

DOMINANT PV TRADE FLOWS IN EUROPE

A customs data analysis performed by the The European Solar Manufacturing Council (ESMC)



The European Solar Manufacturing Council (ESMC) is the organisation representing the interests of the European PV manufacturing industry. The Council relies on key industrial companies, organisations and research centers active in the PV sector rooted in Europe. ESMC aims at promoting and supporting the PV manufacturing industry and its value chain at the European level, speaking with one voice.

This study has been conducted by Amelia Oller Westerberg and Johan Lindahl. Any questions regarding the analysis or requests on additional information can be handled through lindahl@esmc.solar

BRIEF BACKGROUND AND AIM

During the first years of the global PV market and industry development, Europe held a majority share. With time, other parts of the world, with China in the lead, started to gain larger market shares in terms of both installation and manufacturing volumes. At the end of 2020 the European Union was the second largest market in terms of cumulative and annual capacity after China, with three individual markets in the top 10 of annual installations, namely Germany and the Netherlands in place 5 and 10.

With the mission of ESMC in mind, the following study has been conducted to obtain an overview of the central trade flows in and out of Europe. Customs data has been analysed and by mapping the trade ways from specific countries or regions for a time period of 5 years (2016 to 2020) a trade development trend can be evaluated, as well as an estimate on traded amounts.

This analysis could in turn be valuable for the members of ESMC or other actors on the field of renewable energy or policy design, to use in their respective business or organisational development. By detecting the most prominent trade ways and/or the directions in which the market is developing, new or more niche markets could be identified. If not else, this analysis could serve as a pre study on which markets that could be of interest for future client or business expansions. In addition to the value it could bring to specific member companies, through investigating the trade flows and thus the hardware dependency of other regions, this analysis could form a basis for discussion in ESMCs work on the topic of policy development.

DATA AND METHODOLOGY

The main data source for the analysis is a data base managed by the International Trade Centre (ITC), called Trade Map. It provides detailed import and export data by annual quarters where the data availability is divided into three categories, being *No data*, *Reporting Data*, and *Mirror Data*. The *Mirror Data* is available for countries that trade goods with reporting countries, since export of a product from country X to country Y is the same as import into Y from country X. The data in question is reported to ITC by the respective countries' trading entities. The nature of the reporting system could leave room for misreporting and/or differences in data quality but is considered the best available option.

Extracting the data from Trade Map is done in two main steps, being handling the; 1. import data and the 2. export data separately, and categorized by country. Inside the database, the trade is categorized under different Harmonized System (HS) codes. In this particular analysis, the data is collected inside the code 854 140, with the description; *Photosensitive semi-conductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; Light emitting diodes*. This code is globally available and used in classification on all continents. This means that the trade flows presented in this analysis are not exclusively for photovoltaics, but for the content described above.

The analysis has been made on a country level where all European countries' trade have been analysed separately and then added together to form a picture of Europe's trade.

A value conversion from the countries' national currencies has already been done by the national trade ministries as all data is reported in US\$ in the ITC data base. Even though it would be logical to use Euros (€) when presenting the trade flows for ESMCs audience, a choice of not re-converting the data has been made to secure the accuracy of the reported amounts, as information on time of conversion and conversion rates are unknown.

TRADE WAYS

In the following chapter, the results from the customs data analysis are presented. The export regions and countries that are presented in relation to Europe are: China, Malaysia, South Korea, Japan, Taiwan, Rest of Asia, Africa, the Middle East, Oceania, South America, USA and rest of north America and central America. Appendix holds a table of the geographical categorisation. The data availability was mostly satisfactory, but a few countries lacked data, namely Albania, Kosovo and Moldova and are thereby excluded from the analysis. Additionally, Belarus, Macedonia, Montenegro, and Ukraine only had *mirror data*. They constitute the markets with highest uncertainties since trade with other countries without direct data cannot be traced. However, the markets with no reported data available are relatively small compared to the top markets in Europe, with Ukraine as an exception.

