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Document sheet

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1 EXECUTIVE SUMMARY

One of the key objective of RETROFEED is to ensure the exploitation and commercialization of the knowledge and technical results obtained from the execution of the technical work packages in order to pave the way for the market uptake of RETROFEED in the industrial environment around Europe. The related WP11 critically assesses all the issues related to the creation of the required infrastructure for the promotion of a mass market for the RETROFEED solutions.

The following document was prepared to provide the basis of the preliminary analysis in the framework of the RETROFEED project to analyze market application perspectives, risk and opportunities for the uptake of the RETROFEED project solutions. The document analysis the current worldwide and European market situation with focusing on the ceramic, cement, aluminium, steel and the agrochemical (fertilizer production) sectors and its latest trends, future projections to ensure an enhanced downstream and upstream performance of the production chain.

The next version of this document (Final Market Analysis) will provide a more detailed investigation of these markets and will provide further insights into the sector markets with specific surveys, questionnaires and interviews.

2 ABBREVIATIONS

Abbreviation	Meaning
CAGR	Compound Annual Growth Rate
CSI	Cement Sustainability Initiative
DSS	Decision Support System
EC	European Commission
EFTA	European Free Trade Association
GDP	Gross Domestic Product
KPI	Key Performance indicator
REII	Resource and Energy Intensive Industry
R&D	Research and Development
SME	Small and Medium Enterprise
TG	Target Group

3 INTRODUCTION AND OBJECTIVES

The industrial sector is one of main flagships of the economy of the European Union, generating almost one quarter of its GDP and almost 40 million jobs. Among EU industries providing services, products and jobs, the sector of raw materials processing is probably the most dominant one with a total added value of more than 1 billion EUR and more than 80% of the total direct EU industry jobs.

Still, the EU economy is quite prone to the unstable streams of incoming raw materials and especially the rapid fluctuation of (fossil) energy prices. Therefore material resource efficiency, the provision of recycled materials and industrial energy efficiency are the key priorities of the short- and medium term planning in the EU raw material industrial sector.

In the RETROFEED project, raw materials resource efficiency and rational use of energy practices are taken to a next level by offering sector specific solutions to be in line with sustainable EU level strategies and policies. This scenario will be considered as an outstanding market opportunity for project partners (especially the industrial ones) by moving towards a bio-based and circular economy, which will be enabled by the retrofitting solutions implemented through RETROFEED. The project focuses on **bringing state of the art technologies validated in the ceramic, cement, aluminium, steel and the agrochemical (fertilizer production) sector** by implementing various retrofitting and equipment adaptation techniques in several demonstration case sites in Spain, Romania, Portugal, Turkey and Italy.

The objective of RETROFEED is to facilitate project results within the EU industry by contributing to the development of new standards, regulations and training programs in the field of alternative feedstock with high potential for REII, bio economy, waste and circular economy and adaptation and certification of industrial processes. In this regard, by the end of the project the demonstrator partners in **RETROFEED are expected to increase their resource efficiency in 14-48%, their energy efficiency in 17-22% and their productivity in 12-49%** by mobilizing a total private investment of 7.1 million EUR. These demonstrator partners are linked to each five investigated markets:

- **TORRECID – Ceramic industry**
- **SECIL – Cement industry**
- **ASAS – Aluminium industry**
- **FERRIERE NORD and SILCOTUB – Steel industry**
- **FERTIBERIA – Agro-chemical (Fertilizer production) industry**

In this respect, the objective of this deliverable to preliminarily analyze the related market of each five demonstrator industries, including the current **ceramic, cement, aluminium, steel and the agrochemical (fertilizer production) sector market** and its latest trends, future projections to ensure an enhanced downstream and upstream performance of the production chain, so that **plant managers and operators** will be able to fully exploit the potential of RETROFEED by the end of the project in the Final Business Plan.

4 MARKET SEGMENTATION OF RETROFEED

4.1 Ceramic market

The global ceramic industry has undergone a period of significant change in the last 15 years, driven by the demand of the globalized economy. As the world's largest producer, consumer and exporter of ceramic tiles, the sheer scale of China's volumes has been boosting world growth in production, consumption and exportation. In 2018 China was the world's number one ceramic tile exporter, in an amount of approximately 854 million square meters.¹ China exported more than 3.96 million tonnes of porcelain and pottery only for domestic use in that year. The value of these exported goods amounted over 10 billion U.S. dollars. Since China and India are the two largest ceramic tile manufacturing countries, it is not surprising that currently Asia is the largest ceramic tile producing region in the world.²

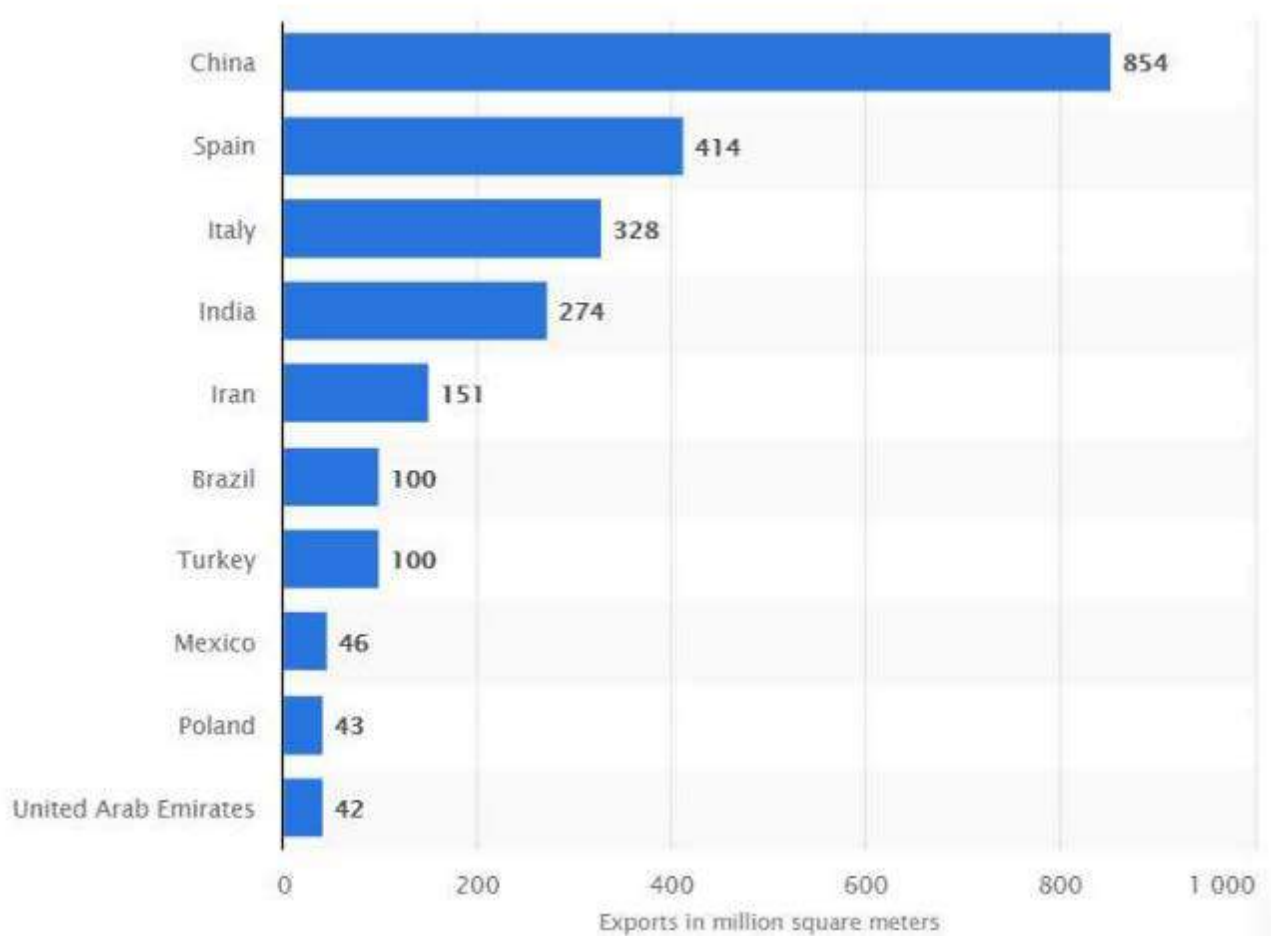


Figure 1: Leading ceramic tile exporting countries worldwide in 2018 (Source: Statista)

¹ <https://www.dccchina.org/2015/08/china-ceramics-industry-major-player-in-global-trade/>

² M. Garside, Nov 29, 2019

The European ceramics industry is one of Europe's oldest industries, being an integral part of the dynamic and innovative European economy. It covers a wide range of sectors from several time tested materials to high-tech and value based products. Despite the leading role of China and India, the EU ceramics industry is still a world leader in producing value added, as uniquely designed, high quality ceramic products manufactured by flexible and innovative European companies, out of them the majority of which are SMEs. The ceramics industry is representing a yearly production value of around 30 billion EUR, accounting for approximately 25% of global production, and over 200,000 direct jobs throughout the EU.

The major producing countries in the EU are Italy, Germany, Spain, France, the UK, Portugal and Austria. Production is also severe in Poland, the Czech Republic and Hungary, countries that have a steadily growing and dynamic ceramic sectors that traditionally export to other EU countries.³

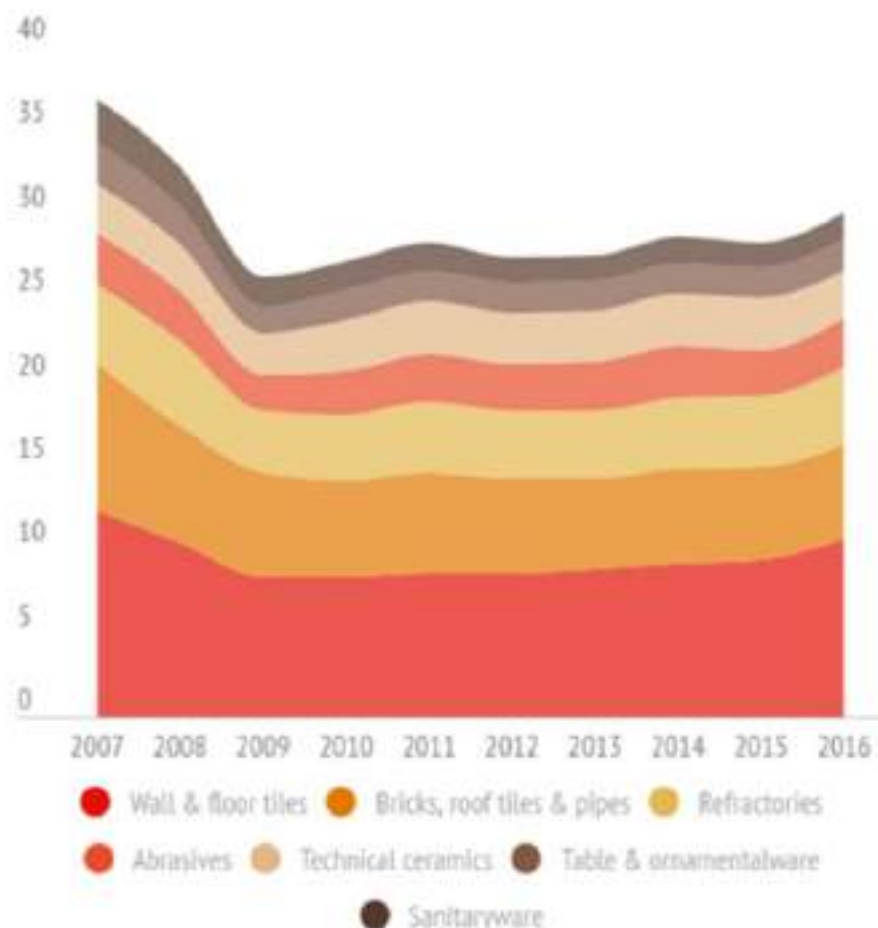


Figure 2: European ceramic industry production per product types between 2007 and 2016 (Source: The European Ceramic Industry Association)

In the EU around 1.25 million tons of frits are produced per year in over 60 production sites. The EU ceramics industry is export-oriented with 30% of its production sold outside the EU market, being competitive, both domestically and internationally. However, in the last decade the market situation

³ The European Ceramic Industry Association

has changed drastically with the rise of lower cost products from new competitors in emerging and developing countries while withstanding trade barriers continue to prevent access to important new markets. ⁴

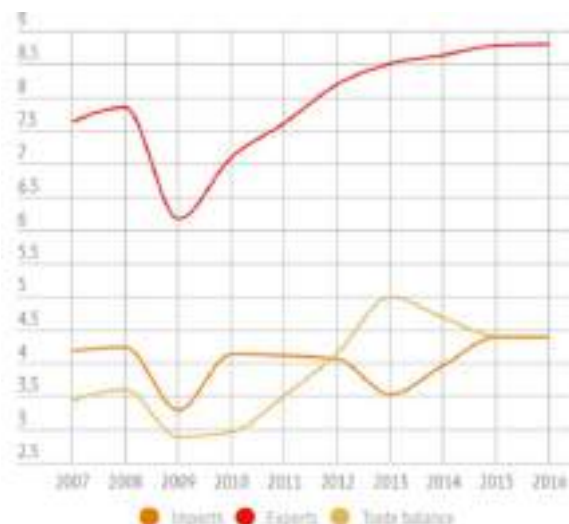


Figure 3: European ceramic industry import, exports and trade balance progress between 2007 and 2016
(Source: The European Ceramic Industry Association)

The figure below shows the leading ceramic tile manufacturing companies worldwide in 2018, based on production. It is worth noting that the number one producer is Mohawk Industries Inc., in the U.S., with an estimated 223 million square meters of ceramic tiles produced, while the only European companies in the list are PAMESA, STN Group (both from Spain) and Cersanit SA (from Poland).⁵

