **raw material costs**. The changes in the market price of steel have a direct influence on the production costs. In 2015, when the steel prices fell, the production costs also decreased for the companies. The below chart portrays the percentage and material cost accounts for a significant portion (almost 55%) of the total costs.

Moreover, R&D is another important cost component that determines the product's ability to capture newer market amidst global competition. Enhancements in design, features and after sales services largely impact customer decision. Fluctuations in exchange rates also have a paramount bearing on the costs.[60]

[59] HTTPS://MASTIP.COM/NEWS/WHITE-GOODS-TRENDS/INVESTING-FOR-NESTING-TOP-3-TRENDS-FOR-WHITE-GOODS-INDUSTRY/
[60] HTTPS://WWW.TELEVISORY.COM/BLOGS/-/BLOGS/HOUSEHOLD-ELECTRIC-APPLIANCE-MANUFACTURING-THE-KEY-PLAYERS-AND-THEIR-VIGOUR-TO-BALANCE-COSTS-AND-RETURNS



*Source: Televisory's Research*

**Labor**

Modern manufacturing process is highly technology intensive, automated and requires labor with high skills. The new factory which operates based on Industry 4.0 principles in Romania, producing 2.2 million washing machines per year has over 1,400 employees.

**Energy**

Factories require electrical energy. The new factory in Romania has its own photovoltaic park, which produces 1 million kWh of electricity per year.

## Case Study

Arctic, the biggest appliance producer in Romania, part of Turkish group Arcelik, announced that its new washing machine factory in Ulmi, Dambovita county, is fully operational. The company said this is the first factory in Romania that operates based on Industry 4.0 principles.

The factory was built in just 17 months on an area of over 70 hectares and required an investment of EUR 150 million. EIB has provided EUR 68 mln to Arctic for new factory in Romania.

The factory implements the most recent technological innovations and automation processes, including Industrial Internet of Things (IIoT) applications, smart equipment, interconnected devices, and cooperative robotic technologies. The plant can produce 2.2 million washing machines per year, which makes it one of the largest such units in Europe.

"The new washing machine factory in Ulmi is an important step in turning Romania into an appliance production hub for the whole Europe. The factory has created over 1,400 new jobs and our products will reach over 85 countries. At the same time, the new factory is the first green production unit in Romania and a candidate for LEED Platinum certification, the highest that such a factory can achieve," said Arctic CEO Murat Büyükerk in a press release.

The industry 4.0 concept defines the fourth industrial evolution and uses the most recent artificial intelligence, machine learning and robotic technologies, which can increase productivity by 30%. More than 70% of the production operations are based on self-determined and self-managed system, and quality control is 100% automatized, according to Arctic.

The factory also uses a modern wastewater treatment system and has its own photovoltaic park, which produces 1 million kWh of electricity per year.

"Due to the advanced technologies implemented, water consumption per product will reduce by 28%. Water used in the production process will be almost 100% recycled and reused, plastic, metal, wood, cardboard, and metal waste will be collected separately, and the factory is equipped with renewable energy source and green areas outside and inside, for better air quality," said Murat Büyükerk.

Since 2002, when Arctic became part of Arcelik group, the company has increased its turnover almost eightfold, from EUR 60 million to EUR 498 million, and the production capacity also saw a similar increase, reaching over 2.9 million units per year at the refrigerator factory in Gaesti. The company has invested over EUR 170 million in new technologies and modern production management systems.

With 4,400 employees, Arctic is one of the biggest exporters in Romania, with 80% of its local production reaching over 85 markets in Europe, Africa, and Asia.[61]

## PRODUCT: AUTOMATIC WASHING MACHINES, OF A DRY CAPACITY <6 KG

**HS Code:** 845011

**EU MFN Tariff:** 2.9%

**Rules of Origin:**

Manufacture from materials of any heading, except that of the product, and in which the value of all the materials used does not exceed 40 % of the ex-works price of the product

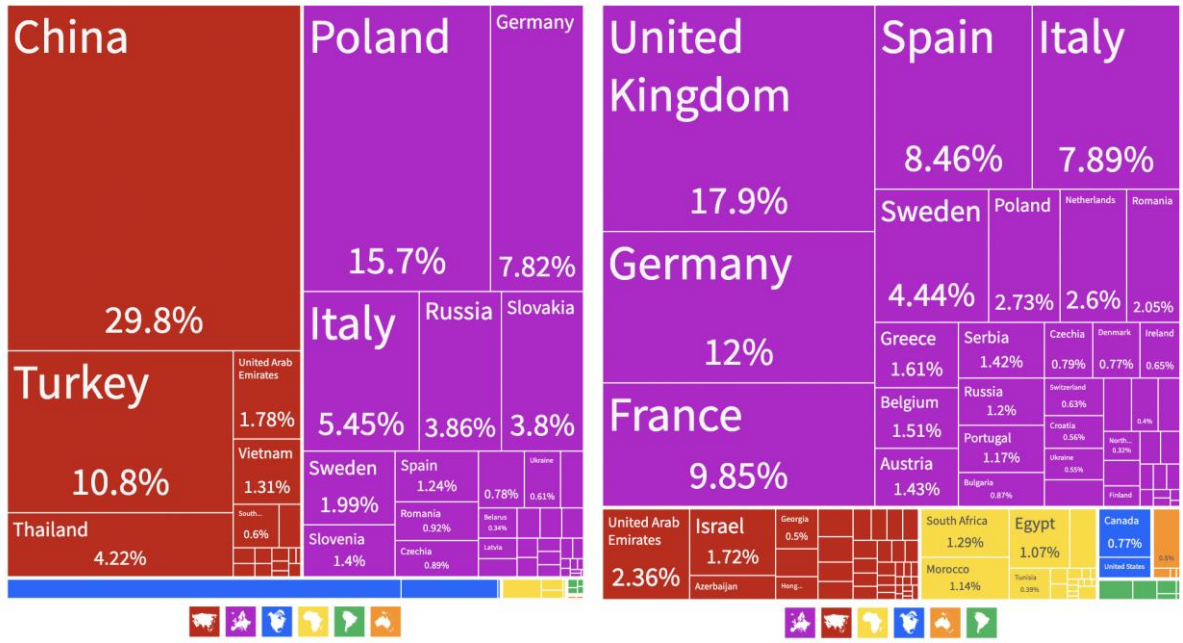
### Trade Statistics (HS 845011)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | -2% |
| TR Exports Share in EU Imports in 2020: | 14% |
| TR Exports in 2020: | € 476,862,000 |
| GE Exports to EU27 in 2020: | € 0 (€ 233,000 to the world) |
| World Exports in 2020: | € 7,193,970,000 |

Türkiye is the third biggest exporter of automatic washing machines of a dry capacity <6 kg (845011) after China (29.8%) and Poland (15.7%). Most of Türkiye's export goes to Europe – United Kingdom (17.9%), Germany (12%), France (9.85%), Spain (8.46%), and Italy (7.89%) are the biggest importers (Figure 4.1).

[61] HTTPS://WWW.ROMANIA-INSIDER.COM/ROMANIA-ARCTIC-MODERN-FACTORY-INDUSTRY-4.0

**Figure 4.1: World's top exporters of HS 845011 | Automatic washing machines, of a dry capacity <6 kg (left) and importers from Türkiye (right) in 2020.**

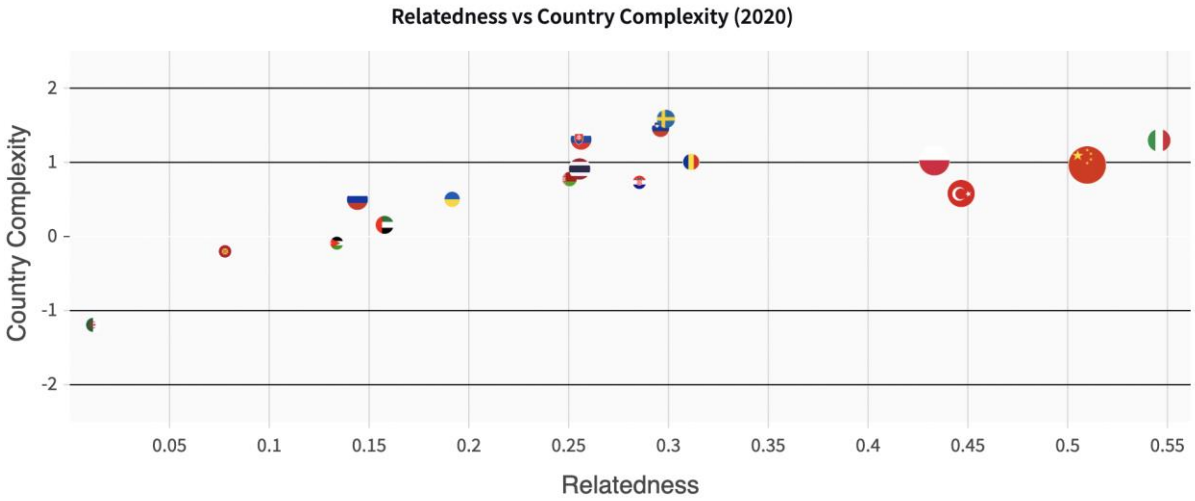



*Source: https://oec.world/*

## Revealed Comparative Advantage (RCA) & Product Complexity

**(HS 845011** | Automatic washing machines, of a dry capacity <6 kg)[62]

**RCA > 1**




*Source: https://oec.world/*

[62] THE COMPLEXITY-RELATEDNESS DIAGRAM COMPARES THE RISK AND THE STRATEGIC VALUE OF A PRODUCT'S POTENTIAL EXPORT OPPORTUNITIES. RELATEDNESS IS PREDICTIVE OF THE PROBABILITY THAT A COUNTRY INCREASES ITS EXPORTS IN A PRODUCT. COMPLEXITY IS ASSOCIATED WITH HIGHER LEVELS OF INCOME, ECONOMIC GROWTH POTENTIAL, LOWER INCOME INEQUALITY, AND LOWER EMISSIONS.

## *Production: Major materials used in manufacturing*

Many parts of a washing machine are manufactured from sheet steel, usually coated with zinc to improve rust resistance. The steel manufacturer supplies the metal in a coil, which allows the material to be cut to size with minimum waste or automatically fed into the forming process. On some models made by Speed Queen, the spin tub is made of stainless steel. All other models use a steel (called enameling iron) designed for a porcelain coating. For the wash tub, which isn't visible unless you open the machine cabinet, enameling iron with a porcelain coating is generally used. Whirlpool is the exception, using plastic instead of enameling iron for the outer wash tub.

Many other parts are plastic as well. Manufacturers receive raw plastic from which they fabricate parts in pieces about the size of a small ant, using them for machine components that do not bear weight and/or require extremely good rust resistance. Such parts include the pump, the tub guards (which prevent your clothes from being thrown out of the spin tub into the wash tub or the cabinet area), and the agitator.