In Table 1, the total traded value imported to or exported from Europe is presented. The analysis is based on all separate European countries' trade flows, where their respective trade with other European countries have been excluded (both import and export).

It is clear that import dominates the trade in this product and material category, indicating a hardware dependency from other regions. Results show that the imbalance between Extraeuropean import and export has increased with 87% in total monetary value between 2016 and 2020 (92% between 2016 and 2019). In relative terms, Europe exported a value amounting to 27 % of its imports in 2016, which decreased to 15 % in 2019 and 17% in 2020. As the market is growing, Europe is becoming more import dependent.

Table 1. The total value of traded *Photosensitive semi-conductor devices, including photovoltaic cells whether assembled in modules or made up into panels; Light emitting diodes* with European countries from 2016 to 2020. All data is presented in thousands of US\$ and collected from ITC data base trademap.

	2016 [kUS\$]	2017 [kUS\$]	2018 [kUS\$]	2019 [kUS\$]	2020 [kUS\$]
Extraeuropean import	6 330 809	6 484 161	8 106 778	10 471 637	10 413 196
Extraeuropean export	1 701 633	1 645 606	1 720 856	1 564 790	1 766 641
Imbalance	- 4 629 176	-4 838 555	-6 385 922	-8 906 847	-8 646 555

Another point worth mentioning is that the market has experienced price reductions during this period. Relating the declining price trend with the trend of an increasing value of traded goods implies an even larger *ramp-up* than the numbers in Table 1 suggest.

Table 2 shows the Intereuropean trade based on export data, where all countries' separate trade to other European countries have been summarised. Note that re-distribution of modules and cells between countries in the Single Market is to be expected and that the value shown in Table 2 likely partially include value already accounted for once in Table 1.

However, it shows that the Internal European Market is strong and that a majority of the countries' export is Intereuropean, which captures the interregional manufacturing volumes, but that the extraeuropean import amounts to much more than the internally traded value.

Table 2. The total value of internally traded *Photosensitive semi-conductor devices, including photovoltaic cells whether assembled in modules or made up into panels; Light emitting diodes* with European countries from 2016 to 2020 registered in ITC data base trademap. All data is presented in thousands of US\$.

	2016 [kUS\$]	2017 [kUS\$]	2018 [kUS\$]	2019 [kUS\$]	2020 [kUS\$]
Intereuropean trade	4 989 042	5 350 049	5 513 785	6 171 691	6 616 593

Import flows

To visualise the trade flows, they are mapped out in figure 1–3. China was the number one exporting market into Europe, and its position strengthened during the studied time-period, from 35.8% in 2016 to 74.8% 2020.