⁴ <http://cerameunie.eu/ceramic-industry>

⁵ Statista

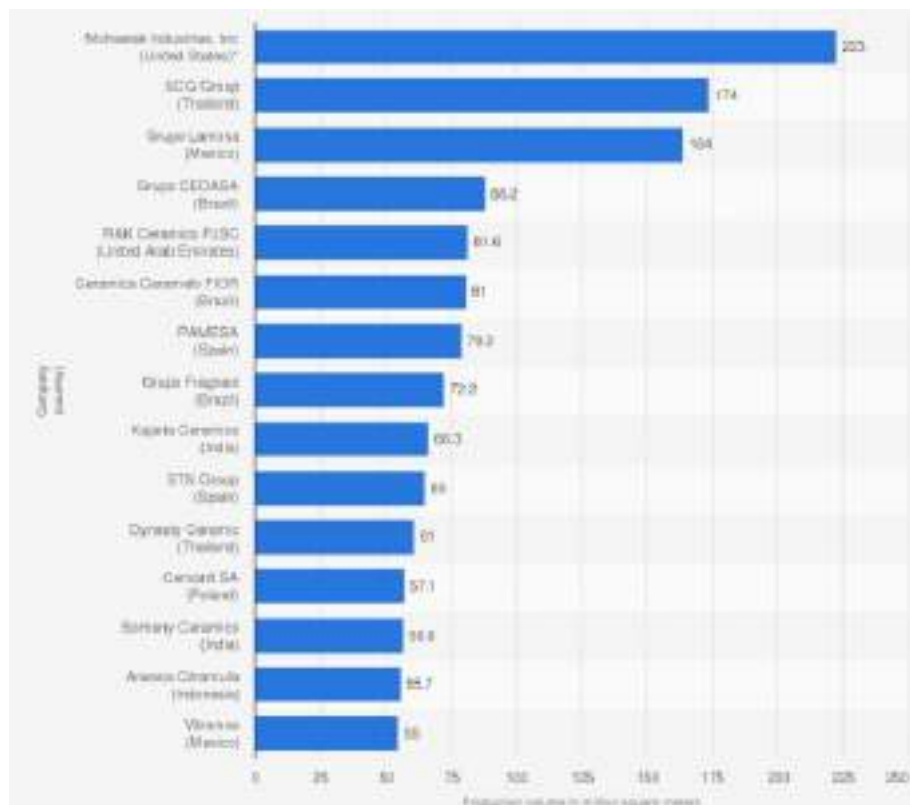


Figure 4: Leading ceramic tile manufacturing companies worldwide in 2018 based on production volume
(Source: Acimac Research Department)

Even if worldwide export is high, the amount of consumed ceramic products is much lower in Europe. Even if production volumes remained unchanged in the European Union (1,366 million sq.m, +0.3%), according to the figure below, the main consuming countries are outside of Europe.⁶

⁶ <https://www.ceramicworldweb.it/cww-en/statistics-and-markets/world-production-and-consumption-of-ceramic-tiles-5/>

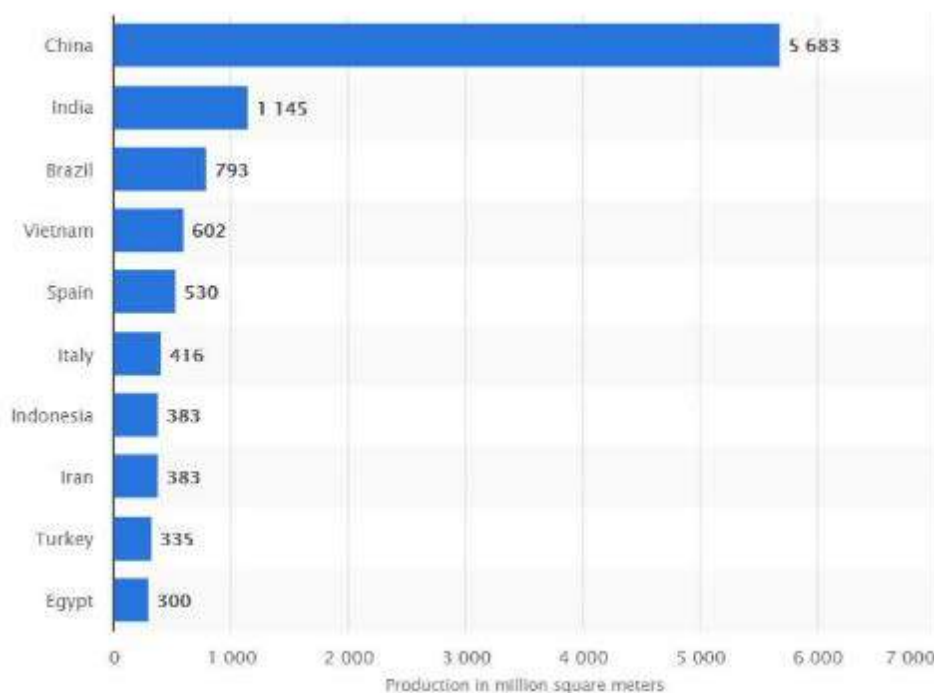


Figure 5: Leading ceramic tile consuming countries worldwide in 2018 (Source: Ceramic World)

The European ceramic tiles market is projected to reach up to a CAGR of 4.19% in terms of revenue during the forecast period of 2020-2028. In terms of volume of the production, the market is estimated to grow at a CAGR of 4.11% during the period. One of the critical factors attributed to the growth is the increasing focus on the improvement of thermal and acoustic properties of tiles, along with its weight reduction. Also, the abundance of feldspar is another factor driving the market growth. The large presence of SMEs that focus on developing tiles for walls and floors is set to be beneficial for market growth, according to the European Commission.

The Europe ceramic tiles market growth is assessed by the markets in the countries of Germany, Russia, France, the United Kingdom, Italy, Belgium, Poland, and the rest of Europe. The third-largest economy in Europe, France, is considered to be the second-largest country when it comes to the construction sector and there is still an increase in new residential construction activities in the country. There is also a rising demand for timber usage due to the growing awareness about the ill-effects of concrete constructions and this further sets to influence the growth of the ceramic tiles market in the country. The European region encompasses Germany, the UK, and Italy as these regions are the major ceramic tiles markets. Italy is considered as a major exporter of ceramic tiles having key import destinations to France, the US, Austria, Belgium, Germany, Greece and Canada. Germany is one of the major producers of kaolin in the European region. In non-EU countries where improving economic conditions and upcoming construction projects, along with favorable

government policies regarding infrastructure development, are propelling the ceramic tiles market growth.⁷

The ceramic sector as represented by Torrecid addresses frit and enamel producers. This market is related with the ceramic industry, tile manufacturers. The frit, enamel producer are located in more than 60 countries, whereas Europe in leading country with Spain and Italy at the front, followed by Turkey and the Czech Republic. It is worth mentioning that frit technology is strongly focused in Spain, and producing companies have plants all around the world, as in the case of ceramic demonstrator Torrecid, with melting facilities in Spain, Czech Republic, Mexico, Brazil and China. Regarding the evolution of the Spanish industry of frits, inks, enamels and ceramic colors, as can be seen in Figure 7, total sales have been increasing year after year except for the economic recession caused by the world crisis, where in 2009, a 27% reduction in sales was observed. Compared to 2018, the total invoiced has increased by 6.6% compared to 2017, reaching a turnover of more than 1,408 million euros.

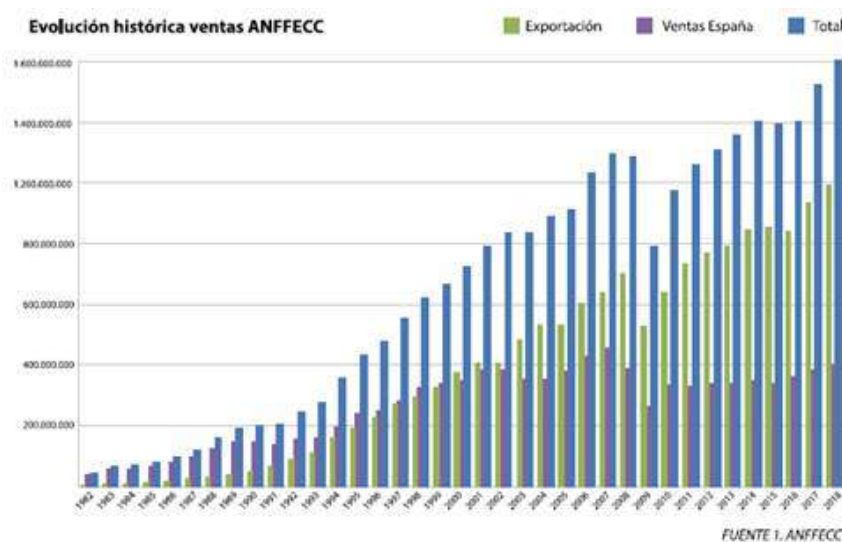


Figure 6: Spanish ceramic frit production (Source: TORRECID)

It is worth mentioning that the involved technology and retrofitting actions can be transferred not only to ceramic tile producer, but also to other related industries like glass industry and refractory. Glass Industry involves in Europe around 300.000 people, with 48 billion EUR and a production of 100 Million tons glass.

⁷ <https://www.marketresearch.com/Inkwood-Research-v4104/Europe-Ceramic-Tiles-Forecast-13028752/>

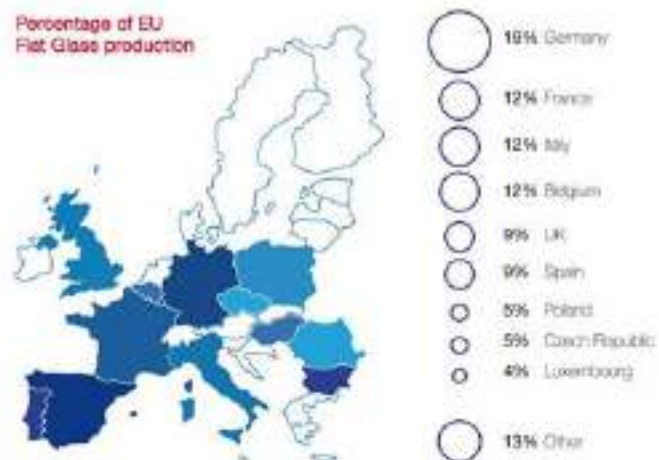


Figure 7: Percentage of EU Flat Glass production (Source: TORRECID)

4.2 Cement market

Cement and lime production is essential to the EU's economy, because cement products are important for construction and civil engineering, while environmental concerns are of paramount growing issue to the European sector, and innovation includes the use of waste as an alternative raw materials and fuels. In 2011, EU lime production reached about 22 million tonnes, accounting for a 2 billion EUR contribution to the EU's GDP. By 2006, 267.5 million tonnes of cement - with a value of 19 billion EUR - were produced in the EU at 356 locations. The EU cement industry in 2006 represented 10.5% of total world production and this value decreased to 5.6% of world production in 2011 (195.5 Mt). Up to now large cement plants keep on producing around 4 000 tonnes of cement per day. The lime sector in the EU has more than eleven thousand employees and the production of cement provides about sixty one thousand jobs, as well as up to 365.000 indirect jobs, while over 305.000 people are employed in the production of concrete. Cement being a vital material for the construction sector, accounted for 1640 billion EUR worth of production in 2010, a total added value of 505 billion EUR, and twenty million jobs.

In 2015, cement production in the EU28 amounted to 167 million tonnes, representing 4% of the global production, putting the EU as the third largest producer behind India with a production of 270 million tonnes.⁸ China keeps on dominating global production with an estimated volume of 2.35 billion tonnes representing 51% of global production in 2015, while the EU has a cement production capacity with over 27.000 companies.⁹

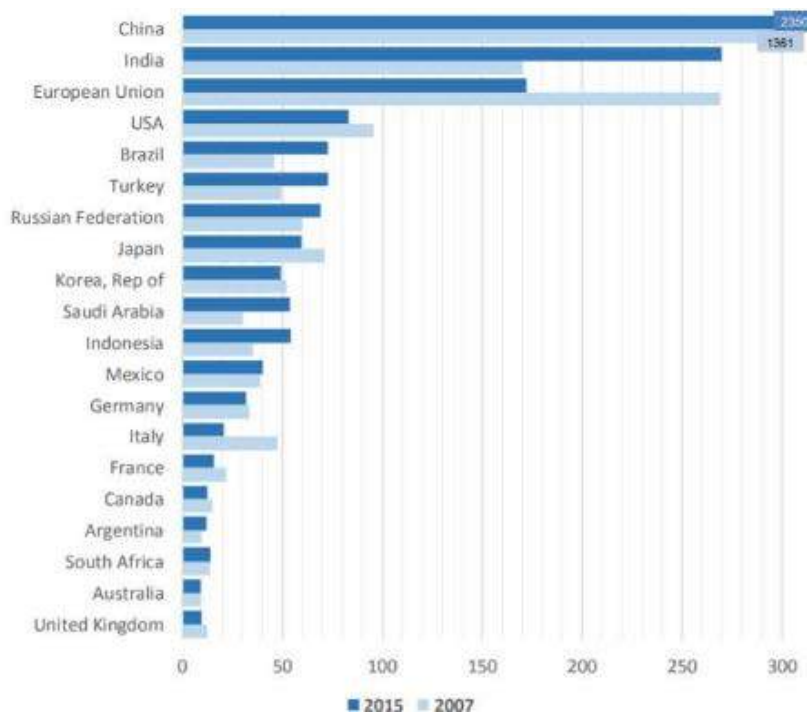


Figure 8: Production levels of main world cement producers (Source: Ecorys elaboration on CEMBUREAU data)

⁸ CEMBUREAU 2017, 'Activity Report'

⁹ European Commission - https://ec.europa.eu/growth/sectors/raw-materials/industries/non-metals/cement-lime_en

Global annual cement production is expected to grow moderately to 2030. Because of expected slow structural changes in its economy, production is likely to decline in China in the longer term (above 2030), however further increases are anticipated in India, other developing Asian countries and Africa as these regions develop their own infrastructure.¹⁰

The cement production process is highly energy-intensive with energy costs representing up to 40% of total production costs for cement and up to 50% for lime and kilns represent a very high, long-term investment. It is difficult for producers to constantly respond to fluctuations in demand or to comply with new legislation on energy or emissions. The majority of EU cement producers operate on a global level, giving them a rather high advantageous access to global best practice and technology. Raw materials are usually extracted on-site; this practice minimizes transportation costs and decreases environmental damage. Cement and lime industries are capital intensive with the cost of laying down a cement production plant equivalent to around three years' turnover. Cement is a high-density product with a relatively low selling price, therefore transport costs are determinant to trade. EU exports go mainly to the US and imports come mainly from East-Asian countries like China, Thailand and the Philippines. EU cement producers own almost 60% of the cement and lime production capacity in the US, and have other significant production facilities in the rest of the world.¹¹



Figure 9: EU28 cement – breakdown of domestic deliveries by product type 2005-2016 (Source: Ecorys based on Eurostat Prodcom and CEMBUREAU)

Eurostat data indicate that the total quantity of EU cement clinker production was 111 million tonnes in 2016.¹² However, there are large disparities between Eurostat production estimates and those coming from industry sources. For example, data from the CSI¹³ show total EU28 cement clinker

¹⁰ <https://www.iea.org/reports/tracking-industry/cement>

¹¹ https://ec.europa.eu/growth/sectors/raw-materials/industries/non-metals/cement-lime_en

¹² PRCCode: 23511100 - Cement clinker

¹³ CSI Global Cement Database "Getting the Numbers Right" (GNR)

production of 125 million tonnes in 2015 compared to a Eurostat estimate of only 105 million tonnes. Eurostat PRODCOM (NACE Rev. 2) data on total cement clinker production are only available since 2009 and so they do not measure the impact of the last economic crisis on total production.