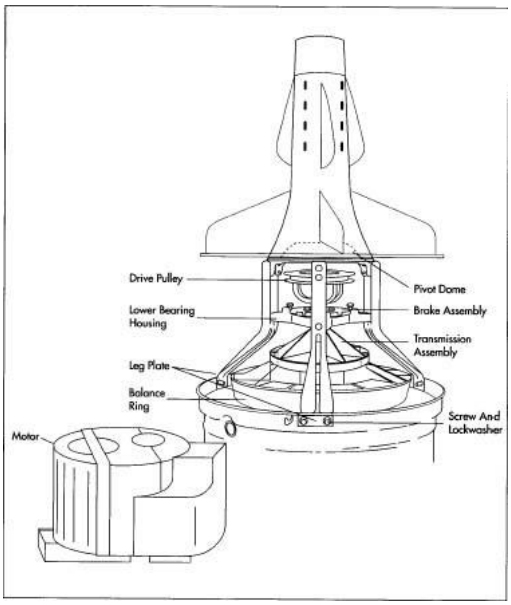
The transmission is generally made from cast aluminium, which arrives from the manufacturer in ingots—20-pound slabs of aluminium. Scrap parts are usually remelted and reused. Hoses, controls (timers, switches, etc.), and motors are purchased in prefabricated form from other manufacturers[63].

## *Manufacturing Process*

The manufacturing process is split into fabrication (making parts), sub-assembly (putting parts together to make components), and assembly (putting the components together to form the final product). The fabrication process comprises several different procedures, each specific to a particular type of raw material—sheet metal, plastic, or aluminium. Once the constituent parts have been made, they are assembled; major sub-assemblies, or components, include the transmission, the pump, the spin and wash tubs, the balance ring, and the painted parts. Finally, the sub-assemblies are put together inside the shell of the washer, which is then complete.

[63] HTTP://WWW.MADEHOW.COM/VOLUME-1/WASHING-MACHINE.HTML#IXZZ7LHEQ5B8I

## Fabrication




- Most sheet metal parts are formed by a machine called a press. This name is quite descriptive, as the machine actually presses (or squeezes) a piece of sheet metal between two halves of a mold called a die. The metal will take the form of the space between the halves of the die. Because metal in parts shaped by only one die tends to wrinkle, crack, or tear, multiple dies are generally used to form each component. Where possible, the metal is fed directly from a coil into the press. When this is not possible, the metal is cut to length and manually (or, with larger parts like the cabinet, automatically) placed into the die.
- Plastic parts are formed in an injection molding machine, a metal mold with one or more cavities in the shape of the desired part. After being heated to its melting point, the plastic is forced into the mold under high pressure. Next, water is passed through the mold to cool and solidify the part. The mold is then opened, and the part pushed out by ejector pins. When you look at a plastic part, you often can see small circles created by these pins.
- Aluminium transmission parts are formed into a rough shape in a die cast machine, which works much like an injection mold except that it does not use pressure. The molten metal is mechanically ladled into the mold and cooled. The ensuing rough casting is then given its final shape by various machines which drill holes, shave excess metal off critical surfaces, or cut metal away from the part.

## Sub-assemblies

- The transmission is assembled manually by workers who bolt, snap, or press (tight fit) several shafts and gears together. Workers then add a metered amount of oil and bolt the unit together.
- The pump is assembled automatically. Robots place the impeller and seals in the cover and body and seal the pump. Some manufacturers use heat and others vibration (which generates heat) as a sealant.
- The tub parts are made in presses, and the sub-assembly is manufactured automatically. After being rolled into a drum shape, the side is welded. The weld is then smoothed out and the drum is placed on a unit called an expander, which stretches the tub into its final shape. A bottom is then welded onto the drum, and this weld is also smoothed. If the tub is stainless steel, it is polished, so it won't snag the clothes. Otherwise, the tub is dipped in a solution called a ground coat and heated to about 1600 degrees until this coating hardens. If the tub will not be visible (the wash tub), the unit is done. If the tub will be visible (the spin tub), a finish coat is applied following the same procedure used with the ground coat; this final coat gives the tub either a white or blue color.
- The balance ring is a large weight that stabilizes the washer. Its outside structure is plastic, with a ring of metal melted into the plastic for strength. Cement is added and balanced precisely. This ring, which weighs more than twenty pounds, keeps the machine from "walking," or moving about, when it is in use.

- Washing machine manufacturers use any one of several painting processes. One manufacturer uses steel that has been prepainted by the steel manufacturer. Although cheaper, this type of steel does not offer the best rust protection because the cut edges are not painted. Other companies treat their parts with various chemicals to clean and ready them before applying paint. In some cases, the paint comes in a powder with a flour-like consistency. Mixed with air and given an electrical charge, the powder is sprayed on the part, which is hung from an overhead conveyor and given an opposite charge so that it and the powder will attract one another. After spraying, the conveyor moves the part into an oven that melts the paint; when the part cools, the paint process is completed.

**Assembly**

- This process begins with mounting the transmission on the balance ring. The transmission is set on a bearing that is bolted on the wash tub; the wash tub is sitting on a conveyor. Another bearing (the lower bearing), the brake assembly, and the drive pulley are put on the end of the transmission. Next, a pivoting mechanism called the pivot dome and legs are bolted on the assembly to hold all the pieces together.
- Using a hydraulically operated mechanism, workers then lift this assembly, called the module, onto the washer base. Springs are added to hold module and base together. A seal is added, the spin tub is bolted to the transmission inside of the wash tub, and its plastic covers are snapped into place. A plastic hub, which attaches the agitator to the transmission, is bolted onto the output end of the transmission shaft. Then the agitator is snapped onto the hub.
- The pump and a mounting bracket are now bolted onto the motor, which is then fitted with a shield to protect against potential leaks. This assembly is bolted to the base of the washing machine and connected to the transmission module with a belt and hoses.
- Next, the lid hinges are attached to the lid and the top. The top of the washer is bolted to the cabinet with a hinge for easy maintenance. A mixing valve to control the mixture of hot and cold is bolted to the back of the cabinet. The graphics panel, which provides words and pictures to explain the controls, is mounted on the control panel; the controls themselves are attached from the back. The wiring, connected as one unit, is called a harness. The harness is clipped to the control connectors at one end, and the other end is passed through a hole in the top to be mounted to the motor. Because of its large size and weight, the cabinet assembly is then placed in the washer by a robot.
- The cabinet is bolted to the base, and the controls are snapped together with the mating connectors on the module and motor. The drain hose is pulled through the cabinet and a part called the gooseneck is added. This part is what gives the hose its hook shape so that it will fasten into the drain. After being tested, the front panel is bolted on, and a packet of information and accessories is added.
- The finished unit is crated automatically. A machine opens the cardboard box, which was flat for shipment, and drops it over the washer. The top and bottom flaps are simultaneously folded over and glued. Then the machine applies pressure on the top and bottom of the crate to make sure the glue sets properly. After the glue has set, the machine puts a banding strap around the top of the crate to add strength for lift truck transportation (the units are carried from the top to reduce the risk of damage)[64].

[64] HTTP://WWW.MADEHOW.COM/VOLUME-1/WASHING-MACHINE.HTML#IXZZ7LHIFRFSG

## *Quality Control & Certification*

All parts purchased from outside manufacturers are spot checked before use, and most sub-assemblies are checked as well. For instance, all transmissions are automatically tested for operation, noise, and vibration. All pumps are leak-tested using air, automatically if their assembly was automated and manually if it was manual. All painted parts are visually inspected for defects. Daily samples are put in detergent, bleach, and steam baths for corrosion testing. Once it has been completely assembled, the machine is filled with water and tested for noise, vibration, and visual defects, as well as properly functional controls and mechanisms. After packaging, some units are put through severe tests to simulate the transportation conditions to test the cartooning process.

### Ecodesign and energy labelling - Washing machines and washer-dryers [65]

Regulation (EU) No 2019/2023 Delegated Regulation (EU) 2019/2014

| | |
|---|---|
| Short name: | Ecodesign and energy labelling - Dishwashers |
| Base: | Commission Regulation (EU) 2019/2022 of 1 October 2019 laying down ecodesign requirements for household dishwashers pursuant to Directive 2009/125/EC of the European Parliament and of the Council amending Commission Regulation (EC) No 1275/2008 and repealing Commission Regulation (EU) No 1016/2010 (OJ L 315, 5.12.2019, p. 267<br><br>Commission Delegated Regulation (EU) 2019/2017 of 11 March 2019 supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of household dishwashers and repealing Commission Delegated Regulation (EU) No 1059/2010 (OJ L 315, 5.12.2019, p. 134 |

## *Capital requirements and Cost Structure*

Capital requirements and cost structure is similar to dish washers, described in the previous chapter.

[65] HTTPS://EC.EUROPA.EU/GROWTH/SINGLE-MARKET/EUROPEAN-STANDARDS/HARMONISED-STANDARDS/ECODESIGN-AND-ENERGY-LABELLING-WASHING-MACHINES-AND-WASHER-DRYERS_EN

# 5. VALUE CHAIN OVERVIEW: TEXTILE/COTTON

Textiles is one of the largest and best performing sectors in the Turkish economy and has accounted for an average of 7% of GDP over the years. The sector accounts for 8.8% of the production value of the manufacturing industry and 9.9% of the value-added created in the manufacturing industry. Türkiye is the fifth largest exporter of textiles/apparel in the world and the third largest in Europe. Textiles account for 3.9% of Türkiye's total exports. The value of Turkish textiles and clothing products is growing significantly, with exports more than doubling since 2000. A large variety of textiles and items of apparel are exported to Germany, the United Kingdom, Spain, Italy and many other countries[66].

There are about 20,000 textiles manufacturers and 52,000 apparel manufacturers in Türkiye. The annual turnovers of these two groups of manufacturers amount to around EUR 30 billion and EUR 22 billion, respectively. One of the most important textiles production centers in Türkiye is Tekstilkent in Istanbul. The Tekstilkent Cooperative was founded in 1986 with the aim of solving problems such as insufficient infrastructure, transport and shipping challenges, irregular development, and the lack of sufficient security in various other locations, particularly in the Sultanhamam and Osmanbey markets, which house wholesale textiles trading and small production units[67].

Over the years, Turkish mills have invested in new machinery and technology to increase quality and to lower costs to stay ahead in the very competitive international textile trade. The increasing youth population, immigration to urban areas, and rapid growth in number of shopping malls with clothing stores significantly increased the total volume of textile products sold in Türkiye in recent years.