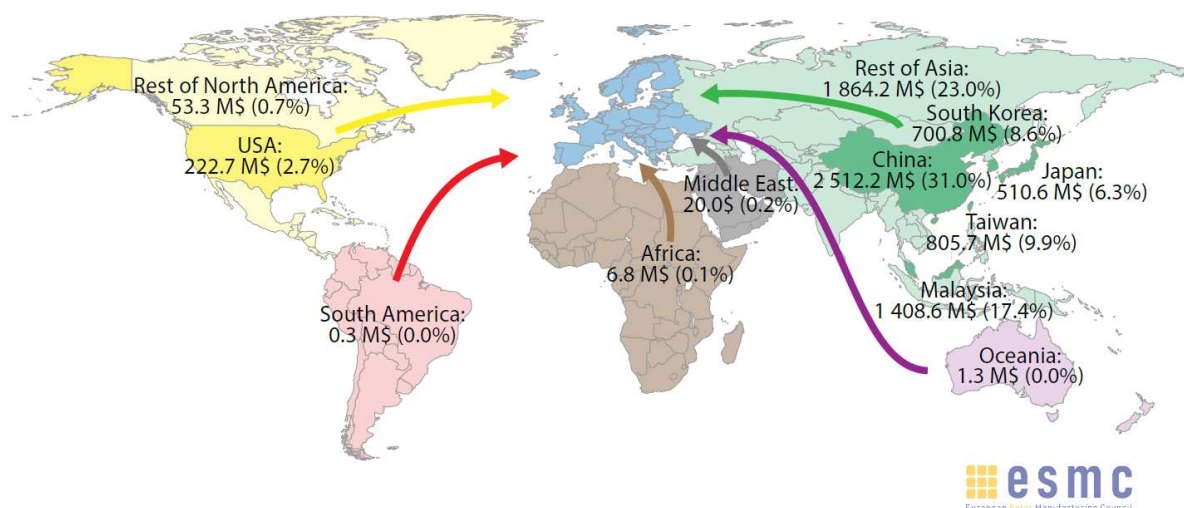


Figure 1. The largest trade flows with goods inside the HS code 854140: *Photosensitive semi-conductor devices, including photovoltaic cells whether assembled in modules or made up into panels; Light emitting diodes* into Europe in 2018.

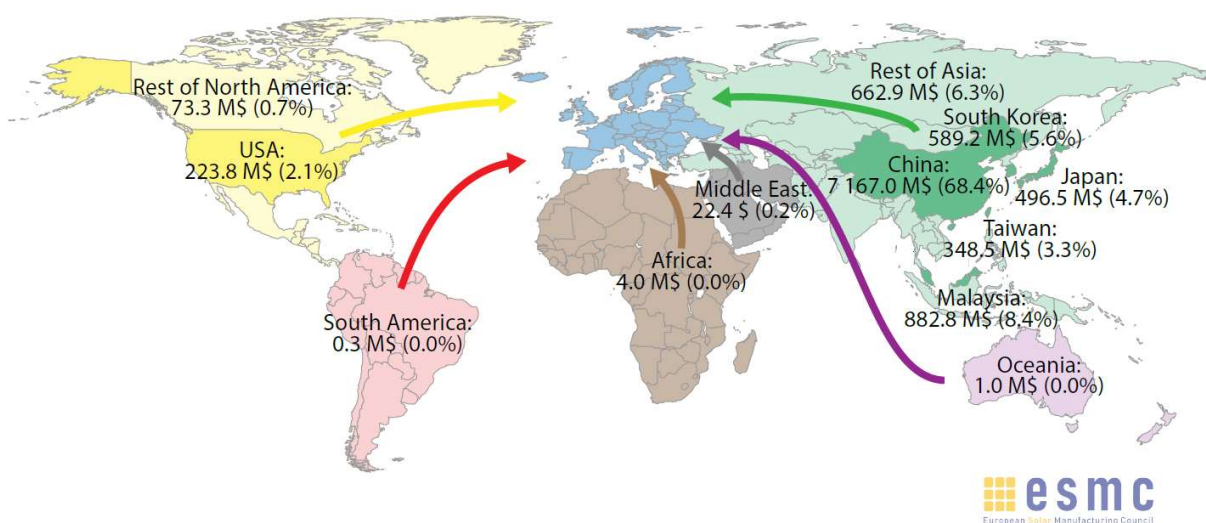


Figure 2. The largest trade flows with goods inside the HS code 854140: *Photosensitive semi-conductor devices, including photovoltaic cells whether assembled in modules or made up into panels; Light emitting diodes* into Europe in 2019.