Data from CSI indicate a sudden fall from 191 million tonnes in 2007 to 144 million tonnes in 2009, followed by a continuing decline to only 122 million tonnes in 2013, after which there has been a slight increase to 125 million tonnes.¹⁴ The majority of clinker production is not sold in the market but transported directly to the production of cement. For the EU as a whole, Eurostat data indicate sold production of cement clinker around 16.6 million tonnes. Volumes of sold clinker have generally increased over time, from 11 million tonnes in 2003 to 20 million tonnes in 2014, but also show some decline for the last two years (2015 and 2016) for which data are available.¹⁵

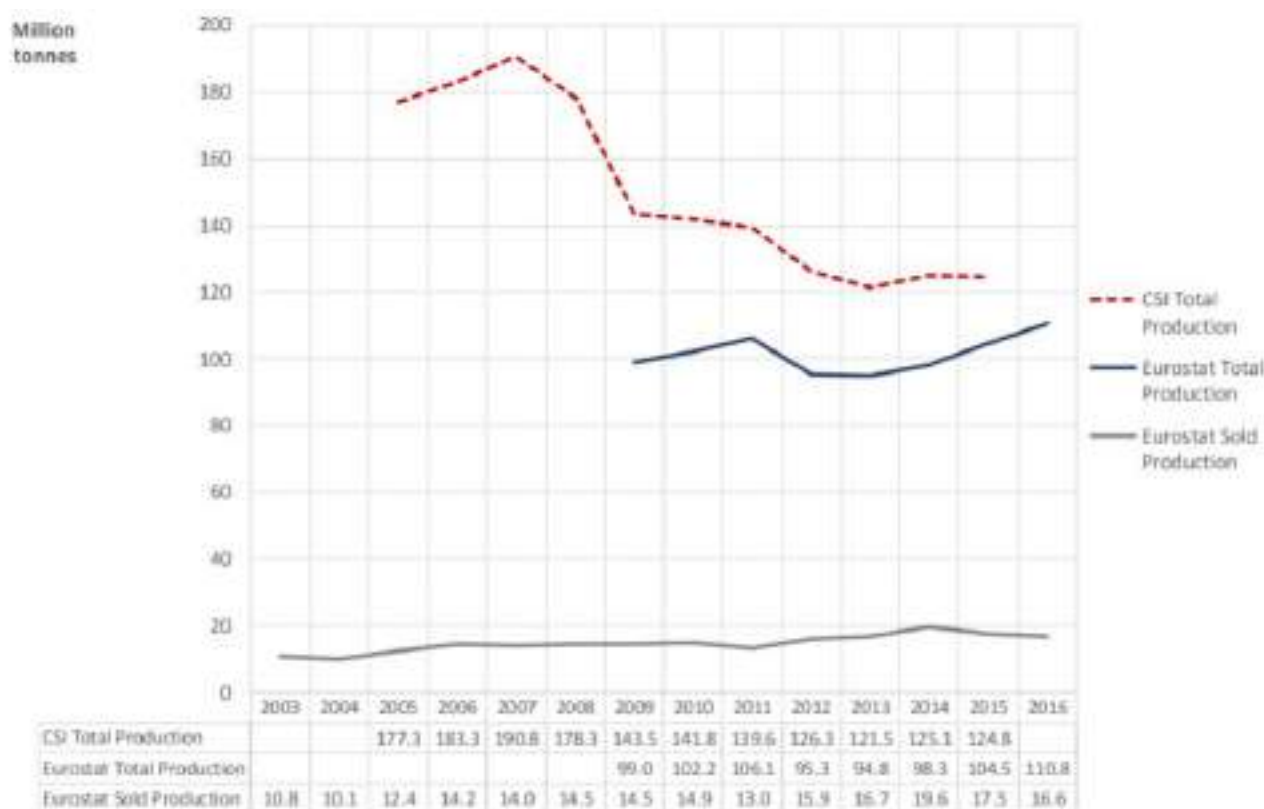


Figure 10: EU28 cement clinker – quantity of production 2003-2016 (Source: Ecorys based on Eurostat Prodcum and CSI Global Cement Database on CO₂ and Energy Information "Getting the Numbers Right" (GNR) available at: <http://www.wbcsdcement.org/index.php/key-issues/climate-protection/gnr-database>).

Both Eurostat data and data from industry sources (CSI) indicate that Spain, Germany, France, Italy, and Poland are the largest producers of cement clinker in Europe. Eurostat data also indicate that these countries together account for 70% of EU production in 2016, while data from industry sources gives a collective share of 60% of EU production in 2015.

¹⁴ Competitiveness of the European Cement and Lime Sectors – Final report

¹⁵ http://publications.europa.eu/resource/cellar/07d18924-07ce-11e8-b8f5-01aa75ed71a1.0001.01/DOC_1

Eurostat does not provide data for the UK, but national industry data suggests that the UK accounts between 5-8% of EU production. However, there are important discrepancies between Eurostat clinker production data and those available from industry sources. This has an important impact not only on the overall level of production but also on the shares of individual countries. For example, Eurostat data indicate that Spain accounts for 18% of EU clinker production, whereas the corresponding share based on industry data is only 10%.¹⁶

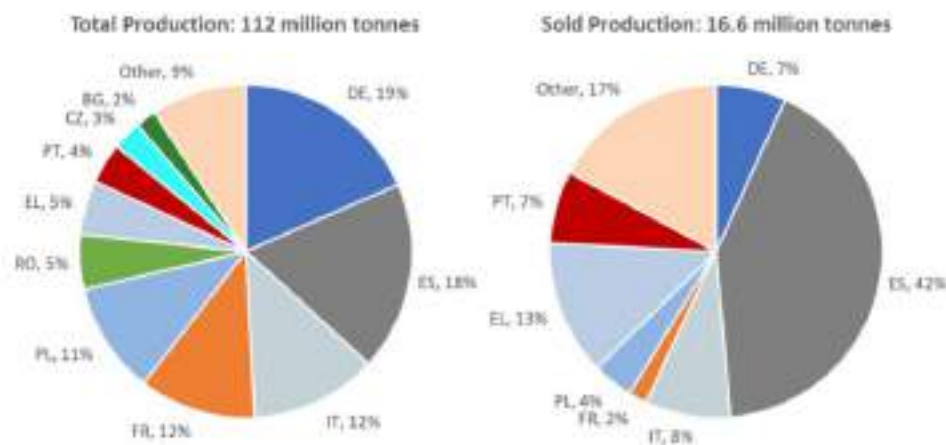


Figure 11: EU28 Cement clinker production - breakdown by country in 2016. Zero production indicated for CY, DK, FI, LT, LU, MT, NL, and UK; Data unavailable for AT, BE, EL, IE, LV, SE, SI, SK.
 (Source: Ecorys based on Eurostat Prodcom)

In 2014, Spain Germany, France, Italy, Poland and Belgium together accounted for 71% of EU's turnover, 68% of EU's value added, 70% of EU's enterprises and 68% of EU's employment in the cement sector. Since 2008, Italy and Spain have seen the most significant decline in their share of total EU cement manufacturing turnover, which has fallen onto 6.5 and 3.6 percentage points (p.p.), Germany (+7.2 p.p.) and France (+5.2 p.p.) have seen the largest increases in their share of EU turnover, while the collective share of smaller cement manufacturing countries is estimated to have fallen by 3.2 percentage points. Within the context of the overall decline, the EU cement industry turnover fell by 37% in recent years.

¹⁶ https://cement.mineralproducts.org/documents/Annual_Cementitious_01_15.pdf

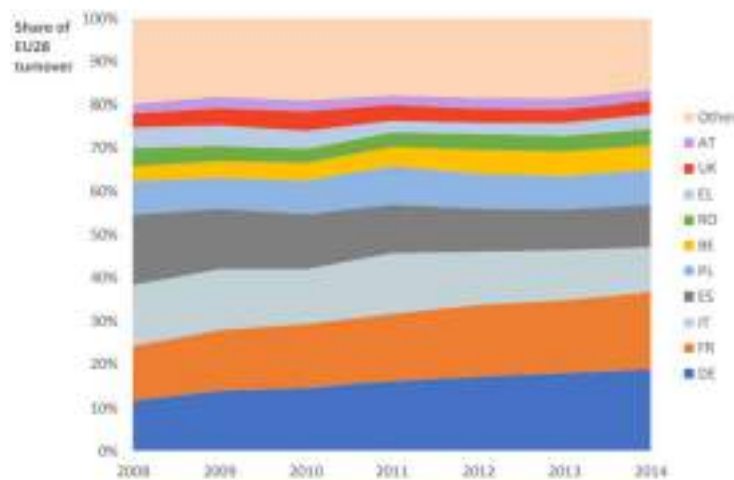


Figure 12: EU28 cement manufacturing breakdown of turnover by country 2008-2014 (Source: Ecorys on Eurostat SBS)

The European cement market is mainly characterized by the presence of a few large vertically integrated companies (LafargeHolcim, HeidelbergCement, Cemex, Buzzi Unicem, Secil). Mergers and acquisitions between the largest companies (e.g. merger of Lafarge and Holcim in 2015, HeidelbergCement's acquisition of Italcementi in 2016) form part of a continuous trend towards an increasingly consolidated ownership pattern within the industry at the European level. The European situation reflects a worldwide tendency, partially due to the economic situation during the past years, which favors larger companies and makes it more difficult for smaller ones to compete with them. Mergers and acquisitions in Europe occurred throughout the 1990s and early 2000s, partially driven by political developments, such as the collapse of communist regimes in Central and Eastern Europe and the ensuing privatization of state-owned companies and German reunification. The years following the 2008 financial crisis were marked by a restructuring and rationalization process within the industry, as well as further horizontal integration. In the meantime these larger companies developed diversified geographic portfolios as a convenient way of limiting risks and increasing their chances for further growth. The figure below shows the geographical distribution of cement plants by holding companies in or around 2014. It also demonstrates that even before 2015, a small number of companies controlled more than half of the plants located in the EU and Norway, however as the results of the recent mergers, this number has been further reduced.¹⁷

¹⁷ <https://hal-enpc.archives-ouvertes.fr/hal-01183725>

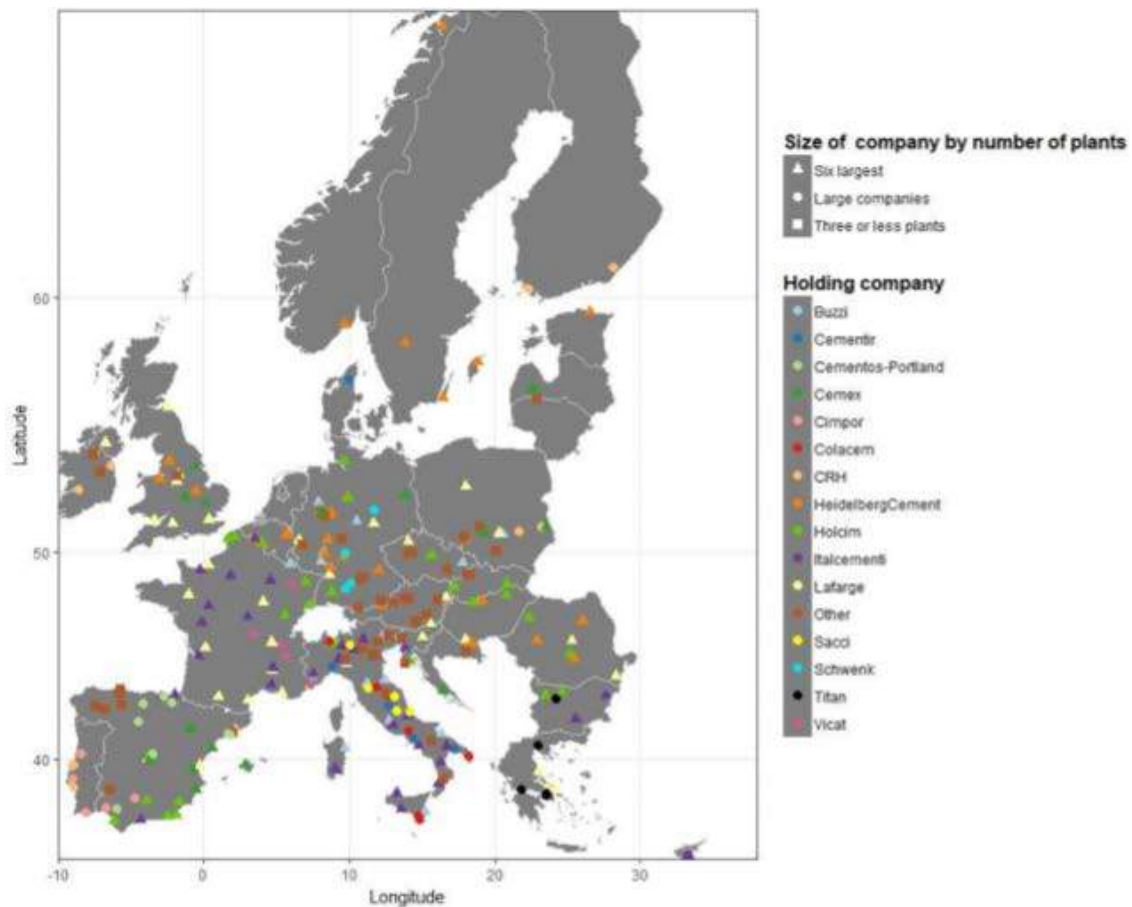


Figure 13: Geographical distribution of cement plants in Europe by holding company (Source: Ecorys based on F. Branger 2015)