The cotton industry is one of the major segments in the country's fabric and textile industry. In 2020/2021 Türkiye ranked as the seventh biggest cotton producer in the world[68]. Türkiye's cotton business is expected to strengthen in the upcoming period due to an expected rise in the cotton harvested area, production, imports, and total domestic consumption. Cotton harvested area is likely to increase due to favorable weather conditions, rising global cotton prices, better yield, and the incentives from the Turkish government[69]. There are three major production regions in Türkiye for cotton: the Aegean region by the Aegean Sea in the western part of the country, the Cukurova region, which is in the southern part of the Adana province, in the Eastern Mediterranean area, and the Southeast Anatolia Project (GAP) in the Southeast Türkiye supported by the Turkish Government (the largest are for cotton production in Türkiye). Domestic cotton is mainly sold directly to mills and the remainder is traded on a spot basis at the exchange in Izmir. The Izmir exchange also trades some cotton from other regions and countries. There are smaller spot markets in Adana and in the Southeast.

According to the latest report released by The United States Department of Agriculture (USDA), both cotton planting area and cotton production in Türkiye are set to increase in Marketing Year (MY) 2021/22. Turkish cotton planting area and production which are for MY 2020/21 is estimated at 0.35 mln hectares and 0.63 mln MT[70], are forecasted to increase in MY 2021/2022 by 29% and 14%, respectively.

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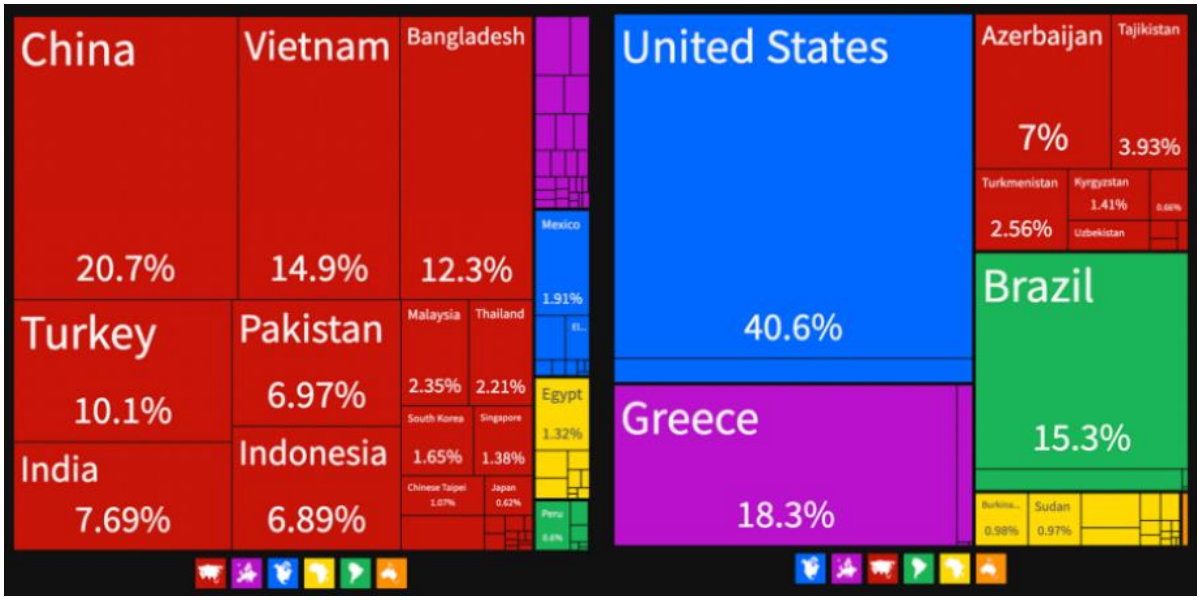
[66] SECTORAL ROADMAPS: TEXTILE SECTOR IN TÜRKIYE, 2020. UNDP.
[67] IBID.
[68] HTTPS://WWW.STATISTA.COM/STATISTICS/263055/COTTON-PRODUCTION-WORLDWIDE-BY-TOP-COUNTRIES/
[69] HTTPS://WWW.FIBRE2FASHION.COM/NEWS/TEXTILE-NEWS/TÜRKIYE-S-COTTON-CONSUMPTION-TO-INCREASE-AS-PRODUCTION-RISES-276859-NEWSDETAILS.HTM
[70] METRIC TON

Domestic consumption in MY 2020/2021 is estimated at 1.6 mln MT and expected to increase slightly in MY 2021/22, reaching 1.65 mln MT (3 % increase), as the textile industry continues to be one of the most important sectors for the Turkish economy (according to the other estimates, the consumption may expand further by 10.61% in MY 2021-22[71]). As of March 2021, cotton yarn producers are working at full capacity, and orders are booked for several months. There has been an increasing demand from both European and U.S. markets and the domestic market for comfortable home style clothing due to COVID-19. According to the USDA, there are new cotton yarn production investments being made in Türkiye and there is a shortage of cotton fabric in the country because of a scarcity of cotton yarn.

Despite being cotton producer country, Türkiye is one of the biggest importers of raw cotton (HS 5201) and ranks fourth after China, Vietnam and Bangladesh (Figure 5.1). Total import value has increased by 7% on average annually from 2016 to 2020, while increased only by 2% in 2020 compared to a previous year[72]. As Türkiye is a major textile and apparel producer country, most of the cotton produced or imported is used domestically; only a minor amount is exported.

**Figure 5.1: Importers of raw cotton - HS 5201 (left); importers of raw cotton – HS 5201 to Türkiye (right), 2019.**




*Source: www.oec.world*

[71] HTTPS://WWW.FIBRE2FASHION.COM/NEWS/TEXTILE-NEWS/TÜRKIYE-S-COTTON-CONSUMPTION-TO-INCREASE-AS-PRODUCTION-RISES-276859-NEWSDETAILS.HTM
[72] WWW.TRADEMAP.ORG

## PRODUCT: BED LINEN

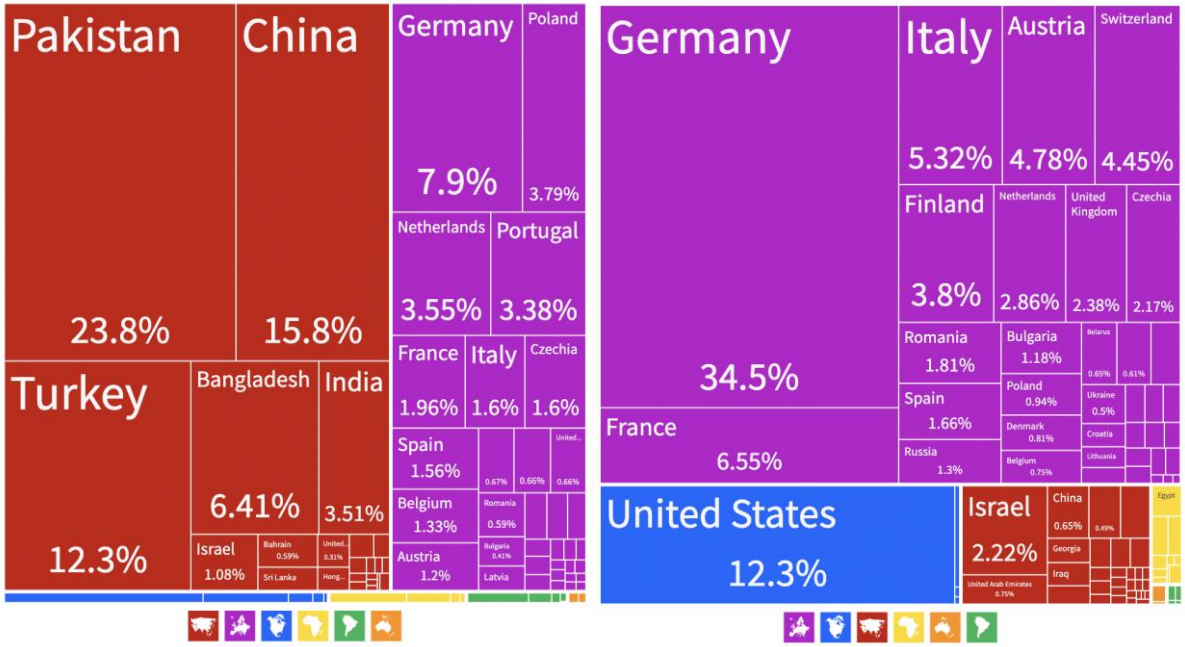
The Turkish home textile industry as a subsector of the Turkish textile industry, which is the world's fourth largest supplier and the EU's second largest supplier, has now a significant role in world trade and capacity to meet the high standards of all sophisticated consumers. The Turkish home textile industry is one of the world leaders with its wide range of products and superior quality in home textile production, especially in the production of towels, bed sheets and covers, curtains, tulle, embroidery, guipure, and quilt covers.

A major part of modern and traditional home textile manufacturing facilities are located in the Western Anatolia and Central Anatolia. Many details from raw materials to manufacturing techniques, machinery, and labor forces are 100% local. According to official records, the home textile industry, which employs more than 500.000 people in Türkiye, also continues manufacturing non-stop with over 3.000 facilities, 750 of which are medium and big sized[73].

As of 2020, Türkiye is the world third biggest supplier of Bed linen (of cotton, printed, not knit – HS 630221) preceded by Pakistan ($551M) and China ($364M)[74].

Europe is the largest importer of bed linen from Türkiye with Germany dominating by 34.5% of total bed linen imports, followed by France (6.55%) and Italy (5.32%)[75].

**Figure 5.2: Exporters of bed linen, of cotton, printed, not knit - HS 630221 (left) and importers of bed linen, of cotton, printed, not knit from Türkiye (right) in 2020.**



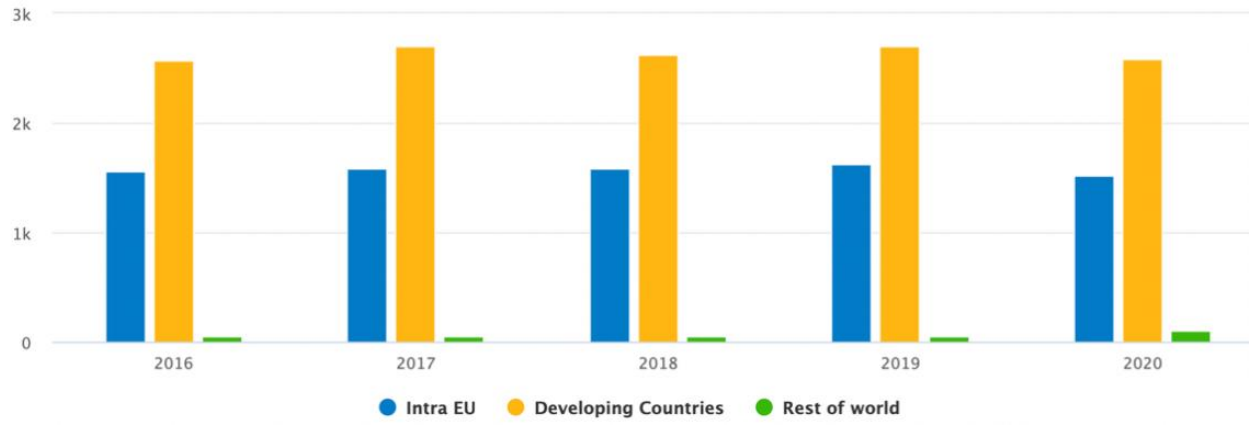

*Source: https://oec.world/*

The European market for bed textiles is stable. Almost two thirds of the import value is sourced directly from developing countries, making Europe an interesting market for bed textile manufacturers

[73] HTTPS://HOMETEXTILE.COM.TR/HOME-TEXTILES-INDUSTRY-IN-TÜRKIYE/
[74] HTTPS://OEC.WORLD/EN/PROFILE/HS92/BED-LINEN-OF-COTTON-PRINTED-NOT-KNIT
[75] IBID.