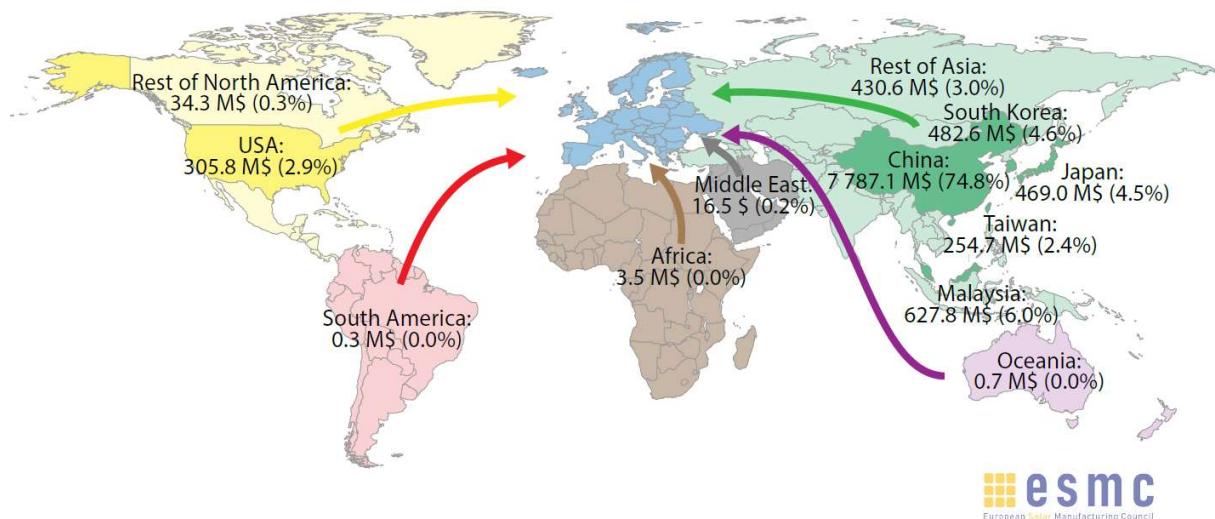


Figure 3. The largest trade flows with goods inside the HS code 854140: *Photosensitive semi-conductor devices, including photovoltaic cells whether assembled in modules or made up into panels; Light emitting diodes* into Europe in 2020.

Below in Table 3, the shares of import from all chosen markets are presented. In the categorisation for this report, Turkey and Russia are not classified as European countries, and are instead included in *Rest of Asia*. The markets that are presented as regions rather than countries (Africa, the middle East, Oceania and the Americas) seem to have a limited impact on the European import market, with steady market shares under 1.5 percent each, with the category *Rest of Asia* as an exception.

Table 3. The imported value [kUS\$] and the share [%] of the total import to Europe's import for each year and export region or country. *N & C America* is short for North America and Central America. *R o* means Rest of.

	2016 [kUS\$ (%)]	2017 [kUS\$ (%)]	2018 [kUS\$ (%)]	2019 [kUS\$ (%)]	2020 [kUS\$ (%)]
China	2 263 306 (35.8)	2 989 265 (46.1)	2 512 197 (31.0)	7 166 951 (68.4)	7 787 140 (74.8)
Malaysia	682 588 (10.8)	1 097 978 (16.9)	1 408 645 (17.4)	882 828 (8.4)	627 846 (6.0)
South Korea	252 623 (4.0)	378 479 (5.8)	700 846 (8.6)	589 181 (5.6)	482 648 (4.6)
Japan	485 439 (7.7)	477 462 (7.4)	510 617 (6.3)	496 464 (4.7)	469 019 (4.5)
Taiwan	1 352 614 (21.4)	1 114 652 (17.2)	805 705 (9.9)	348 508 (3.3)	254 724 (2.4)
Rest of Asia	943 241 (14.9)	1 477 735 (22.8)	1 864 188 (23.0)	662 850 (6.3)	430 603 (4.1)
Africa	3 595 (0.1)	28 008 (0.4)	6 805 (0.1)	4 034 (0.0)	3 535 (0.0)
The Middle East	11 337 (0.2)	13 370 (0.2)	20 044 (0.2)	22 369 (0.2)	16 476 (0.2)
Oceania	2 573 (0.0)	1 192 (0.0)	1 298 (0.0)	1 082 (0.0)	736 (0.0)
South America	406 (0.0)	759 (0.0)	317 (0.0)	282 (0.0)	338 (0.0)
USA	258 833 (4.1)	284 154 (4.4)	222 749 (2.7)	223 830 (2.1)	305 831 (2.9)
R o N & C America & the Caribbean	74 254 (1.2)	65 351 (1.0)	53 367 (0.7)	73 258 (0.7)	34 300 (0.3)

Export flows

As presented in Table 2, a clear trend is that most of the European countries' total exported value is Intereuropean. This could either mean that the European industry is providing the regional European market with hardware, or that several steps in the trade chain are European, or most probable, a combination of both.