Despite a consolidated ownership pattern within the European industry, the continued presence of smaller local or regional companies implies that large differences exist in industry structure at national level. Due to the low value to weight ratio of cement, it is usually supplied within a close geographical proximity to location of production, typically within a maximum radius of 150 to 250 km and as a consequent result, cement markets are local and geographically segmented, with competition occurring at a local/regional level. Therefore the increased concentration at a European level may not directly result in changes in competition conditions at a local or regional level.¹⁸

The five largest cement clinker exporters are all located in the periphery of the EU, which facilitates the shipment of cement clinker to third countries. The increase of Spanish exports to third markets over the last decade was quite remarkable.¹⁹

¹⁸ F. Branger (2015) EUTL Cement dataset

¹⁹ http://publications.europa.eu/resource/cellar/07d18924-07ce-11e8-b8f5-01aa75ed71a1.0001.01/DOC_1

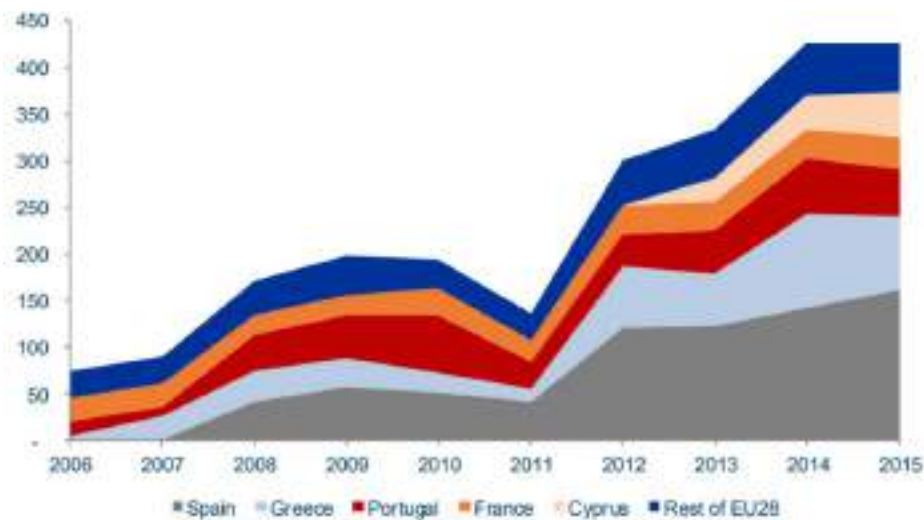


Figure 14: Extra-EU exports in cement clinker, per EUMS (in million EUR) (Source: Eurostat Comext, Ecorys calculations)

The following figure shows the breakdown of average cement production costs obtained for a sample of 15 European cement companies. Among the different cost categories, cost of energy is the largest item in the reported cost structure of cement companies, constituting around 24% of total costs on average. This figure includes both the expenses incurred for electricity and for the fuel used during the production process, for example burning.

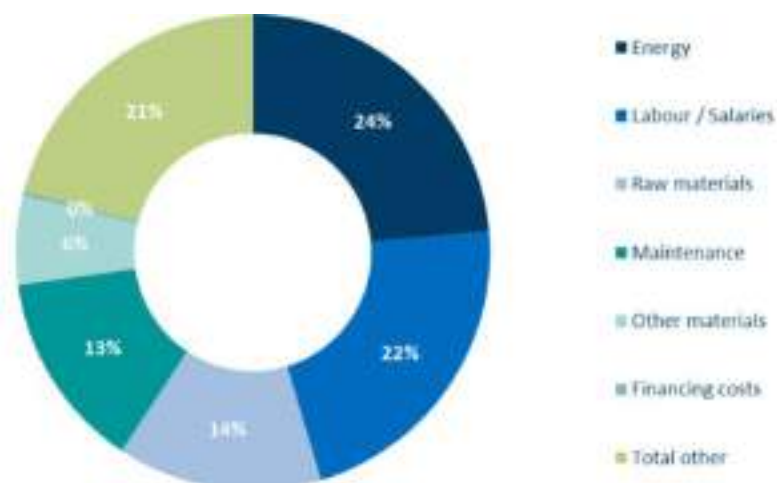


Figure 15: Cost structure, % of total production costs, EU cement sector (n=15) (Source: Ecorys questionnaire)

4.3 Aluminium market

China is responsible for around 57 percent of aluminium production globally, while Europe represents about 7 percent, around half of which comes from within the EU27 (plus the UK). Current primary aluminium production in Europe is flat, despite a growing demand for aluminium products in a range of various strategic applications. This is due to some tensions in the aluminium supply chain caused by different trade issues at global level. The serious excess capacity on global markets, more and more strict EU regulations and challenges in accessing aluminium scrap are putting additional pressures on the aluminium industry. However, for semi-fabricated products, continuous increases in production for Europe can be experienced. Since 2002, the EU has been a net exporter of aluminium scrap.

In 2018, the primary aluminium production in Europe (EU28+EFTA) slightly decreased and this negative profile reflected considerable pressures on the aluminium supply chain which impacted the alumina and the primary smelting production in a relatively negative way. As a consequence, smelters located in EU28 were particularly affected by production decreases and the lack of affordable electricity prices expected in the future may also place some smelters at a higher risk of suspension or closing down operations in the foreseeable future. Still in 2019, aluminium demand in Europe continued to be driven by growing demand in many applications and most end-use markets.²⁰

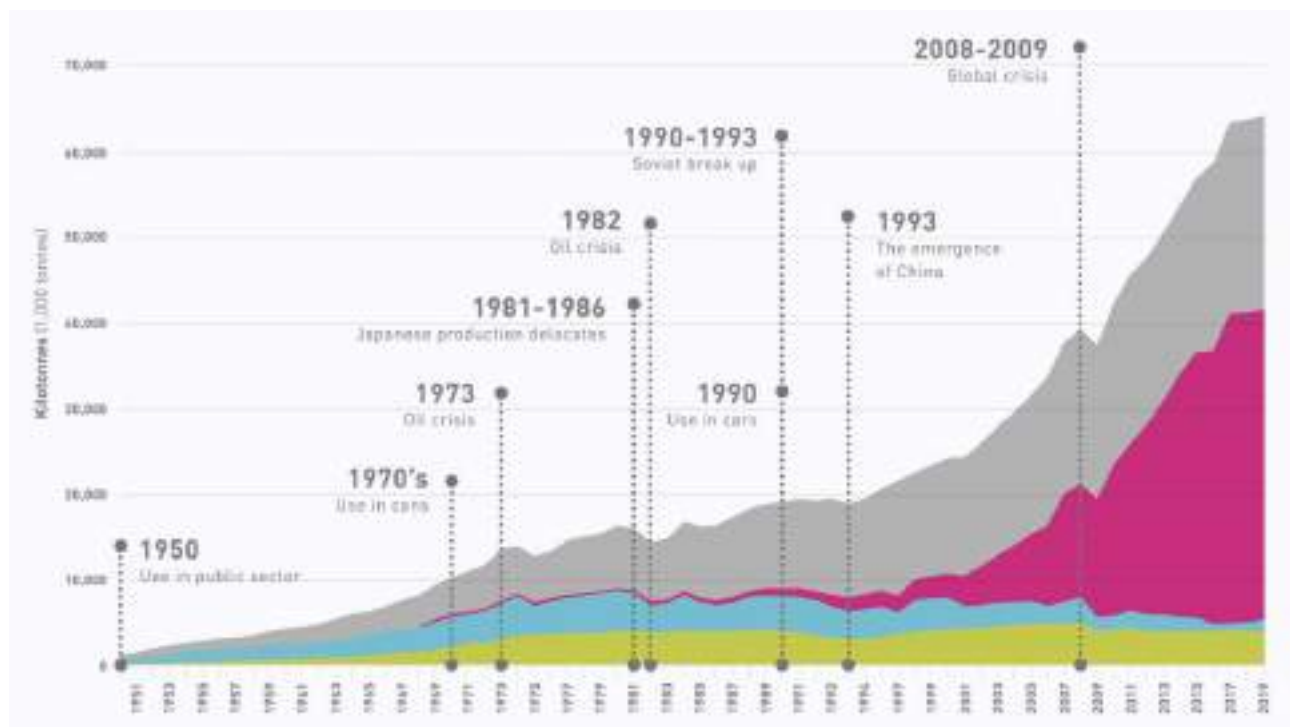


Figure 16: Worldwide main aluminium producing countries and regions 1950 – 2017 (Green: Europe, Blue: USA, Purple: China, Grey: Other) (Source: European Aluminium)

²⁰ European Aluminium (www.european-aluminium.eu)

There are sixteen aluminium smelters in the EU (plus the UK), located in ten countries: France, Germany, Greece, the Netherlands, Spain, United Kingdom, Romania, Slovakia, Slovenia and ten smelters in EFTA countries (Norway and Iceland).



Figure 17: Location of aluminium smelters in EU28 + EFTA in 2019 (Source: Mapbox OpenStreetMap)

Although aluminium production was stable until 2019, the EU27 + UK still imports approximately 50 percent of its aluminium ingots requirements. Iceland and Norway being part of the European Economic Area (EEA), are the biggest exporters of primary aluminium to the EU. Other major exporters to Europe are the United Arab Emirates, Russia and Mozambique.²¹

²¹ European Aluminium (www.european-aluminium.eu)

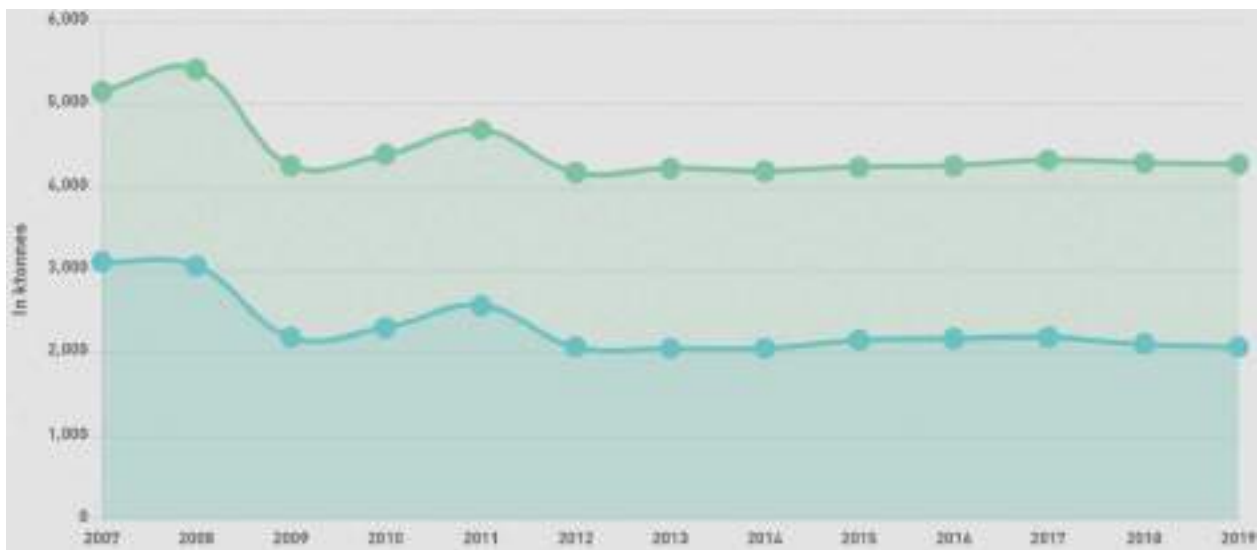


Figure 18: EFTA (in green) and EU28 (in blue) annual primary aluminium production 2007 – 2018 (Source: European Aluminium)

Domestic production is fulfilled through both primary and recycled production of aluminium.

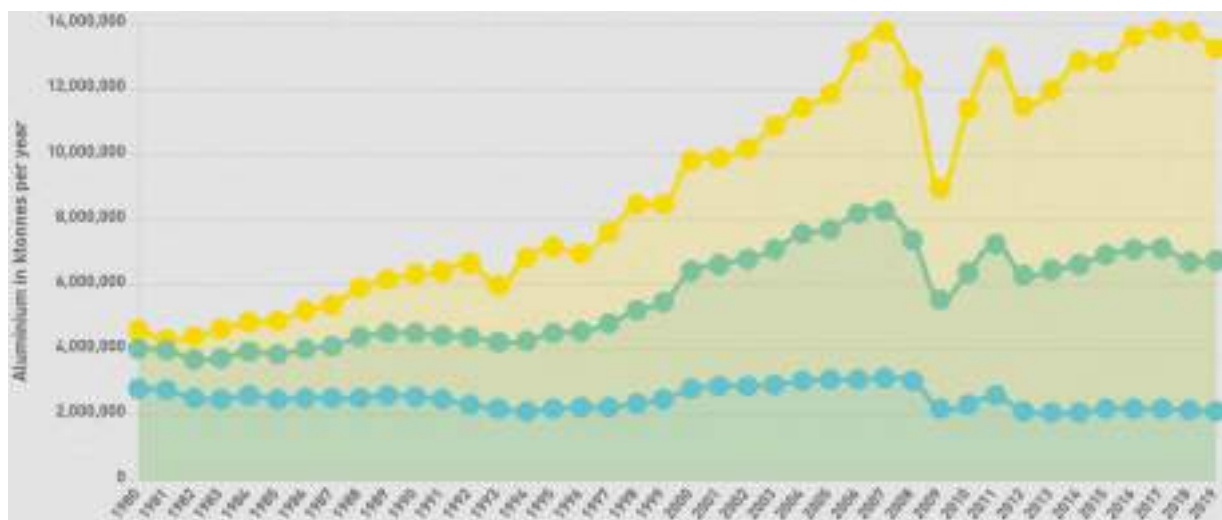


Figure 19: EU28 domestic aluminium processed annually, primary production in blue, recycled in green, imported in yellow 1980 – 2018 (Source: European Aluminium)