(Figure 5.3). Germany remains the biggest importer of bed textile through the years as it is the largest economy in Europe, home to nearly a fifth of the European Union's population. In addition to having a large domestic market, Germany is also a key trade hub within Europe[76].

**Figure 5.3: European imports of bed textiles (mln Euro)**




The Turkish Home Textile Industrialists' and Businessmen's Association (TETSIAD), the association of the Turkish home textile industry, has been serving the industry since its establishment in 1993. The association organizes home textile and accessories fair[77].

## Product: Bed Linen, Printed, Of Cotton, Not Knit or Crochet

### HS Code: 630221

### EU MFN Tariff: 12%

### Rules of Origin:

Manufacture from yarn or Manufacture from uncoated fabric, provided that the value of the uncoated fabric used does not exceed 40 % of the ex-works price of the product.

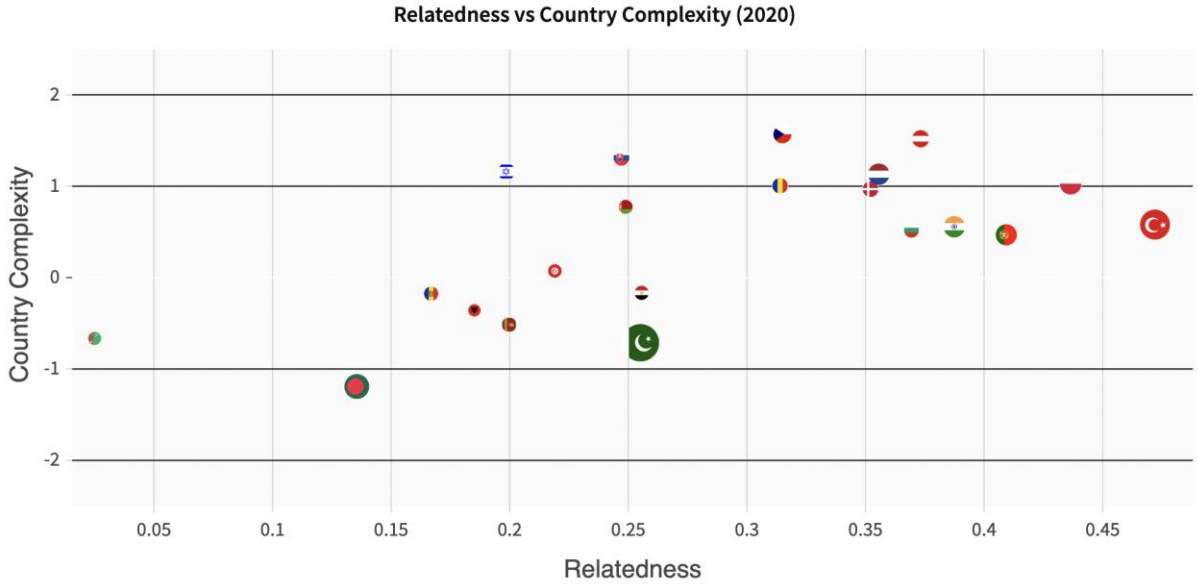
### Trade Statistics

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 2% |
| TR Exports Share in EU Imports: | 16% |
| TR Exports to EU27 in 2020: | € 175,158,000 |
| GE Exports to EU27 in 2020: | € 0 (€ 0 to the world) |
| World Exports in 2020: | € 1,504,328,000 |

[76] HTTPS://WWW.CBI.EU/MARKET-INFORMATION/HOME-DECORATION-HOME-TEXTILES/BED-TEXTILES/MARKET-POTENTIAL
[77] HTTP://WWW.TETSIAD.ORG/TR/FUARLAR-EVTEKS-FUARI.HTML

## Revealed Comparative Advantage (RCA) & Product Complexity[78]:

### RCA > 1




*Source: https://oec.world/*

## *Production: Major materials used in manufacturing*

The major raw materials required for production of bed linen are:

- Cotton (or cotton fabric dyed or undyed, if only cutting and sewing processes are moved to Georgia)
- Dye
- Sewing thread of various colors
- Packing materials

## *Manufacturing Process*

Some manufacturers spin the bales of cotton delivered to the manufacturer. Others purchase the yarn already spun on spools. This section will describe the process of making 100% sheeting from bales of cotton delivered to the plant which are not yet spun.

***Procuring the cotton*** - Bales of cotton are purchased and shipped to the sheeting manufacturer.

***Blending -*** Bales are laid out side by side in a blending area. The bales are opened by a Uniflock machine that removes a portion of cotton from the top of each bale. Next, the machine beats the cotton together, removing impurities and initiating the blending process. The fibers are then blown through tubes to a mixing unit where the blending continues.

[78] THE COMPLEXITY-RELATEDNESS DIAGRAM COMPARES THE RISK AND THE STRATEGIC VALUE OF A PRODUCT'S POTENTIAL EXPORT OPPORTUNITIES. RELATEDNESS IS PREDICTIVE OF THE PROBABILITY THAT A COUNTRY INCREASES ITS EXPORTS IN A PRODUCT. COMPLEXITY IS ASSOCIATED WITH HIGHER LEVELS OF INCOME, ECONOMIC GROWTH POTENTIAL, LOWER INCOME INEQUALITY, AND LOWER EMISSIONS.

***Carding -*** Once blended, the fibers move through tubes to a carding machine, which aligns and orients the fibers in the same direction. Cylinders with millions of teeth pull and straighten the fibers and continue to remove impurities.

***Drawing, testing, and roving -*** Here, the cotton fibers are further blended together and straightened as many strands of fibers are drawn together into one strand by a roving frame. The frame twists the fibers slightly and winds a cotton roving onto bobbins.

***Spinning -*** The rovings are spun on a ring spinner, drawing the cotton into a single small strand and twisting it as it spins. The yarn is then wound onto bobbins and the bobbins are placed onto winders that wind the thread onto section beams that will eventually fit onto a loom for weaving.

***Warping a section beam -*** It takes between 2,000-5,000 warps (lengthwise yarns) to make up a single width of sheet. Thus, the warping beam, which holds all of the yarns, is very large and cannot be loaded at once. So, 500-600 ends of yarn from spools are pulled onto a single section beam, thus warping it. Later, several section beams will be loaded onto the large warping beam, each contributing a portion of the warp.

***Slashing -*** Each section beam goes through a slasher—a machine that coats the yarn with starch or sizing to protect the ends and makes the yarn easier to weave.

***Warping the beam -*** Once coated with sizing, several section beams are loaded onto a single large loom beam. As many as 6,000 yarns are automatically tied onto old yarns by a machine called a knotter in just a few minutes. The knots are pulled through the machine and the weaving can begin.

***Weaving -*** The weaving, in which the weft or filler threads interlock with the warp or vertical threads, is done on high-speed automatic air jet looms. The filler threads are transported across the warp threads at a rate of 500 insertions per minute, meaning that a filler thread runs across the warp thread about every one-tenth of a second. It takes about 90 insertions to weave an inch of sheeting. Thus, about 5.5 in (14 cm) of sheeting is woven per minute—10 yd (9.14 m) per hour is woven. Typically, 8,000 yd (7,312 m) of sheeting is woven on a loom and wound up in rolls and shipped for further processing.

***Cleaning and bleaching -*** The fabric, called greige, is gray in color. It is further finished by singeing—a process in which bits of yarn are burned off the surface. Then, the sheeting is ready to be bleached. This is done in three steps. First, it is desized by bathing it in water and soaps that removes contaminants. Next, caustic chemicals are applied to get rid of dirt and remnants of debris found in cotton yarn. The caustic is washed out and concentrated bleaches (chlorine and/or hydrogen peroxide) are applied to dissipate the gray color. Now whitened, the sheeting is rolled into a rope and put into a dryer which takes the moisture out prior to dyeing.

***Dyeing -*** All sheeting is dyed. Even sheeting sold as white must be dyed to become a truly white sheet. To give the gray-colored sheets color, pigments are applied to the sheeting in color vats that use large rollers to press the dyestuff into the material. Once dyed, the sheeting is steamed to set the color. Next, a resin is applied to the sheeting to control shrinkage. The sheeting is rolled onto huge rolls and is ready to be cut and sewn.

***Cutting and sewing -*** Automatic cutting equipment pulls the cloth off the rolls as it automatically cuts the sheeting to the requisite length. The rolls are transferred to a sewing machine that sews top and bottom hems.

***Packaging -*** The sewn sheet is either folded by hand or machine. Machine-folded sheets are ejected, shrink wrapped, and individually packaged for sale.

***NOTE:*** *This is a full process of bed linen manufacturing from cotton fiber to sewing; however, this process can be divided so that only cutting and sewing processes (which are the most labor-intensive) can take place in a factory.*

## *Quality Control & Certification*

Sheeting manufacturers carefully choose cotton bales. Cotton is classified by length (staple) and by quality (grade). Shorter staples are used for batting, while longer staples are used to make higher quality products. Egyptian cotton is made from longer staples. Medium staples ar considered standard. There are nine grades used to classify cotton from middling to good. Cotton with much debris and residue would be of a lower grade than that with less impurities. The lower grade bales tend to slow down the processing of the cotton into spool yarn and may never render a quality product. Many weaving facilities perform their own tests on bales to be purchased to assess quality and cleanliness.

Rovings the rope-like strand that is spun into yarn generally undergoes quality control inspection prior to spinning. At major points in the production of yarn and sheeting, statistical samples are taken and tested in the laboratory. Physical tests are run on the completed products. Because the bleaching and dyeing processes include a number of chemicals that must be mixed exactly, the chemical solutions are monitored. Furthermore, employees within the plant carefully monitor the process and visually inspect the product at each manufacturing stage.

Many manufacturers in the sector are able to produce with quality and environment management systems, e.g. ISO 9000 series. Additionally, some companies in the home textile sector have private Eco labels.