The United States of America is the single largest importer from Europe, while the export streams to Asia are still prominent in terms of share, while the amounts are evidently smaller. Still comparing the two trade directions, *Africa* and *The Middle East* have appeared as new trade partner regions, see Figure 4-6 for a visual representation of the export flows.

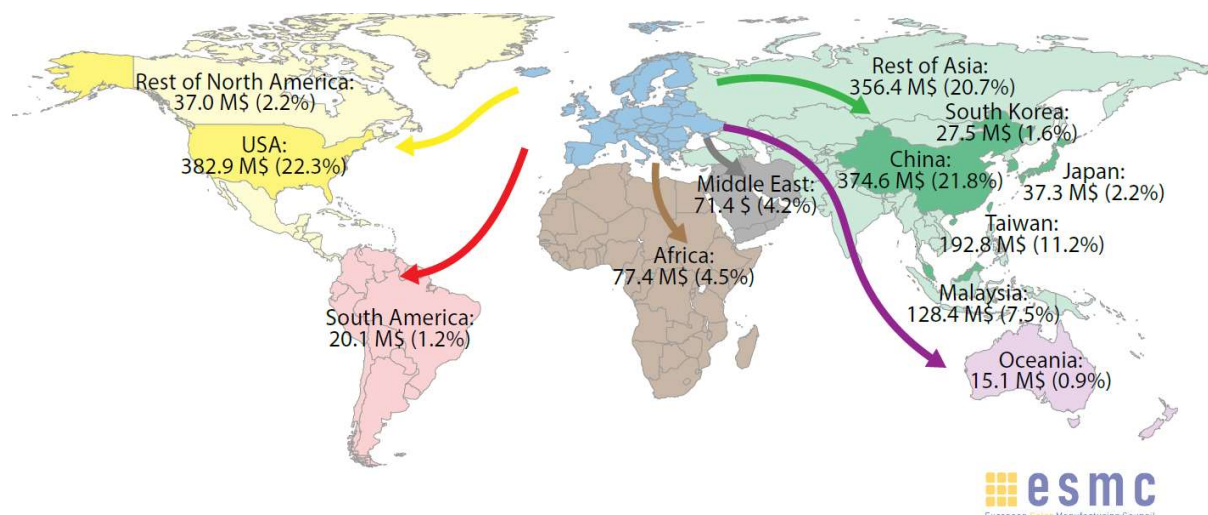


Figure 4. The largest trade flows with goods inside the HS code 854140: *Photosensitive semi-conductor devices, including photovoltaic cells whether assembled in modules or made up into panels; Light emitting diodes* exported out of Europe in 2018.