In 2018, the EU exported around 970.000 tonnes of aluminium scrap, which is an increase of 7 percent compared to 2017. Around 80 percent of this is exported to Asia, mainly to China, to India and to Pakistan. While the recent legislation ban on imports of waste and scrap saw EU exports to China decrease by around 6 percent, these volumes were fully absorbed by other Asian countries, including India (+3 %), Pakistan (+65 %) and Indonesia (+6 %).²²

²² European Aluminium (www.european-aluminium.eu)



Figure 20: EU28 exports of aluminium scrap in ktonnes 2007 – 2018 (Source: European Aluminium)

There is a continuous increase (+4%) of flat-rolled aluminium products demand since 2018 and European Aluminium statistics confirm the continuous demand increase in Europe during 2018 in semi-fabricated aluminium, products that are obtained from processing aluminium ingots that need to undergo further processing before use in final applications. The growing demand (+4 percent) for flat rolled aluminium products was driven mainly by transport and particularly automotive and packaging industries. Both markets represent more than 60 percent of the flat rolled aluminium products market.²³

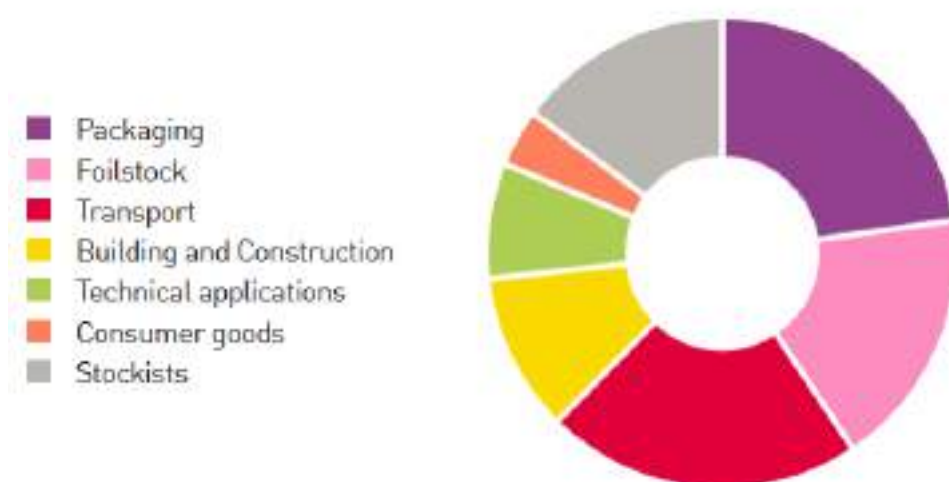


Figure 21: Distribution of EU28 flat-rolled aluminium products per utilization sector in 2018 (Source: European Aluminium)

²³ European Aluminium (www.european-aluminium.eu)

There is a well-established aluminium value chain in Europe, with more than 600 plants covering all steps of procession, like raw materials (e.g. bauxite and alumina), primary metal production, semi-fabrication (e.g. rolling and extrusion) and recycling. Smelters and rolling mills are usually part of larger multinational companies, while extrusion and recycling activities are often undertaken by small to medium enterprises.²⁴

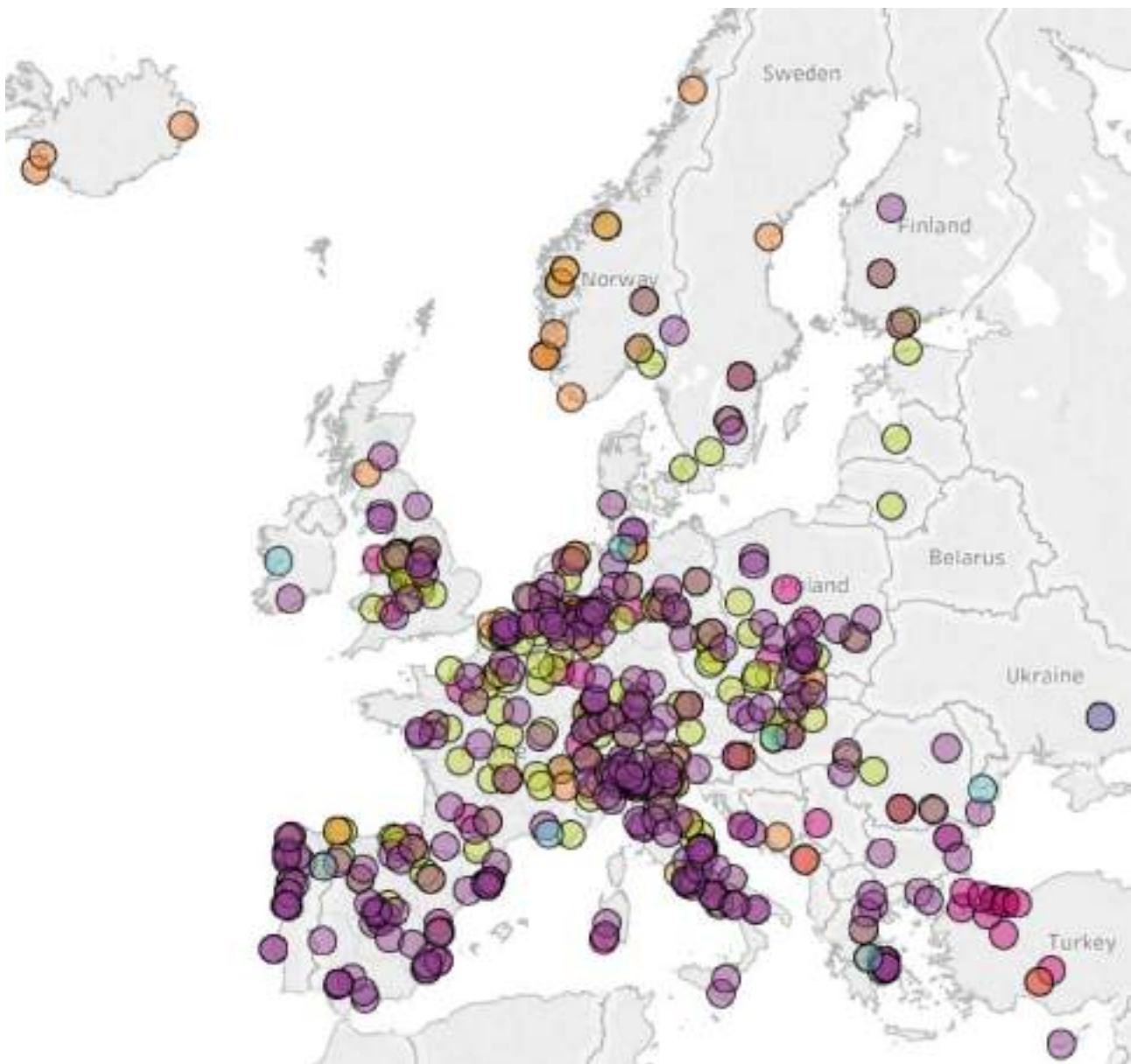


Figure 22: Aluminium production value chain in Europe. Light blue - Alumina. Purple – Extrusion. Orange – Primary, Yellow – Recycling, Magenta – Rolling (Source: European Aluminium)

The European aluminium casting market is segmented into four notable segments which are based on the basis of process, source, application and end-user.²⁵

²⁴ European Aluminium (www.european-aluminium.eu)

²⁵ <https://www.marketresearch.com/DataBridge-v4178/Europe-Aluminum-Casting-Trends-Forecast-12929919/>

- On the basis of process, the market is segmented into expendable mold casting and non-expendable mold casting
- On the basis of source, the market is segmented into primary (fresh) aluminium and secondary (recycled) aluminium
- On the basis of application, the market is segmented into intake manifolds, oil pan housings, structural parts, chassis parts, cylinder heads, engine blocks, transmissions, wheels & brakes, heat transfers and others
- On the basis of end-user, the market is segmented into automotive, building and construction, industrial, household appliances, aerospace, electronics and electrical and engineering tools

Main European market players

- | | |
|--|---|
| • Alcoa Corporation | • Dynacast |
| • Novelis | • Reliance Foundry Co. Ltd |
| • Endurance Technologies Limited | • Toyota Industries Corporation |
| • Ryobi Limited | • LA Aluminum |
| • DyCast Specialties Corporation | • TPi Arcade, Drahtwerk Elisental
W. Erdmann GmbH & Co |
| • Consolidated Metco, Inc | • Wagstaff Inc |
| • Alcast Technologies | • Ningbo Innovaw Mechanical
CO.,LTD |
| • Ningbo Beilun Create Mould
Machine Co., Ltd | • Modern Aluminum Castings CO.,
INC |
| • Leggett & Platt, Incorporated | • Pacific Die Casting Corp |
| • Martinrea Honsel Germany GmbH | • Asas |
| • GIBBS | |

4.4 Steel market

Europe's steel industry accounts for roughly nine percent of global crude steel production, however the production of crude steel in the EU appears to be remaining stable despite shifting global trade trends and changing markets. The EU is the second largest producer of steel in the world after China. In 2018, the apparent consumption of crude steel in China amounted to approximately 870 million metric tons. The output of the EU is over 177 million tonnes of steel a year, accounting for 11% of global output in 500 production sites split among 23 countries. However, from 2009 through 2013, the European steel industry experienced a challenging period including the upheaval in the US financial markets, slowing economic growth in China, as well as the EUR zone sovereign debt crisis. In 2020, worldwide apparent steel use is estimated to grow to around 1.8 billion metric tons. Globally, consumption of steel scrap increased by 10 percent between 2017 and 2018.²⁶

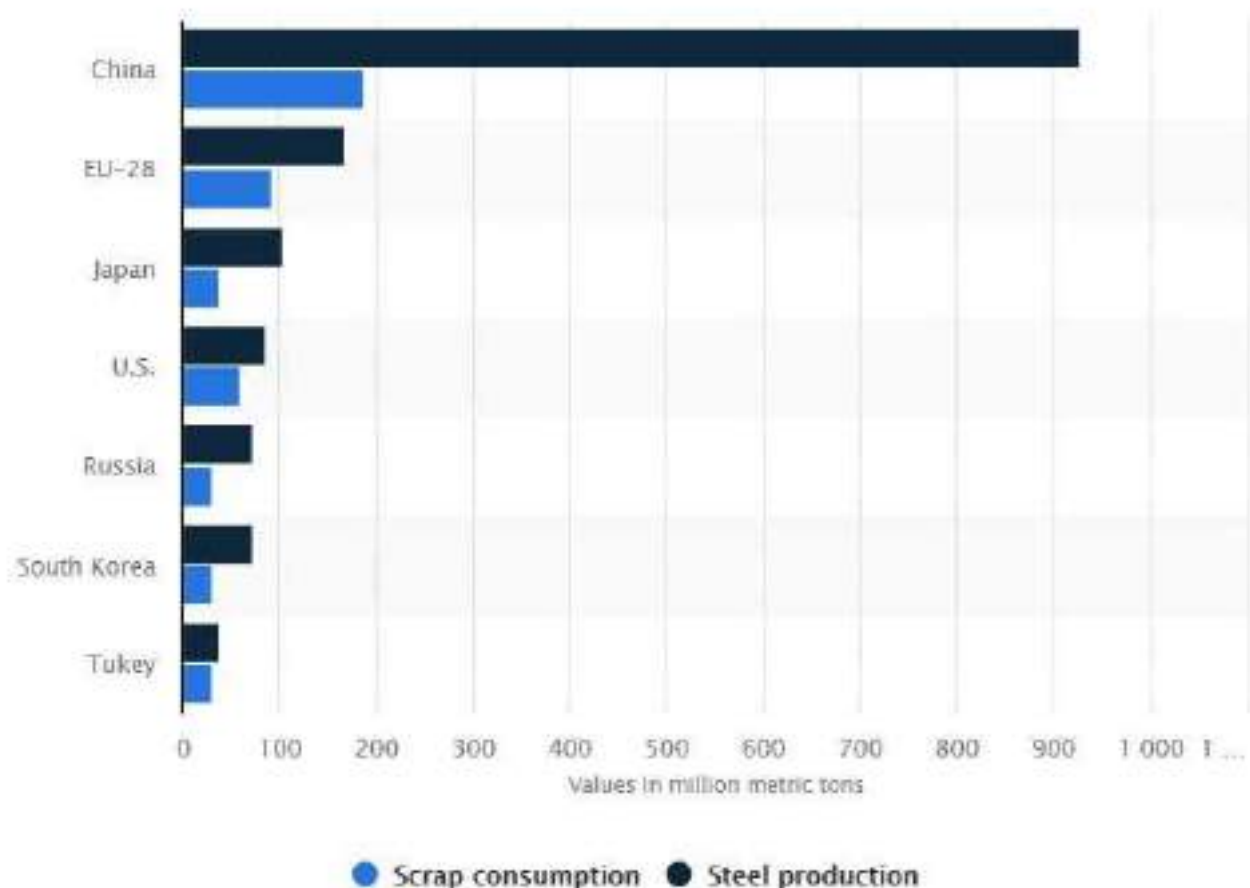


Figure 23: Global steel production and scrap consumption (Source: Bureau of International Recycling)

Asia's largest economy is expected to enter a phase of stagnation between from 2020. Between 2019 and 2020, steel demand in Africa is tipped to grow by 3.2 percent to reach 40.92 million tonnes.

²⁶ Statista

China is the largest consumer of apparent steel. The market for steel scrap and steel recycling is predicted to spell trouble for the steel production sector.