When exporting to Europe, product must comply with the following legal requirements:

- General Product Safety Directive
- REACH
- Textile Regulation
- Packaging and Packaging Waste Directive

More information on mandatory requirements: https://www.cbi.eu/market-information/home-decoration-home-textiles/bed-textiles/market-entry

### *Capital requirements*

For setting up machinery, a factory of 250 to 500 $m^2$ area would be required. Also, there must be a separate space to keep raw material storage, finished good section and packaging section, etc.

Common machines used in bed linen manufacturing are:

- Foot stitching machine
- Double needle stitching machine with motor
- Embroidery machine
- Over lock machine
- Ironing machine

**Labor**

Labor requirement depends on the extent of production automation – fewer workers are required for a fully automated factory; however, bed linen production can be labor-intensive as well if they are sewn by individual hand sewing machines.

**Energy**

Electricity and water are the major inputs to the bed linen manufacturing factory.

## PRODUCT: WOMEN'S, GIRLS' TROUSERS & SHORTS, OF COTTON, NOT KNIT

### HS Code: 620462

### EU MFN Tariff: 12%

### Rules of Origin:

Manufacture from yarn or Manufacture from unembroidered fabric, provided that the value of the unembroidered fabric used does not exceed 40 % of the ex-works price of the product.

### Trade Statistics

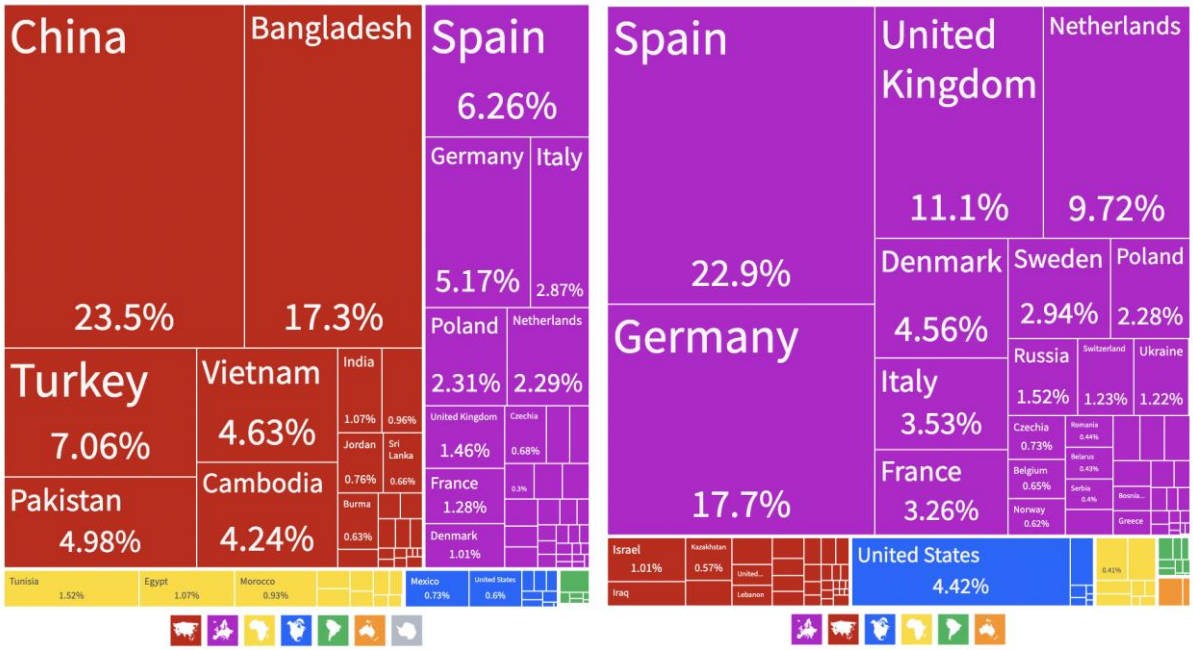
| | |
|---|---|
| TR Exports CAGR (2016-2020): | 0.2% |
| TR Exports Share in EU Imports: | 13% |
| TR Exports to EU27 in 2020: | € 768,152,000 |
| GE Exports to EU27 in 2020: | € 97,000 (€ 1,688,000 to EU27) |
| World Exports in 2020: | € 15,343,855,000 |

Women's, girls' trousers & shorts, of cotton, not knit are the world's 126th most traded product.

In 2020, the top exporters of women's, girls' trousers & shorts, of cotton, not knit were China ($4.23B), Bangladesh ($3.11B), Türkiye ($1.27B), Spain ($1.13B), and Germany ($931M).

In 2020, the top importers (in EU) of women's, girls' trousers & shorts, of cotton, not knit (HS 620462) from Türkiye were Spain (22.9%), Germany (17.7%), United Kingdom (11.1%), Netherlands (9.72%), and Denmark (4.56%)[79].

**Figure 5.4: Exporters of Women's/girls' trousers & shorts, of cotton, not knit – HS 620462 (left) and importers from Türkiye (right) in 2020.**

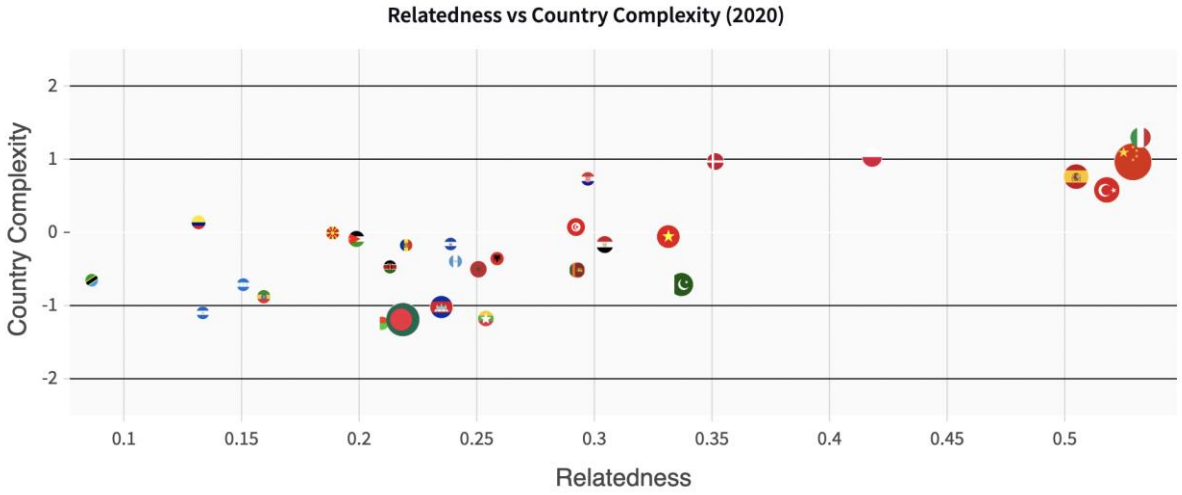



*Source: https://oec.world/*

[79] HTTPS://OEC.WORLD/

## Revealed Comparative Advantage (RCA) & Product Complexity[80]:

### RCA > 1




*Source: https://oec.world/*

### *Production: Major materials used in manufacturing*

The major raw materials required for production of cotton trousers are: Cotton fabric, dye, sewing thread of various colors, button, lining, zipper, labels, packing materials.

### *Manufacturing Process*

Mass trouser manufacturing in a factory involves the following processes[81]:

**1. Pre-Production (PP) Process -** Before starting bulk material sourcing and bulk cutting, pre-production processes are involved. Like trouser sample development and sample approval. Size set samples and PP samples are developed. A trouser manufacturer can start bulk cutting after getting approval on the PP sample.

**2. Selection of fabrics, trims as per the buyer** - Depending on the product detailing and product specification, factory selects fabrics. These activities are performed by the merchandising team.

**3. Procurement of fabric, trims, and accessories -** Factory prepares a bill of material according to the material consumption and order volume. The sourcing team involved in sourcing of fabrics and other items.

[80] THE COMPLEXITY-RELATEDNESS DIAGRAM COMPARES THE RISK AND THE STRATEGIC VALUE OF A PRODUCT'S POTENTIAL EXPORT OPPORTUNITIES. RELATEDNESS IS PREDICTIVE OF THE PROBABILITY THAT A COUNTRY INCREASES ITS EXPORTS IN A PRODUCT. COMPLEXITY IS ASSOCIATED WITH HIGHER LEVELS OF INCOME, ECONOMIC GROWTH POTENTIAL, LOWER INCOME INEQUALITY, AND LOWER EMISSIONS.
[81] HTTP://MODATON.COM/?PAGE_ID=386

**4. Storage of fabric and trims in warehouse -** After the procurement of raw material, all raw materials are to be kept in a proper place that is in a storage-area/warehouse with ambient temperature, humidity required for the fabrics, and other raw materials.

**5. Quality checking of fabric and trims -** The fabric inspection is done by laying it on the inspection table against the light. Fabric inspection and approval of fabric are done before cutting process so that unevenness in colour/shade or any other faults if any visible in the fabric are eliminated. The same level of checking is to be followed for trims and accessories. For fabric approval, for some orders fabric sample is sent to a testing lab for verifying physical and chemical properties of the fabric. Fabric must pass the quality checking and lab testing.

**6. Pattern making and grading -** Simultaneously after the approval of the order, pattern master is assigned to make patterns that will go for further marker planning and cutting department for production. Trouser patterns can be made manually or by using a CAD system. After pattern making, grading of the patterns is done for all sizes.

**7. Marker planning and cutting -** A marker is commonly done by large thin paper that holds all the size of pattern pieces for a specific style of garments. Marker is the perfect way to reduce fabric wastage. The marker gives actual guidelines for completing the flawless or correct fabric cutting. Marker making can be done in both ways like manually and computerized methods.

**8. Fabric Spreading & Cutting** - Spreading is a preparatory operation for cutting. The main aim of the spreading process is to lay the several fabric plies essential for the production process to the marker length without any tension on the fabric. The lay height depends on order size, fabric characteristic, capacity of the spreader, cutting method and equipment used. The preference of a mode of spreading will influence the cost of spreading as well as finished garment quality. The cutting is the process of reproduction of shape of pattern pieces in the fabric during the production of garments. Automatic cutting machine is used for cutting fabric layer. Alternatively, you can use straight knife cutting machine. Sometimes a band knife cutting machine is useful for cutting small components.

**9. Ticketing and bundling of cut components -** Whenever the bundling system is used, it is accompanied by tickets or bundle tickets. It gives fundamental information about the work such as the style number, the size of the garment, the number of garments in the bundle, and the date issued. After cutting the entire fabric lay, all the garments' components in stack form is shorted out as per size and color.

**10. Trouser stitching process -** The next process is the stitching of trousers using sewing machines. Cutting bundles are moved to the sewing floor and loaded to sewing lines as per the loading plan. In a line, sewing machines of different types are arranged as a vertical line to assemble the garments. The sequence of types of sewing machine arrangement depends on the sequence of assembling operations. The number of sewing machine arrangements per line may be up to 60-70 depending on the design and output quantity of trousers. Normally, a trouser line is set up in sections – preparatory sections, front section, back section, and assembly sections. In the preparatory section small parts are made and the move to the assembly section. once front part and back part of the trouser is ready, sewing operators assemble the trouser.