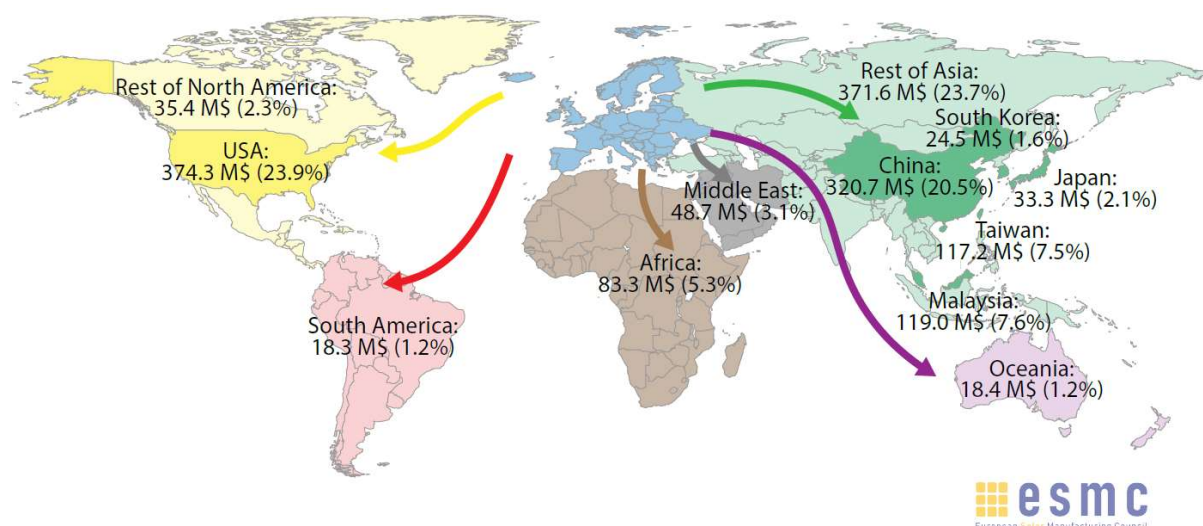


Figure 5. The largest trade flows with goods inside the HS code 854140: *Photosensitive semi-conductor devices, including photovoltaic cells whether assembled in modules or made up into panels; Light emitting diodes* exported out of Europe in 2019.

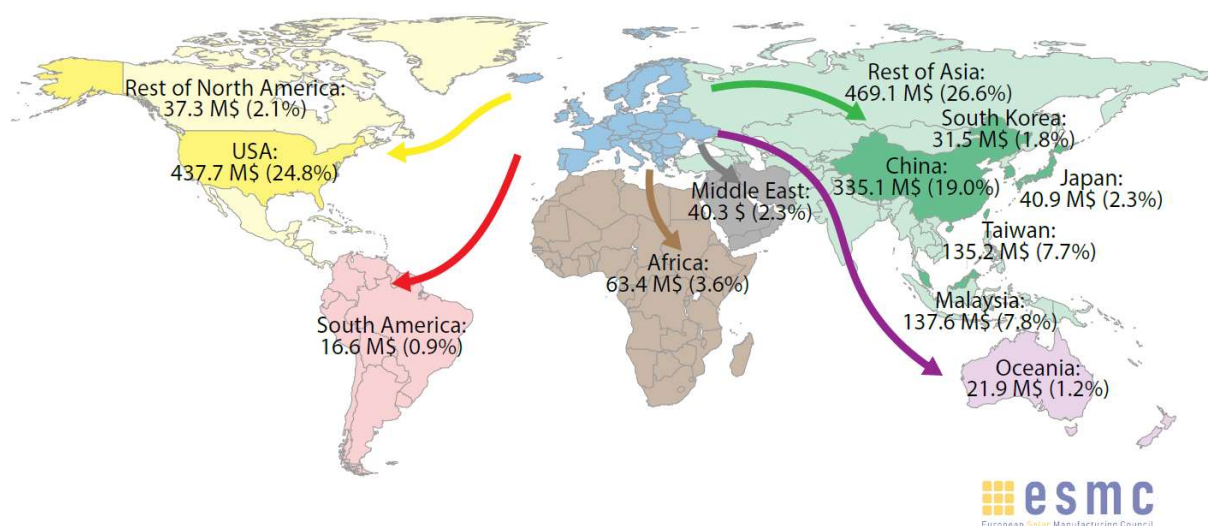


Figure 6. The largest trade flows with goods inside the HS code 854140: *Photosensitive semi-conductor devices, including photovoltaic cells whether assembled in modules or made up into panels; Light emitting diodes* exported out of Europe in 2020.

Below in Table 4, the shares of export to all chosen markets are presented.

Table 4. The exported value [kUS\$] and the share [%] of the total import to Europe's export for each year and import region or country. *N & C America* is short for North America and Central America. *R o* means Rest of.