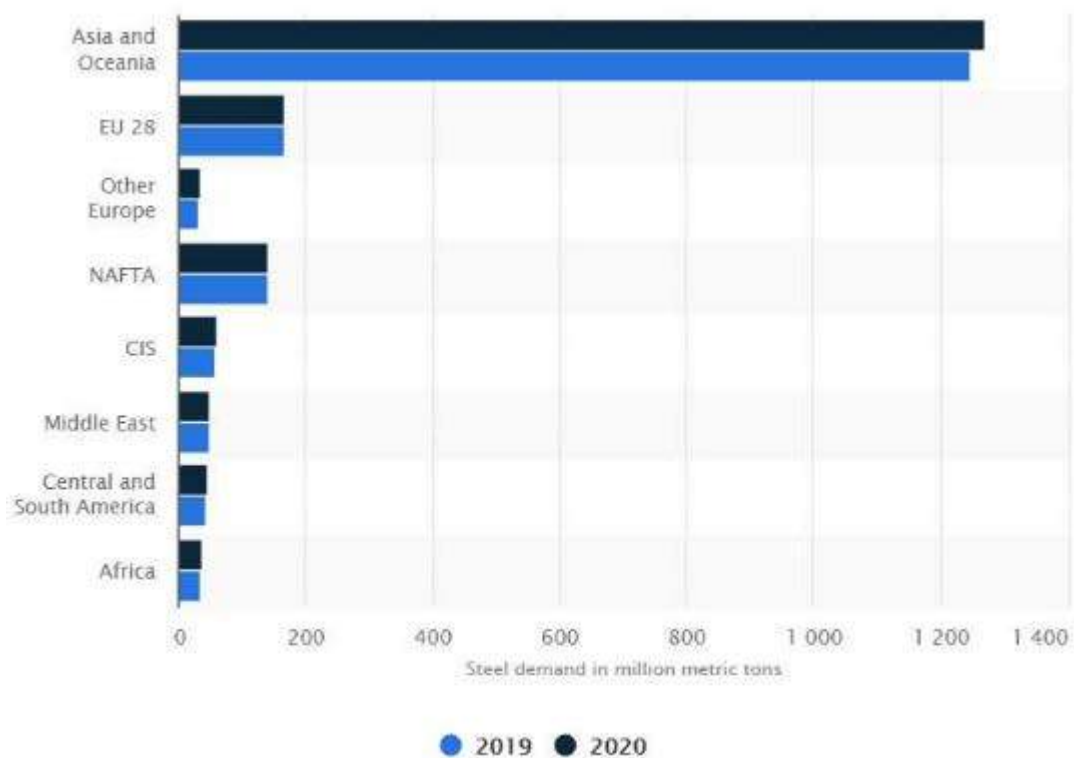


Figure 24: Estimated worldwide demand by regions for finished steel products from 2019 to 2020, (Source: World Steel Association)

The history of European industrial steel production dates back to the early 19th century in some European countries, such as Germany. Like many other regions, crude steel production was closely linked to the production of coal. Europe's third largest producer of steel, Italy, was a world pioneer in the development of electric furnaces in the 20th century. Europe is home to some of the oldest and largest steel companies in the world such as ArcelorMittal, headquartered in Luxembourg City. The oil crisis of 1973 and the 1980s recession led to further decline of the European steel industry. Since Europe has always maintained a high level of demand for steel and the European Union is among the world leading importers of steel products. Similarly the EU is the leading exporter of scrap steel. In the last few years, relatively cheaper steel production in other emerging and third countries has undercut European steel. Conscious of further disruptions to its steel, the European Commission states it is committed to boosting the industry to promote innovation and global market demand is expected to grow by 2020.²⁷

²⁷ World Steel Association

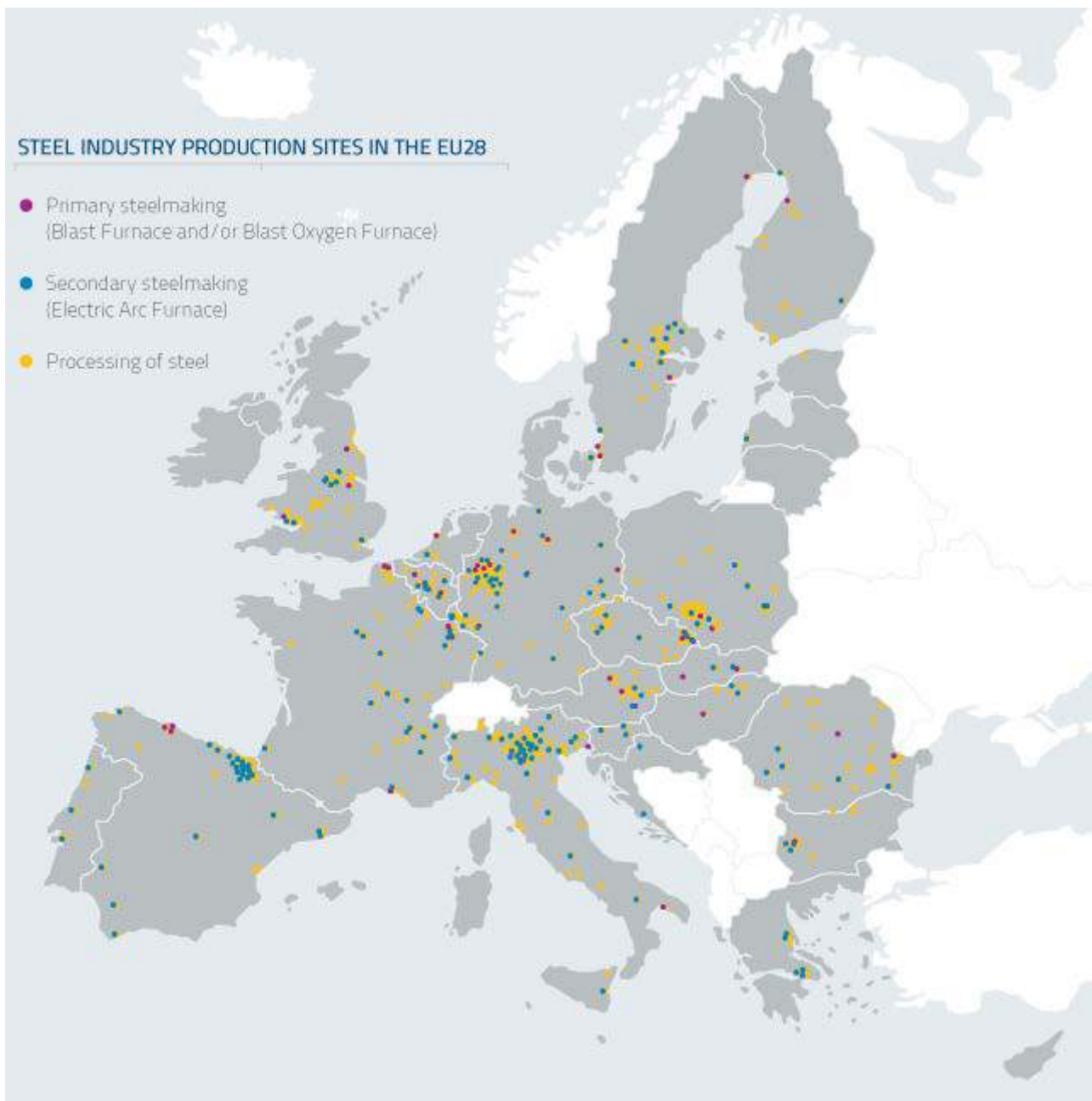


Figure 25: EU28 steel industry production sites (Source: www.eurofer.org)

The main challenges for the EU steel industry are linked to the cost and the availability of raw materials and energy, environmental and climate change regulation, and fierce competition from non-EU country producers. The main issues affecting the competitiveness of the EU steel industry were identified in the steel action plan launched by the European Commission. At the international level, non-EU steel producing countries often use trade restrictions to give advantages to their own domestic steel industries and these restrictive measures include tariff barriers, non-tariff measures such as technical regulations or conformity assessment procedures, export incentives and sometimes restrictions on steelmaking raw materials. The EU addresses trade barriers by

implementing its market access strategy by enforcing international commitments and secures even market conditions for the EU steel sector.²⁸

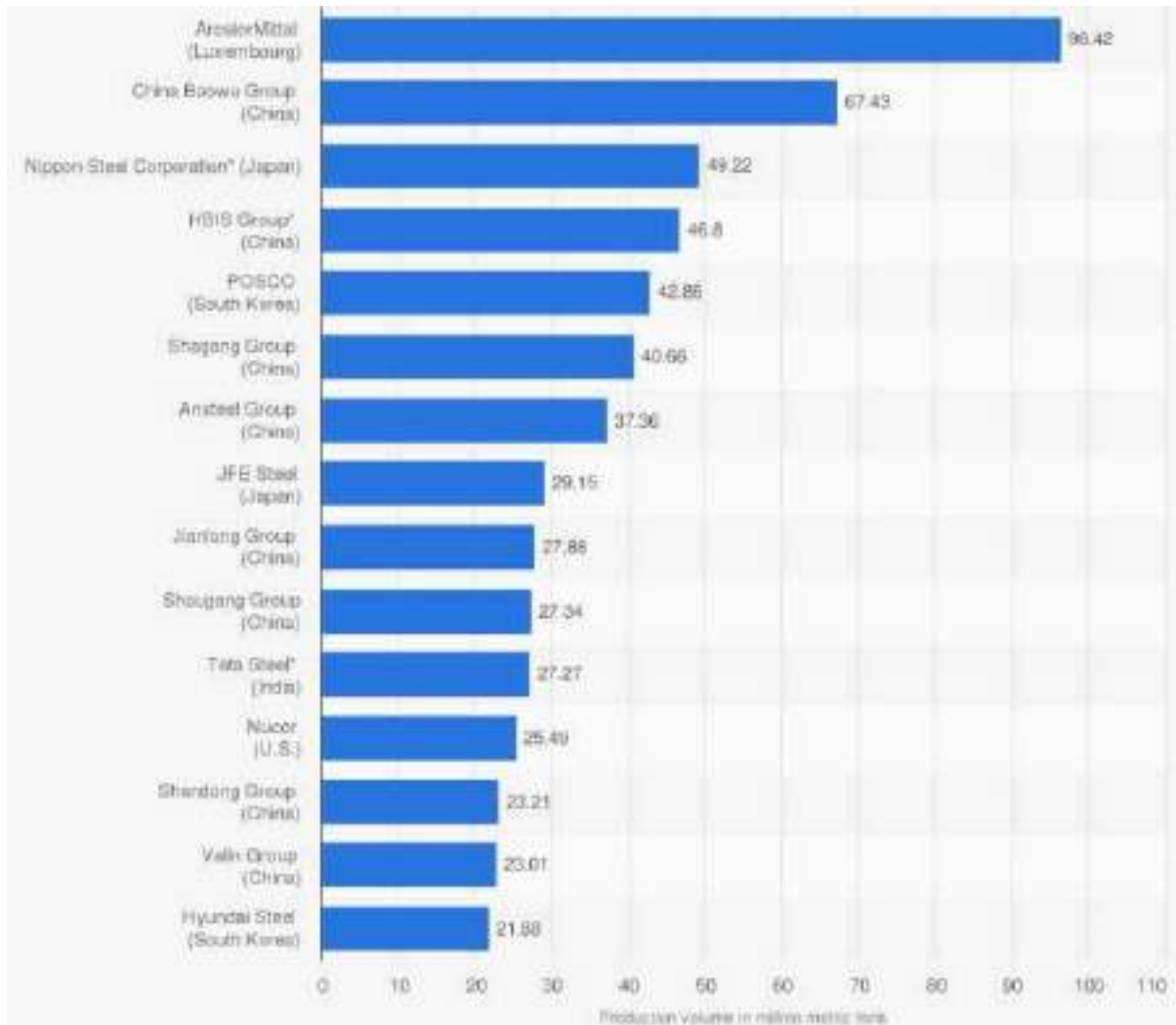


Figure 26: The world's largest crude steel producer corporations in 2018, by production volume (Source: World Steel Association)

The demand for steel products in emerging markets is forecasted to amount to approximately 1.43 billion tonnes in 2020. Emerging markets, like China and India in particular are playing a significant role in the global demand for steel products.

China itself accounts for nearly half of the world's steel consumption and similarly provides much of the global steel output either. However it is expected that in the coming years, China's steel product consumption is expected to grow more slowly and perhaps even drop already in 2020. At the same

²⁸ European Commission

time, India is expected to see some of the fastest growth in the world ever seen, as domestic construction and infrastructure account for most of India's steel demand.

Global demand for steel is expected to increase throughout 2020. In industrial nations, growth is slower due to more and more strict environmental regulations and uncertain demand from the automotive and construction industries, especially from the second half of 2019. Steel prices are currently volatile and on top of that, the United States has been changing the tariffs of steel imports from many (EU) countries and therefore demand for certain products pushed up prices.

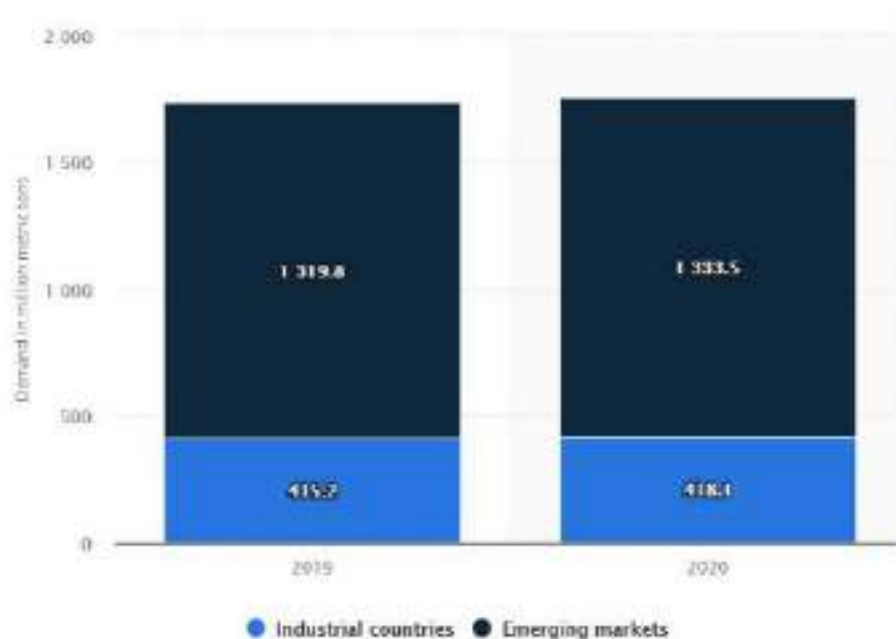


Figure 27: Global steel production demand forecast from 2019 to 2020 (Source: World Steel Association)

Stainless steel production was stagnating on the relatively same level with only minor fluctuations since 2013. In this period, stainless steel production in Europe remained relatively stable and in 2018, manufacturers based in Europe produced around 7.4 million tonnes of stainless steel, an increase of 0.3 million tons compared to 2013.²⁹

²⁹ Statista

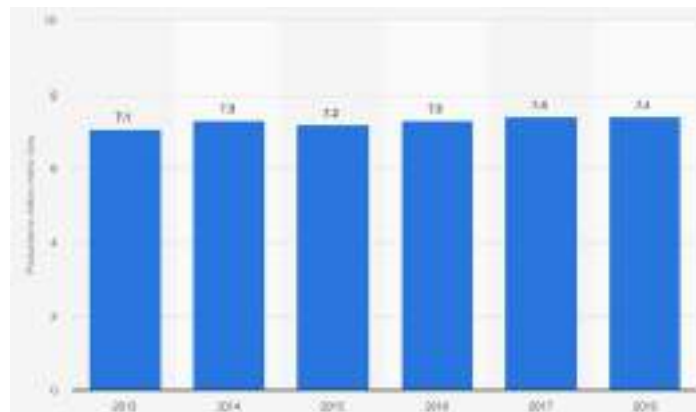


Figure 28: Stainless steel production EU27 + UK 2013-2018 (Source: International Stainless Steel Forum)

The figure below illustrates the total volume of various qualities of steel produced in EU-28 from 2011 to 2018, measured in thousand metric tons. Each type of steel decreased in production volume between 2011 and 2016, but 2017 saw a slight increase in crude steel production in comparison with the previous year. In 2018 however, non-alloy and other alloy steel production declined, but stainless steel production saw a slight increase in comparison to the previous year.