**11. Quality checking of stitched garments – (1)** Inline quality checking - Inside the sewing lines, quality checkpoints are kept. Normally, after making each trouser part, stitching quality is checked by

a trained quality checker. All garments are thoroughly and carefully checked to detect/find any defect is present in the garment. The defects may be for example variation of measurement, sewing defect, fabric defects, spots, etc. if the defect is possible to overcome, then the garment is sent to the respective person for correction. (2) End-of-line quality checking – After the garment assembly, an end-of-line checker checks the whole trouser inside and outside. Check cut the loose and uncut thread tail if found any. She also removes ply number tickets from the trouser. If the checker found any stitching defect, missing of any operations, defective trousers are given to the operators who made the defect of missed an operation. After correcting the operation, the end-of-line checker recheck the pieces and passed them for the next process.

**12. Washing of trousers** - Washing is an important process in trouser manufacturing. For cleaning and adding softness to the trouser. Washing is done using mild detergent. Industrial washing machines are used for trouser washing. After washing, the garments are hydro extracted to remove excess water and after this, these garments are dried in tumbler dryer.

**13. Finishing process (pressing and ironing trousers)** - In the finishing stage, thread trimming is done. 100 percent of the trousers are checked by the quality checkers. If stains are found on the fabric, stains are removed using spotting workstations. Then individual trousers are pressed by steam presses on a vacuum table to remove wrinkle marks. Pressman follows pressing instruction. After pressing, visual inspection is done one more time and random measurement checking is done the same checker. Now trousers are ready for folding and packing.

**14. Folding and Packing of trousers** - After the final inspection, the trousers are folded. Hand tags are attached. As per packing requirement pieces are poly packed. Then trousers are sorted by color-wise, size ratio wise, bundled and packed in the cartoon. The cartons are marked with important information in printed form which is seen from outside the cartoon easily. The trouser manufacturing process end after packing the trousers.

**15. Final audit of packed trousers** - Internal inspection is not enough to consider the packed garment for ensuring the quality of the trousers. Buyers send 3rd party quality auditors (for shipment inspection). Packed garments are audited by 3rd party auditors following the AQL standard set by the buyer. Inspection result can be good or bad. If the order or lot is passed the inspection, the buyer approves the shipment for delivery. In case, quality auditor fails the is inspection, the factory needs to rectify defective garments and offer reinspection to the buyer.

## *Quality Control & Certification*

There are many legal requirements for exporting denim to Europe, including those concerning product safety, the use of chemicals (REACH), quality and labelling.

Manufacturer should follow the steps below to ensure that product meets the relevant legal requirements:

1. The EU's General Product Safety Directive (GPSD: 2001/95/EC).
2. The EU's REACH Regulation. This restricts the use of chemicals in apparel and trims, including certain azo dyes, flame retardants, waterproofing and stain-repelling chemicals, and nickel.

3. Define if Restricted Substances List (RSL) is used. These are often inspired by the guideline on safe chemicals use from the Zero Discharge of Hazardous Chemicals (ZDHC) foundation. Download the ZDHC Conformance Guidance here.

The requirements for apparel to enter the European market: https://www.cbi.eu/market-information/apparel/buyer-requirements

## *Capital requirements*

The area required to start an apparel factory depends on the scale of production. A list of sewing machines used in trouser manufacturing given below:

- Lock stitch sewing machine: used for stitching waist ban, pocket bag and side pocket.
- Button hope sewing machine: used for waist band and back pocket.
- Button sewing machine: used for waist band and back pocket.
- Over lock sewing machine: used for inseam and out seam of a trouser.
- Bar tack sewing machine: used for belt loop, pocket corner and zipper fly.
- Bling stitch sewing machine: used for bottom hem.
- Kansai special sewing machine: used for waist band.

More about the machinery and equipment needed for garment manufacturing factory: https://www.onlineclothingstudy.com/2018/05/machinery-needed-for-garment.html

## *Manufacturing Costs*

Labor requirement depends on the extent of production automation; however, apparel sector remains among the most labor-intensive industries, despite advances in technology. Electricity and water are the major cost drivers to the textile manufacturing factory together with the labor costs.

# 6. PRODUCT: FOOTWEAR

**HS Code:** 640399

**EU MFN Tariff simple average:** 7.6%

**Rules of Origin:**

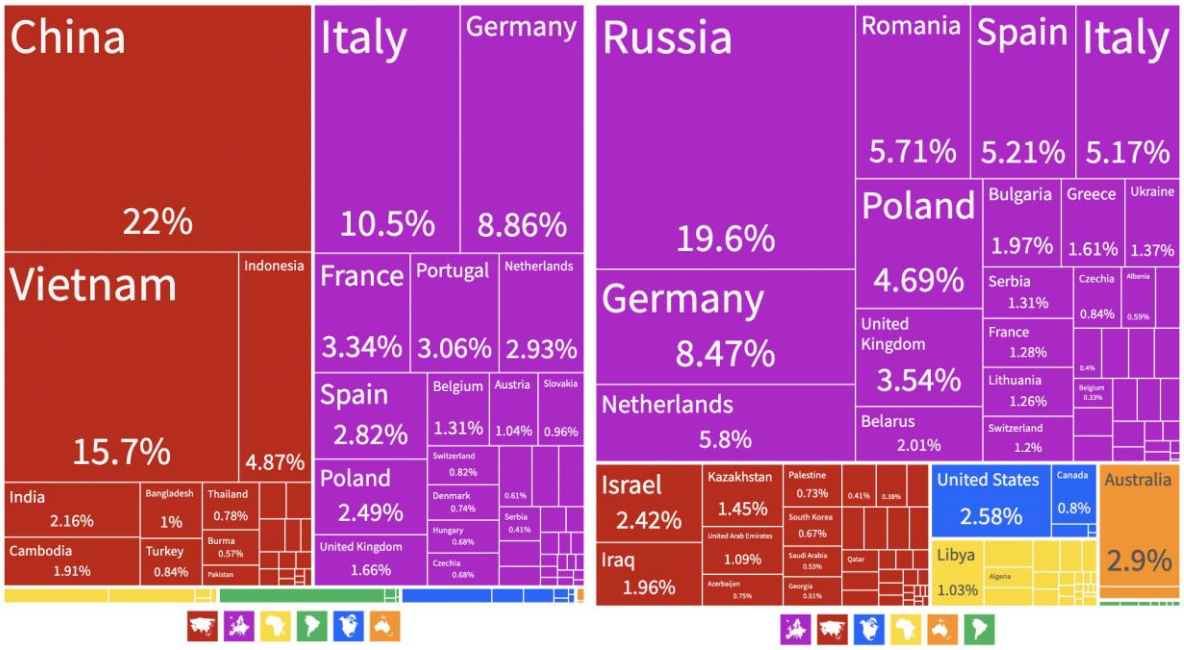
Manufacture from materials of any heading, except from assemblies of uppers affixed to inner soles or to other sole components of heading 6406.

## Trade Statistics (HS 640399)

| | |
|---|---|
| TR Exports CAGR (2016-2020): | 12% |
| TR Exports Share in EU Imports in 2020: | 1% |
| TR Exports in 2020: | € 73,308,000 |
| GE Exports to EU27 in 2020: | € 32,000 (€91,000 to the world) |
| World Exports in 2020: | € 21,323,826,000 |

In 2020 Türkiye exported only 0.84% (196 mln USD) of the world's total export of HS 640399 Footwear, sole rubber, plastics uppers of leather, other. In 2020 top importers of Turkish footwear (HS 640399) were Russia (19.6%), Germany (8.47%), Romania (5.71%), and Spain (5.21%).

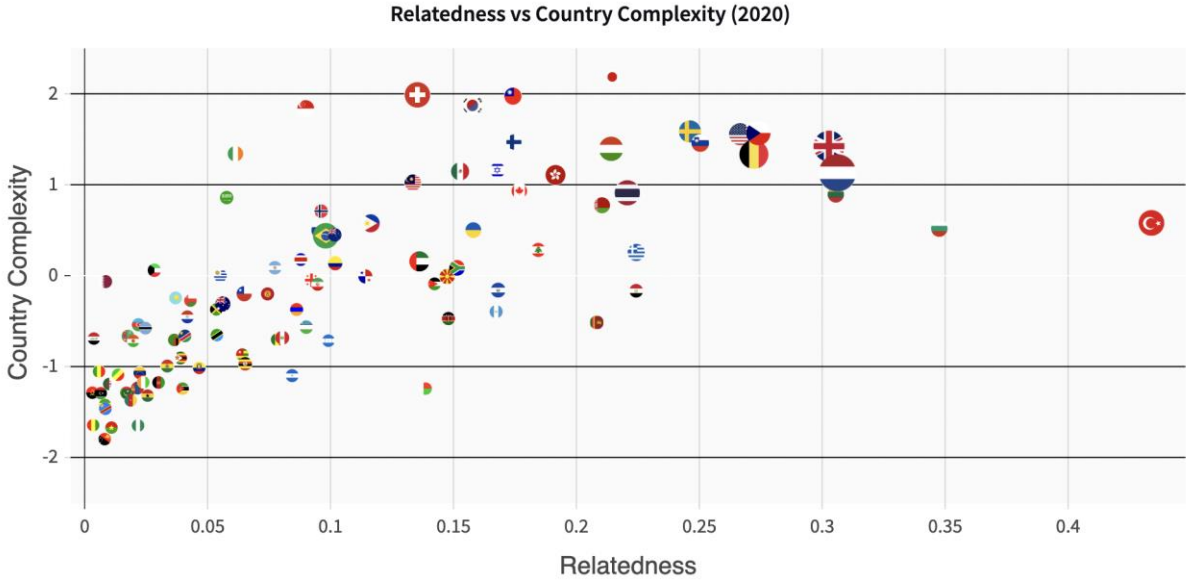
**Figure 6.1: World's top Exporters of HS 640399 | Footwear, sole rubber, plastics uppers of leather, other (left) and importers from Türkiye's (right) in 2020.**




*Source: https://oec.world/*

## Revealed Comparative Advantage (RCA) & Product Complexity

**(HS 640399 |** Footwear, outer soles/uppers of rubber or plastic, other):[82]




*Source: https://oec.world/*

### *Production: Major materials used in manufacturing*

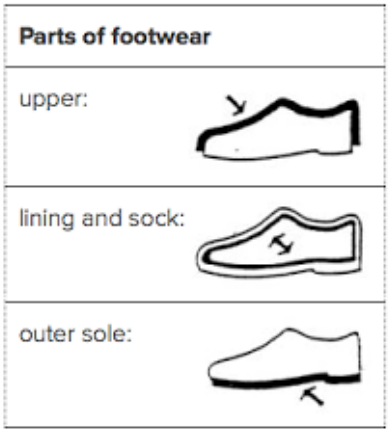
Sole and upper are two main components of shoes.