	2016 [kUS\$ (%)]	2017 [kUS\$ (%)]	2018 [kUS\$ (%)]	2019 [kUS\$ (%)]	2020 [kUS\$ (%)]
China	349 009 (20.5)	354 662 (21.6)	374 552 (21.8)	320 708 (20.5)	335 142 (19.0)
Malaysia	184 649 (10.9)	161 041 (9.8)	128 367 (7.5)	119 031 (7.6)	137 613 (7.8)
South Korea	23 774 (1.4)	23 717 (1.4)	27 476 (1.6)	24 538 (1.6)	31 473 (1.8)
Japan	67 751 (4.0)	35 684 (2.2)	37 261 (2.2)	33 260 (2.1)	40 858 (2.3)
Taiwan	50 890 (3.0)	163 570 (9.9)	192 754 (11.2)	117 196 (7.5)	135 234 (7.7)
Rest of Asia	231 995 (13.6)	228 359 (13.9)	356 417 (20.7)	371 607 (23.7)	469 149 (26.6)
Africa	91 529 (5.4)	99 812 (6.1)	77 401 (4.5)	83 317 (5.3)	63 443 (3.6)
The Middle East	55 174 (3.2)	67 675 (4.1)	71 437 (4.2)	48 731 (3.1)	40 270 (2.3)
Oceania	12 525 (0.7)	15 021 (0.9)	15 114 (0.9)	18 356 (1.2)	21 942 (1.2)
South America	15 428 (0.9)	22 615 (1.4)	20 145 (1.2)	18 281 (1.2)	16 584 (0.9)
USA	552 158 (32.4)	436 935 (26.6)	382 930 (22.3)	374 328 (23.9)	437 666 (24.8)
R o N & C America & the Carribean	66 751 (3.9)	36 515 (2.2)	37 002 (2.2)	35 437 (2.3)	37 267 (2.1)

SUMMARY

Concluding the analysis of the import streams to Europe, the largest amounts are imported from Asian, especially from China. The import is also increasing, both in absolute terms and in relation to Europe's export market.

In terms of export, a substantial interregional trade behaviour can be traced. The Interregional export exceeds the Extraeuropean export. It signals that a significant amount of the created value inside Europe likely stays in Europe and that imported material and products in HS code 854140 are likely redistributed amongst European countries.

Even though the shares are still small, some export to *Africa* and *The Middle East* can be detected, as well as to the Americas. The United States of America is identified as the single largest import nation.

APPENDIX- ADDITIONAL TABLES

Presented below are the countries categorised into regions or continents. All trade in or out of Europe from or to all countries mentioned in the table have been analysed specifically. The countries that are part of a region have then been summarised for presentation purposes because of their limited share of the total trade.

Table A.1. The categorisation of countries inside and outside of Europe used in this analysis. All countries that are not mentioned in this table are categorized under *Rest of World*.

Country or region	Specified: the classification of the different regions
China	China, Hong Kong
Malaysia	
South Korea	
Japan	
Taiwan	
Rest of Asia	Afghanistan, Armenia, Azerbaijan, Bangladesh, Bhutan, Brunei, Cambodia, East Timor, Georgia, India, Indonesia, Kazakhstan, Kyrgyzstan, Laos, Maldives, Mongolia, Myanmar, Nepal, North Korea, Pakistan, Philippines, Russia, Singapore, Sri Lanka, Tajikistan, Thailand, Turkey, Turkmenistan, Uzbekistan, Vietnam
Africa	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo Democratic Republic, Côte d'Ivoire, Djibouti, Dominican Republic, Egypt, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome & Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia & Zimbabwe
The Middle East	Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine (West Bank and Gaza Strip), Qatar, Saudi Arabia, Syria, United Arab Emirates & Yemen
Oceania	Australia, Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu
South America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela
USA	
Rest of North America & Central America & the Caribbean	Mexico, Canada, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama
Rest of Europe	Albania, Andorra, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Holy See, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine & United Kingdom
Rest of World	All countries not specifically mentioned