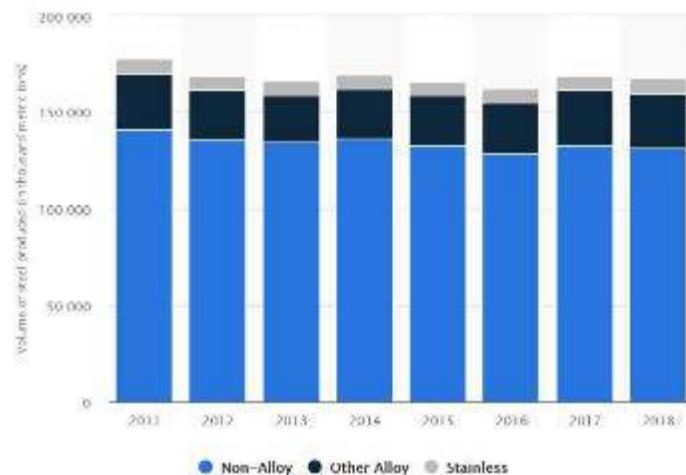


Figure 29: Volume of crude steel produced in the EU-28 from 2011 to 2018, by quality

Automotive industry, energy engineering and construction account for the main part of Europe's steel consumption with a steel demand accounting with more than half of the steel produced in the EU-28. In 2018, the construction industry share of steel produced declined at 1 percent in comparison with the previous year, but the automotive industry steel demand rose 1 percent in 2018.³⁰

³⁰ Statista

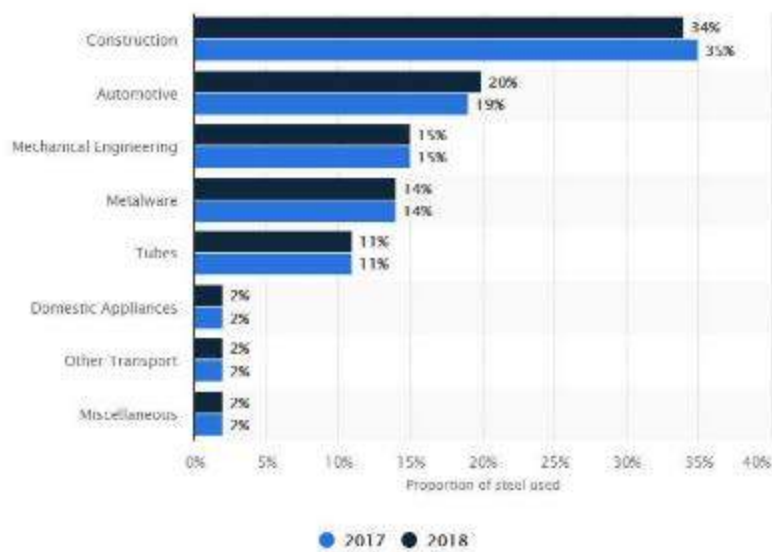


Figure 30: Steel demand share per industrial sector in Europe in 2017 and 2018 (Source: EUROFER)

European steel demand has also been affected negatively by low-cost imports coming from places like Turkey and Russia. Steel imports were supposed to decrease after the regulators approved a series of quotas and tariffs, but instead, supply remains high. Production outside the EU began to rise in April 2019, according to the World Steel Association, calling for more price pressure.³¹

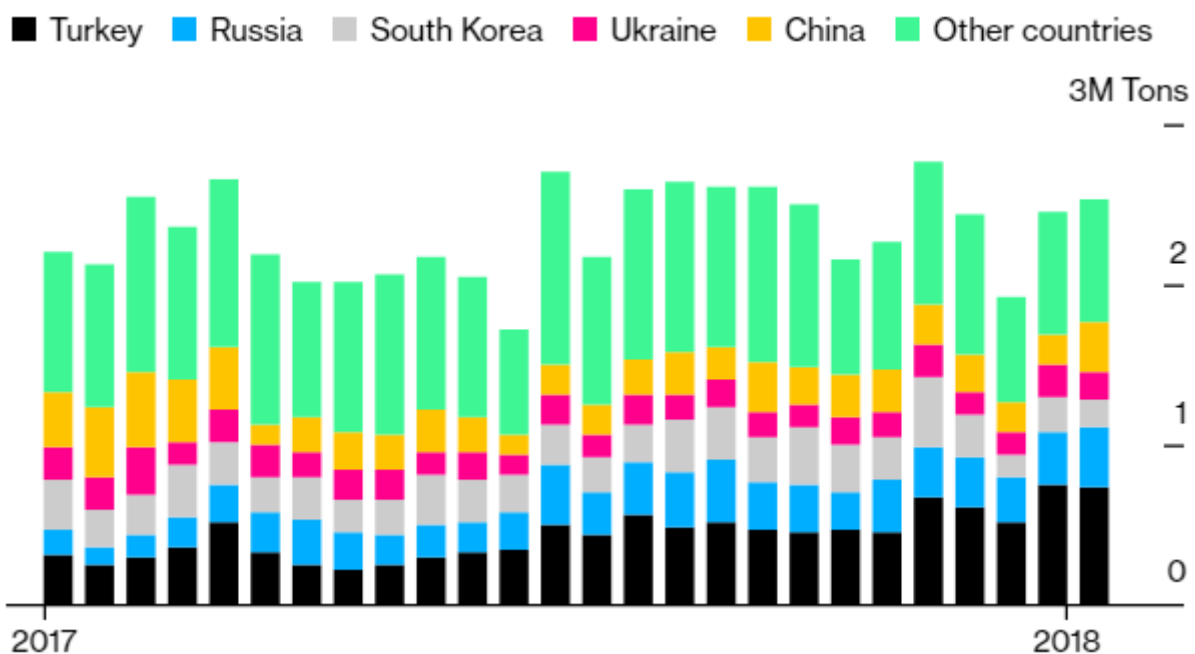


Figure 31: Imported steel from non-EU countries from 2017 to 2018 (Source: EUROFER)

³¹ <https://www.bloomberg.com/news/articles/2019-05-29/europe-s-steel-sector-is-suffering-here-are-charts-showing-why>

According to Argus Media, a rebound in the European steel market was expected by the first quarter of 2020. Market participants had previously anticipated a market recovery in the third and fourth quarters of 2019, but continuously sluggish demand, destocking, an influx of lower-priced imports and poor performance of EU economies, particularly the automotive industry in Germany, made prices deteriorate further over the last few months of 2019. Still, the outlook for a tightening of supply in the EU flat products market, owing to production cuts, should see demand balance out and prices lift, for example by reduced shipments of Turkish hot-rolled coils were expected to make their way into the EU in the first quarter of 2020. Market participants are concerned that in the case of a slight improvement of the market in the first quarter of 2020, steelmakers will try to capitalise and restart any idled capacities as soon as possible, which would jeopardise the longer-term recovery of the EU market.³²

Europe high quality steel market is expected to reach at a CAGR of 8.0% in the forecast period of 2020 to 2026. In grade type, the high strength low alloy will dominate the market and will hold the majority of share in the market as it has low carbon content and improved toughness and enhance corrosion resistance of the final products. However, dual phase is expected to grow with the highest CAGR owing to its low yield to strength ratio which propels its demand in automotive, construction, heavy machinery and other end use industry. In product type, the cold rolled high strength steel will dominate the market and hold the major share in the market owing to their easy handling, excellent dimensional accuracy and good finish of the final product.

In the end use industry, the automotive is dominating in the market as high demand for high strength steel in light weight application. Expected rising production of passenger cars and light weight vehicles is anticipated to strengthen the consumption of high strength steel in coming years.³³

Key players of the European market:

- | | |
|-----------------------------|--------------------------------|
| • Arcelormittal S.A. | • AK Steel Corporation |
| • SSAB AG | • VOESTALPINE AG |
| • POSCO | • Thyssenkrupp AG |
| • JSW Steel Limited | • BENXI STEEL GROUP |
| • SAIL | • JFE Steel Corporation |
| • NUCOR | • FERRIERE NORD |
| • HBIS Group | • SILCOTUB |
| • HYUNDAI STEEL | |

³² <https://www.argusmedia.com/en/news/2004411-eu-steel-market-expected-to-rebound-in-1q20>

³³ <https://www.marketresearch.com/DataBridge-v4178/Europe-High-Strength-Steel-Companies-12070594>

4.5 Agro-chemical (fertilizer production) market

The global agrochemical market was valued at 64,038.00 Million USD in the year of 2018. This market is mainly driven by increase in human population at a rapidly growing rate but with the increase in the population the land available for agriculture is declining. With the help of the agrochemicals products such as herbicides, fungicides and insecticides crop farmers are able to grow more crops on less land, which makes the crops cost less and the crops would be available to the end consumers at less price.

Also the usual agricultural support and incentives provided by governments for the use of fertilizers and pesticides to the farmers, help them to grow more crops on a less land. Pesticides are also critical for the control of invasive species and noxious weeds.

Among the regions, Asia Pacific leads the agrochemical market where the demand for agrochemical products is expected to be high because the region is known for its agro-based countries such as India, Sri Lanka, and China which are majorly dependent on agriculture and related industries for economic growth. The market value of agrochemicals in the Asia Pacific region amounted to 17.000 million U.S. dollars in 2018.³⁴

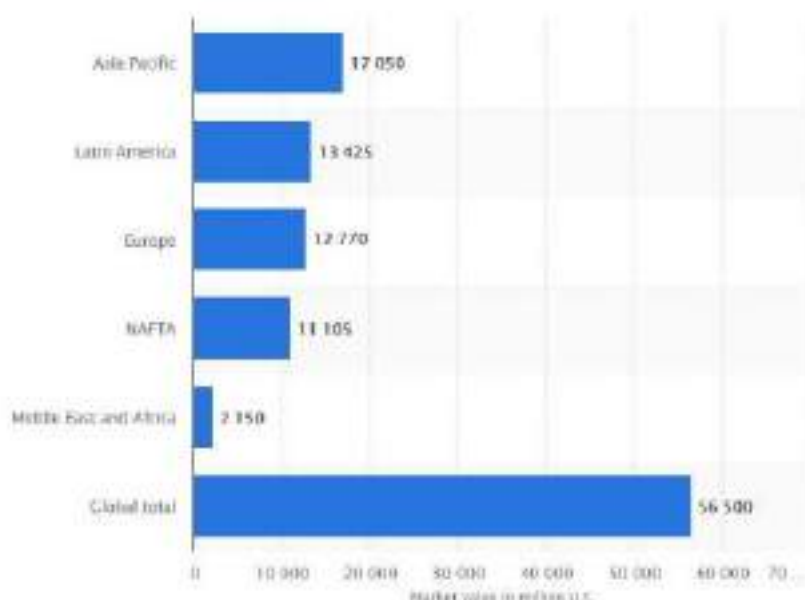


Figure 32: Market value of agricultural chemicals worldwide in 2018 by region (Source: Informa Agribusiness Intelligence)

The global agro chemicals market is expected to grow strong during the forecast period from 2020 to 2027.

³⁴ <https://www.marketresearch.com/Azoth-Analytics-v4068/Global-Agrochemical-Review-Product-Type-12784848>

Some of the unique trends that the global agrochemical market is witnessing include the implementation of new methods of crop protection, novel fertilizers, introduction of biopesticides, mergers and acquisitions leading to market consolidation and growth opportunities/investment opportunities.³⁵

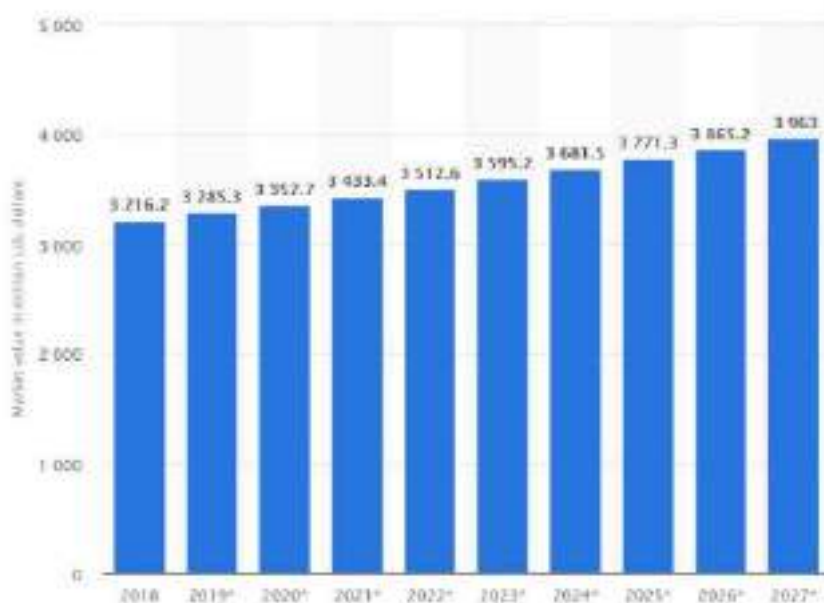


Figure 33: Expected market value of fertilizer additives worldwide from 2018 to 2027 (Source: The Insight Partners - <https://www.theinsightpartners.com/reports/fertilizer-additive-market>)

By application, the market is divided into crop-based, animal husbandry, forestry operations and non-crop-based. The crop-based segment is further classified into cereals and grains, fruits and vegetables, oilseeds and pulses and other crop types. The non-crop-based segment is further divided into turf and ornamental grass and other non-crop-based applications.