Materials for HS 640399:

Upper – leather;

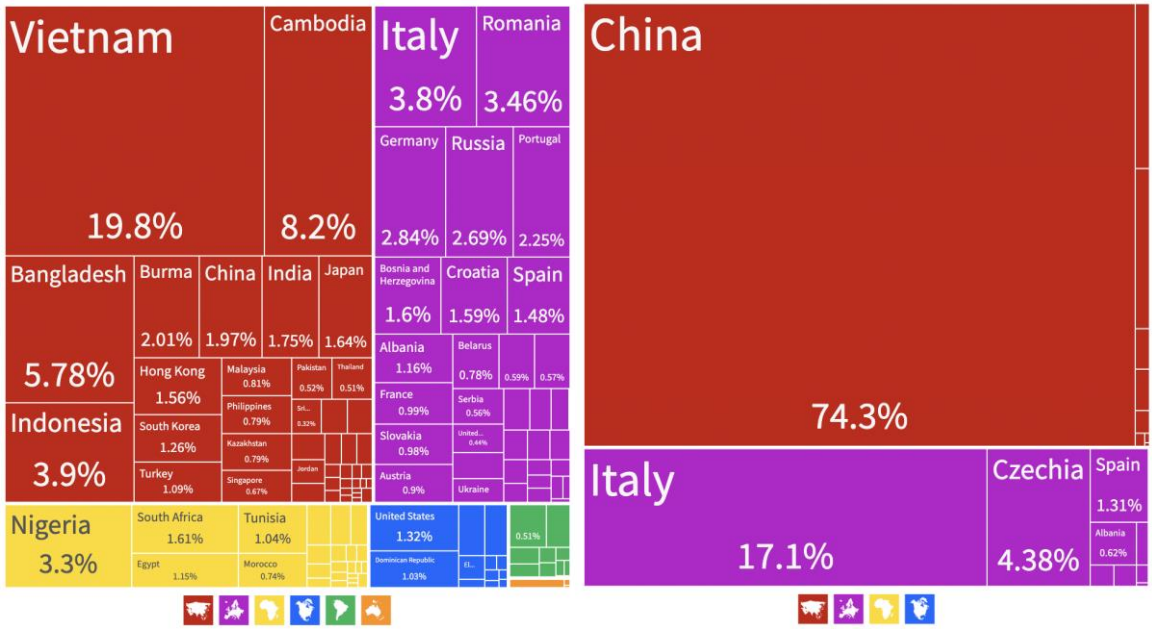
Soles – rubber, plastic, leather of composite leather.

Türkiye is a net importer of outer soles of rubber or plastic (HS 640620). In 2019 Türkiye's export and import accounted to 2 and 13.3 mln Euros, respectively (export decreased by 12% CAGR from 2016 to 2020). In 2020 Top imports of HS 640620 to Türkiye came from China (74.3%) and Italy (17.1%).




[82] THE COMPLEXITY-RELATEDNESS DIAGRAM COMPARES THE RISK AND THE STRATEGIC VALUE OF A PRODUCT'S POTENTIAL EXPORT OPPORTUNITIES. RELATEDNESS IS PREDICTIVE OF THE PROBABILITY THAT A COUNTRY INCREASES ITS EXPORTS IN A PRODUCT. COMPLEXITY IS ASSOCIATED WITH HIGHER LEVELS OF INCOME, ECONOMIC GROWTH POTENTIAL, LOWER INCOME INEQUALITY, AND LOWER EMISSIONS.

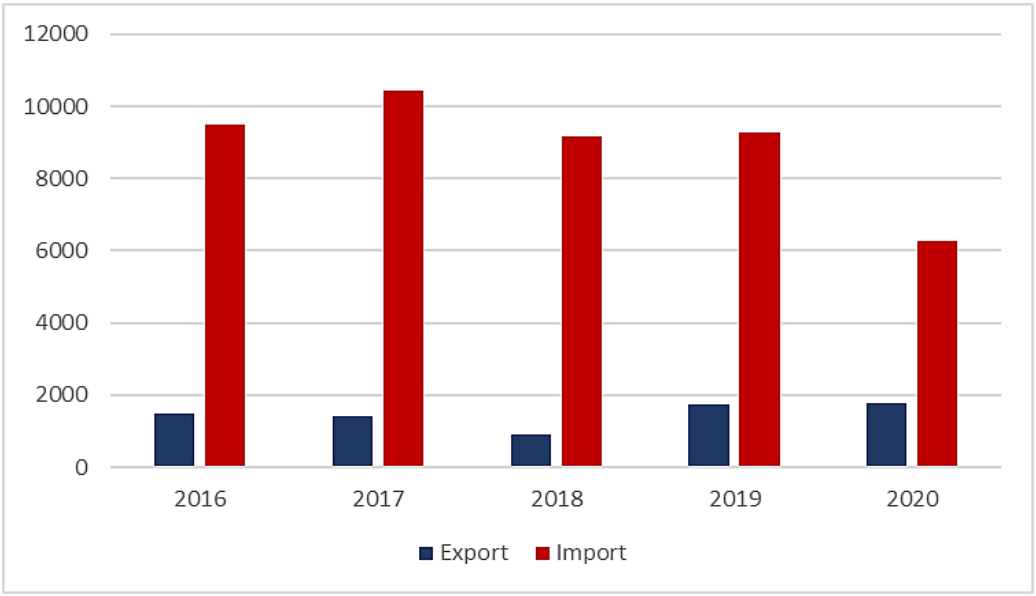
**Figure 6.2: Importers of outer soles of rubber or plastic (HS 640620) and top suppliers of Türkiye, 2020.**




*Source: https://oec.world/*

Türkiye is a net importer of a leather (HS 4113 - Leather further prepared after tanning or crusting "incl. parchment-dressed leather") as well. In 2020 Türkiye's total export and import of leather accounted to 1.8 and 6.3 mln Euros, respectively

**Figure 6.3: Türkiye' export and import of leather- HS 4113, (thousand Euros), 2016-2020.**

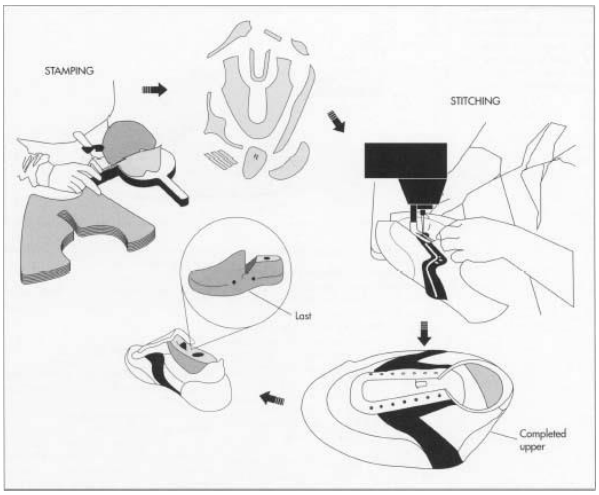



*Source: www.Trademap.org.*

Other parts/raw materials of shoes may include lace, eyelets, collar linen, logos, stitches, etc.

## *The Manufacturing Process*

### Stamping the fabric




Die machines stamp the shoe shapes, which are then cut out in cookie cutter fashion with various markings to guide the rest of the assembly. After being bundled and labeled, these pieces are sent to another part of the factory where they'll be stitched.

### Assembling the upper and the insole

- The pieces that will form the upper part of the shoe are stitched or cemented together and the lace holes punched out. These pieces include the featherline, the vamp, the mudguard, the throat (with eyestay and lacing section), the tongue, reinforcements such as the saddle or arch bandage, the collar, the foxing, and the logo. At this point, the upper looks not like a shoe but like a round hat, because there is extra material—called the lasting margin—that will be folded underneath the shoe when it gets cemented to the sole.
- Next, the insole is stitched to the sides of the upper. Stiffening agents are then added to the heel region and toe box, and an insole board is inserted.

### Attaching the upper and bottom parts

- The completed upper is heated and fitted around a last, a plastic mold that forms the final shape of the shoe. An automatic lasting machine then pulls the upper down over the last. Finally, a cement nozzle applies cement between the upper and insole board, and the machine presses the two pieces together to bond them. The upper now has the exact shape of the finished shoe.
- Pre-stamped and cutout forms of the midsole and outsole or wedge are layered and cemented to the upper. First, the outsole and midsole are aligned and bonded together. Next, the outsole and midsole are aligned with the upper and placed over a heater to reactivate the cement. As the cement cools, the upper and bottom are joined.
- The shoe is removed from the last and inspected. Any excess cement is scraped off[83].

## *Quality Control & Certification*

Shoe manufacturers can test their materials using procedures developed by the Shoe and Allied Trades Research Association (SATRA), which provides devices designed to test each element of the shoe. Once the shoe is complete, an inspector at the factory checks for defects such as poor lasting, incomplete cement bonding, and stitching errors[84].

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[83] HTTP://WWW.MADEHOW.COM/VOLUME-1/RUNNING-SHOE.HTML
[84] HTTP://WWW.MADEHOW.COM/VOLUME-1/RUNNING-SHOE.HTML

Requirements footwear should comply with to be allowed on the European market: https://www.cbi.eu/market-information/footwear/buyer-requirements

## *Capital requirements*

**The list of typical shoe factory equipment:**

**Cutting and stitching part:**

- Cutting machine
- Stitching machine
- Hammer machine

**Lasting part:**

- Lasting line: belt conveyor with oven
- cold and hot back part molding machine
- Hot air steaming machine
- Hydraulic toe lasting machine
- Automatic heel lasting machine
- Heel steaming machine
- Pneumatic marking machine
- Hand grinder
- Buffing machine
- High speed heat setter

**Assembly line**

- Double-layer NIR conveyor
- Hydraulic walled sole pressing machine
- Auto high-speed chiller

**Packing part**

- Hydraulic de-lasting machine
- Packing line: belt conveyor with UV oven
- Thread burner[85]

## *Manufacturing Costs*

Shoemaking is a labor-intensive process, and the cost of producing the many components of the running shoe reflect the skilled labor necessary. Each phase of production requires precision and skills, and taking shortcuts to reduce costs can result in an inferior shoe. Some running shoes (known as slip-lasted shoes) have no insole board. Instead, the single-layer upper is wrapped around both the top and the bottom portions of the foot. Most running shoes, however, consist of an insole board that is cemented to the upper with cement. This section will focus on cement-lasted shoes[86].

[85] HTTPS://WWW.LINKEDIN.COM/PULSE/FOOTWEAR-MACHINERY-WHAT-DO-I-NEED-SHOE-PRODUCTION-LINE-JANIS-ZHOU/
[86] HTTP://WWW.MADEHOW.COM/VOLUME-1/RUNNING-SHOE.HTML

# ANNEX 1: GEORGIAN AND TURKISH COMMPANIES

## Georgian Companies

| Sector/Value Chain | # | Company Name |
|---|---|---|
| Packaging | 1. | Caucaspack LTD |
| | 2. | LTD Polyvim |
| | 3. | LTS Nika Plast |
| | 4. | Georgian Packaging LTD |
| | 5. | Fabrika 1900 |
| | 6. | Greenpack LTD |
| | 7. | Megaplast LTD |
| | 8. | PolimerProductor |
| Textile and Apparel | 9. | LTD Doctor Goods |
| | 10. | LTD Adjara Textile |
| | 11. | Imeri |
| | 12. | Elven Technologies |
| | 13. | LTD Materia Fashion House |
| | 14. | ATA |
| | 15. | Med Style |
| | 16. | ELSELEMA |
| | 17. | GL Style |
| | 18. | Unistyle |
| | 19. | LTD Anabechdi |
| | 20. | LTD BTM Textile |
| | 21. | LTD Batimi Tex |

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| | 22. | LTD ISN FASHION TEXTILE |
| | 23. | LTD OZURGETI DENIM |
| | 24. | LTD Grixon |
| **Aluminium** | 25. | Sakcable |
| | 26. | Alutech |
| | 27. | Tegeta |
| | 28. | Alumet |
| | 29. | Alcom |
| | 30. | bikes.ge (Georgian Bicycle Group) |
| | 31. | Trinx |
| | 32. | Rustavi Steel |
| **Construction Materials** | 33. | Steel House |
| | 34. | LTD Old Group |
| | 35. | Heidelberg Georgia |
| | 36. | Knauf Georgia |
| | 37. | Domus Aluminium |
| | 38. | Geocapitals |
| | 39. | LTD EUROBLOCK |
| | 40. | Ultragranit 16 |
| | 41. | LTD Mshenebeli |
| | 42. | Mshenebeli 2019 LLC |
| | 43. | LTD Kamara |
| | 44. | Basalt Fibers / Rebas |
| | 45. | Smarter |
| | 46. | Akustiko |

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| | 47. | UBG |
| | 48. | Dio |
| | 49. | LTD Star RG |
| | 50. | LTD NOVA |
| | 51. | LTD Mshenberi |
| | 52. | MEGADOORS |
| **White Goods** | 53. | Vestel |
| **Furniture** | 54. | LTD Royal-Georgia |
| | 55. | Istanbul Bazaar |
| | 56. | LTD Belinda |
| | 57. | LTS Suti |
| **Shoes** | 58. | Gepherrini |
| | 59. | DASA |
| **TAG Members** | 60. | Georgian Business Association |
| | 61. | Georgian Association of Small and Medium Enterprises |
| | 62. | Georgian Chamber of Commerce and Industry |
| | 63. | Georgian Banks Association |
| | 64. | Georgian Employers Association |
| | 65. | American Chamber of Commerce and Industry |
| | 66. | International Chamber of Commerce |
| | 67. | EU-Georgia Business Council |
| **Clusters** | 68. | Georgian Packaging Cluster |
| | 69. | Georgian Apparel and Fashion Association |
| | 70. | Georgian Construction Materials Cluster |
| | 71. | Georgian Furniture Cluster |

## Turkish Companies

| Sector/ Value Chain | # | Company | Website |
|---|---|---|---|
| Aluminium | 1. | AK Aluminyum (Plates) | http://www.akaluminyum.com.tr/ |
| | 2. | VIG Metal (Sheets) | https://vigmetal.com.tr/en/index.html |
| | 3. | Teknik Aluminyum (Sheets) | http://teknikaluminyum.com.tr/ |
| | 4. | Celikler Aluminyum (profiles) | https://www.celikleraluminyum.com.tr/en/home/ |
| | 5. | CB Metal (ingots and billets) | https://www.cbmetal.com.tr/en/category/urunler |
| | 6. | Burak (doors and window systems, profiles) | https://www.burak.com.tr/ |
| | 7. | BDM Bilginoglu Dokum (ingots) | https://www.bdmbilginogludokum.com.tr/index.php |
| | 8. | AYKİM METAL SANAYİ (profiles) | http://www.aykimaluminium.com/tr/Urunler/ |
| | 9. | Alfa Metal (ingots) | https://www.alfa-metal.com.tr/products.html |
| | 10. | Ayde Aluminium | https://aydealuminium.com/#top |
| Bed Linen | 11. | Home Strum | https://www.homesturm.com/otel-tekstili/3466m.html |
| | 12. | Iyi Geceler Istanbul | https://www.iyigeceleristanbul.com/ |
| | 13. | Modalita | https://www.modalita.com.tr/ |
| | 14. | Bahce Kapili Home | https://www.bahcekapilihome.com/ |
| | 15. | Tanem Tekstil | https://www.tanemtekstil.com/ |
| | 16. | Cizgi Tekstil | http://www.cizgitekstil.com.tr/urunler.asp?id=11 |
| | 17. | Daisy Home | http://daisyhome.com.tr/en/ |
| Cotton Trousers | 18. | Mavi | https://www.mavicompany.com/en |
| | 19. | De Facto | https://www.defacto.com.tr/ |

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| | 20. | LC Waikiki | https://www.lcwaikiki.com/tr-TR/TR |
| | 21. | LTB | https://www.ltbjeans.com/tr-TR/ |
| | 22. | Koton | https://www.koton.com/tr/ |
| **Cotton Rubber Sole Shoes** | 23. | 3GEN | https://www.3gen.com.tr/tr/ |
| | 24. | ATT TABAN | http://www.atttaban.com/ |
| | 25. | Bagbek | https://www.bagbek.com.tr/index.html |
| | 26. | Bayrak Taban | https://bayrakebt.com.tr/ |
| | 27. | Damla Rubber | http://www.dks.com.tr/ |
| | 28. | Opak | http://opak.com.tr/# |
| | 29. | Greyder | https://www.greyder.com.tr/ |
| | 30. | Tergan | https://www.tergan.com.tr/ |
| | 31. | Kinetix | https://www.greyder.com.tr/ |
| | 32. | Kemal Tanca | https://www.kemaltancaonline.com/en |
| | 33. | Lescon | https://kurumsal.lescon.com.tr/en/shoes/ |
| | 34. | Hotic Shoes | https://www.hotic.com.tr/pages/who-we-are |
| **White Goods** | 35. | Arcelik | https://www.arcelik.com.tr/ |
| | 36. | Beko | https://www.beko.com.tr/ |
| | 37. | Altus | https://www.altus.com.tr/ |
| | 38. | Profilo | https://www.profilo.com/ |
| **PP Woven Packaging Bags** | 39. | Sunbag Ambalaj | https://sunbagambalaj.com/ |
| | 40. | Isbirs Entetik | https://www.isbirsentetik.com/ |
| | 41. | Ursa | http://www.ursa.com.tr/bigbag.php |
| | 42. | Cesur | ceshttp://www.cesur.com/en/home |
| | 43. | Eska BigBag | https://www.eskabigbag.com/index.html |

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| | 44. | Polybag | http://polybag.com.tr/ |
| | 45. | DMN Ambalaj | https://www.dmnambalaj.com.tr/ |
| | 46. | SUTAPLAS | http://www.sutaplas.com/ |
| **Non-woven products** | 47. | Broche Medikal | https://brochemedikal.com/ |
| | 48. | 3TEKS Tekstil | https://3teks.com.tr/en/ |
| | 49. | Akınal Sentetik Tekstil | https://www.akinaltekstil.com/ |
| | 50. | Almina Non-wovens | http://almina.com.tr/tr/almina-non-wovens |
| | 51. | Apex Non-wovens | https://www.apexnonwovens.com/ |
| | 52. | Aras Tekstil | https://arastekstil.com.tr/ |
| | 53. | Baknoteks | http://www.baknoteks.com |
| | 54. | Başat Laminasyon | https://www.basatlaminasyon.com/iletisim |
| | 55. | Bayteks Teknik Tekstil | http://www.bayteks.com/ |
| | 56. | Berfa Group | https://www.berfa.com.tr/ |
| | 57. | Bezci Tekstil | http://www.bezcitekstil.com/ |
| **Bicycles** | 58. | ACCEL BICYCLE SAN.VE TİC.A.Ş. | https://www.accell-group.com/en/about-us/contact/resellers/accell-bisiklet-sanayi-ve-ticaret-a-s.htm |
| | 59. | ARZU BICYCLE INDUSTRY AND TRADE. Inc. | https://www.arzubisikletshop.com/ |
| | 60. | ASLI BICYCLE TİC.SAN.VE LTD.ŞTİ | https://www.aslibisiklet.com/ |
| | 61. | BISAN MOTORCYCLE AND BICYCLE SAN.TİC.A.Ş. | https://bisan.com.tr/ |
| | 62. | CYCLEUROPE BICYCLE IND. VE TİC.A.Ş. | https://www.cycleurope.com.tr/ |
| | 63. | CELIK BICYCLE MOTORSIKLET SAN.TİC.LTD.ŞTİ. | http://canellobisiklet.com/kurumsal/ |
| | 64. | ERBAŞ BICYCLE MOTORSIKLET SAN.VE TİC.A.Ş. | http://www.erbasbisiklet.com.tr/ |
| | 65. | İTEK İKİ KİERLEKLİ ARAÇLAR SAN.VE TİC.A.Ş. | https://www.itek.com.tr/ |

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| **Mattresses** | **66.** | **3A Textile** (Mattress cover, medical supported pillow types, pillow types, under mattress types, mattress protector products, sleeping pads) | https://3atekstil.com/ |
| | 67. | AAS Group Machinery (Sales and after-sales services of industrial hot and cold glue application systems, chemical application systems and chemical transfer pumps. Hot melt glue production and sales (IMELT Hot Melt Adhesives) | https://www.aasmakina.com/en/ |
| | 68. | AAT Machinery (Machine Production) | https://www.aatmakina.com/ |
| | 69. | Akdemir Machinery (Plastic, Textile, Winter Sports, Special Production) | http://www.akdemirmakina.com.tr/en/?s=urun&id=6 |
| | 70. | Akkoza Weaving and Labeling Industry. Tic.Ltd.Şti. (Manufacture of mattress wicks, mattress labels, handles and accessories ventilation capsules *All of our accessories have the privilege of seamless assembly.) | http://www.akkozadokuma.com.tr/en/ |
| | 71. | Armador Mühendislik (Mattress Manufacturing Machines and Lines) | www.armadormuhendislik.com |
| | 72. | Armateks (Mattress, Mattress Cover and Quilted) | https://www.armateks.com.tr/ |