Based on type, the market is classified into fertilizers, pesticides, adjuvants and plant growth regulators. The fertilizers segment is sub-segmented into phosphatic fertilizers, potassic fertilizers and nitrogenous fertilizers. The pesticides market is sub-divided into neonicotinoides, pyrethroids, organophosphates and biopesticides. The adjuvants segment is further divided into utility adjuvants and activator adjuvants. The plant growth regulators are further classified into auxins, cytokinins and other growth regulators.³⁶

³⁵ <https://www.marketresearch.com/Azoth-Analytics-v4068/Global-Agrochemical-Review-Product-Type-12784848/>

³⁶ <https://www.marketresearch.com/Accuracy-Group-LLP-v4083/Global-Agro-Chemicals-Trends-Forecast-11707938/>

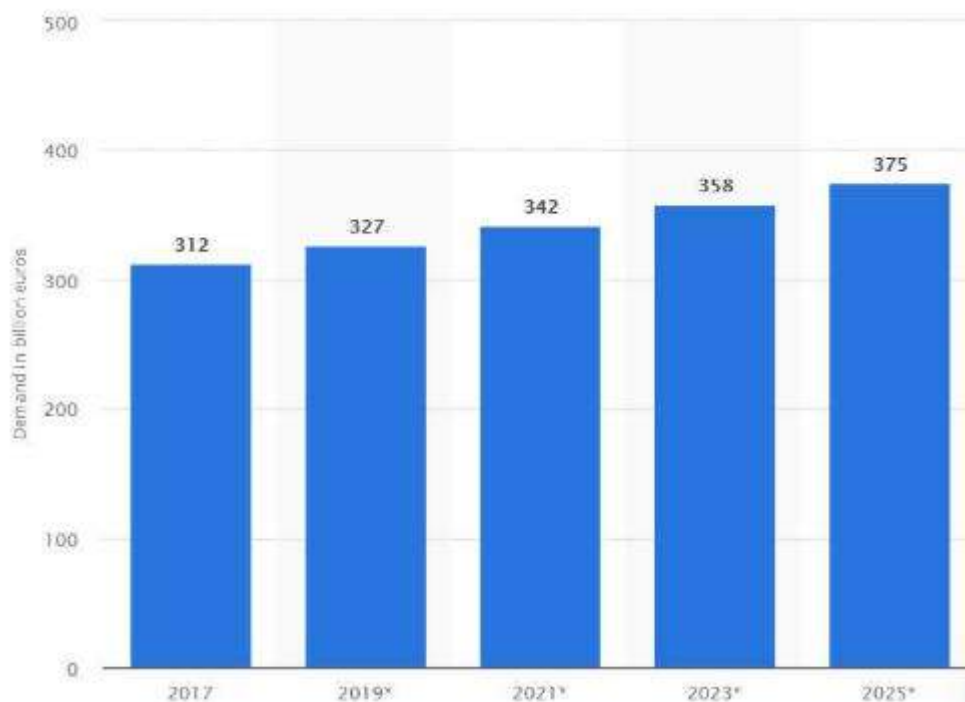


Figure 34: Demand for agricultural chemicals worldwide from 2017 to 2025 (Source: SGL Carbon, Investor Relations Presentation 2019, page 67)

The number one agrochemical company worldwide in 2018 based on sales was the Chinese-owned company Syngenta. Based on market capitalization, the Canadian fertilizer company Nutrien was one of the world's leading agrochemical company as of 2019. Nutrien is the result of a merger between PotashCorp and Agrium. Monsanto was previously one of the largest and most well-known agrochemical-biotechnology companies in the world until June 2018, when Bayer finalized a deal to take Monsanto over.³⁷

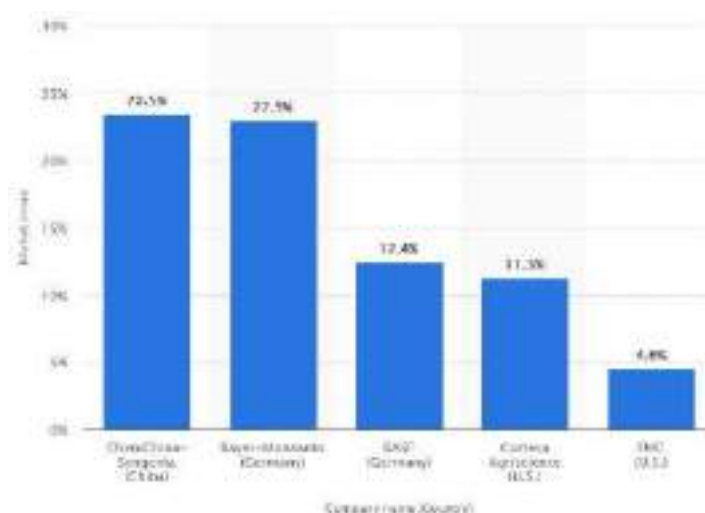


Figure 35: Market share of the five largest agricultural chemical companies worldwide as of 2018 (Source: ETC Group)

³⁷ Statista

The European fertilizer market is expected to grow steadily until 2025 with the registration of a CAGR of 3.5% during the period. As per Eurostat, France accounts as the largest share (19.6%) in Europe, followed by Germany and Poland in 2019. The nitrogen fertilizer segment occupied the largest share in the European overall market and thus the projected shift towards decarbonization of energy in Europe, the market for 'green' ammonia fertilizers is expected to grow rapidly during the period until 2025. The fertilizers market is fragmented with the top international players like Yara International ASA, EuroChem, Nutrien (Agrium and PotashCorp), CF Industries Holdings, The Mosaic Company, Anwil S.A., Cargill, Terra Nitrogen Company and others in addition to many small players capturing the overall market in Europe.

According to the Food and Agricultural Policy Research Institute the total fertilizer consumption in Europe increased from 11.584 thousand metric tons in 2010 to 12.472 thousand metric tons in 2018.

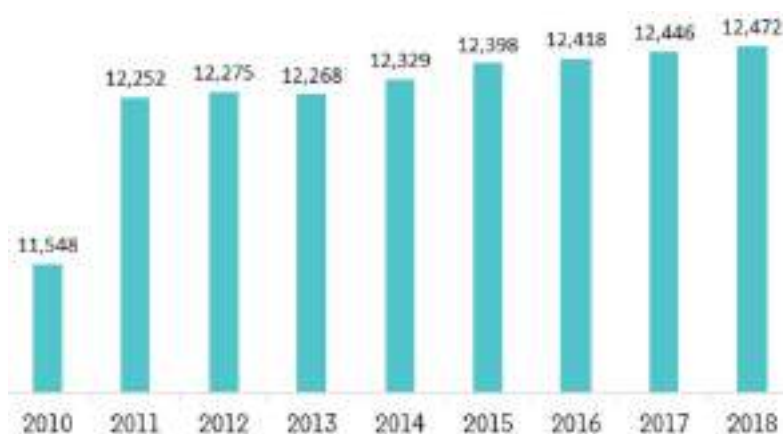


Figure 36: Europe fertilizer market: Total fertilizer use in thousand metric tons between 2010 and 2018 (Source: FAPFRI, Mordor Intelligence Analysis)

In the European Union, farmers are being pressured to reduce the use of mineral fertilizers and Fertilizers Europe (European Producers Association) is working in an increase of efficiency in fertilizers use. Current situation and forecasts are the following:

- 2017/18 average nutrient application (N+P₂O₅+K₂O) in Agriculture area in Use= 100, 6 kg/ha
- 2028/29 average nutrient application (N+P₂O₅+K₂O) in Agriculture area in Use = 97,4 kg/ha.³⁸

³⁸ Fertiberia

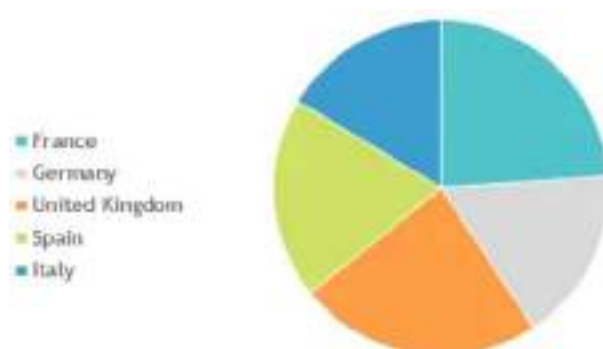


Figure 37: Europe's fertilizer market share in 2019 (Source: Mordor Intelligence Analysis)

The European fertilizers market is highly fragmented with the international players capturing the overall market, in addition to many small players competing with the world leaders. The big players of the market are Yara International ASA, EuroChem, Nutrien (Agrium and PotashCorp), CF Industries Holdings, The Mosaic Company, Anwil S.A., Cargill, Terra Nitrogen Company and others. The most adopted strategies by these companies have been mergers and acquisitions as well as investments on set up of plants, to maintain a strong customer base across whole Europe. For example, the fertilizer giant from Europe, Yara International ASA, acquired the urea segment of Tata Chemicals in India, to broaden its fertilizer base in the world's leading developing economy in 2018.³⁹

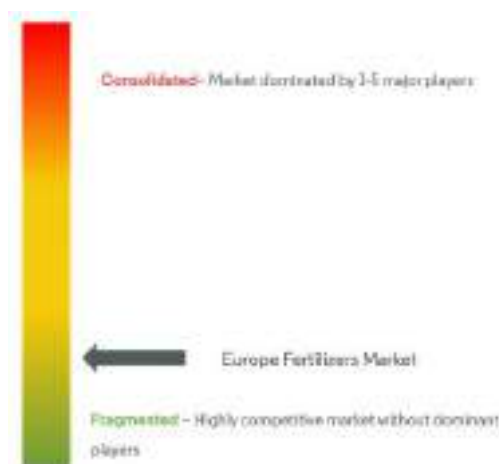


Figure 38: Europe's fertilizer market concentration in 2019 (Source: Mordor Intelligence Analysis)

In 2018, some 11.8 million tonnes of the chemical were used to encourage optimal crop production on Europe's farmlands. Overall, fertilizer consumption totaled 17.6 million tonnes that year, out of which nitrogen was the most commonly used fertilizer nutrient in Europe's agricultural industry.⁴⁰

³⁹ <https://www.mordorintelligence.com/industry-reports/europe-fertilizers-market>

⁴⁰ Statista

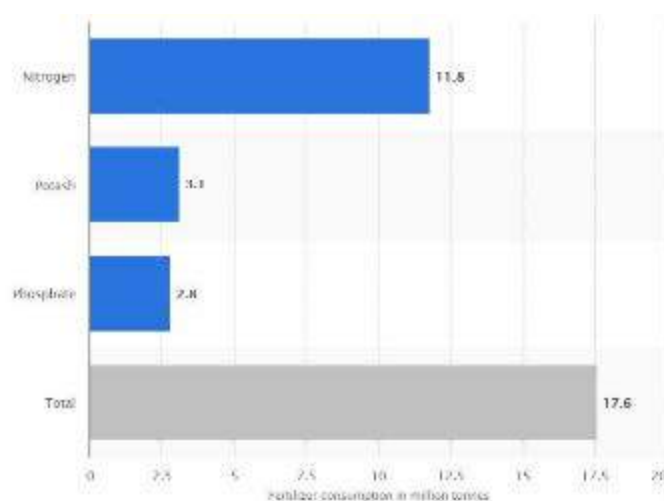


Figure 39: Volume of fertilizer usage in Europe 2018, by nutrients (Source: Fertilizers Europe, Annual Overview 2019, page 18 - https://issuu.com/efma2/docs/fertilizers_europe_annual_overview_dbafb67a3c1810)

According to N. Sönnichsen (7 February 2020) coarse grains and wheat combined to take more than half of the fertilizer that was used in Europe in 2015, this remained to be true in the year 2016 as well.⁴¹

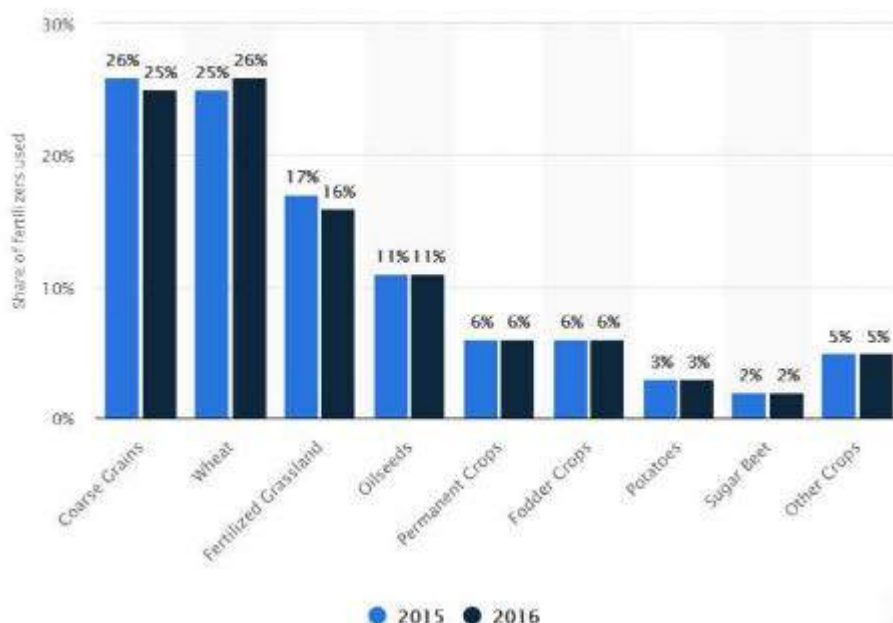


Figure 40: Share of fertilizers used in Europe by type of crop in 2015 and 2016 (Source: Fertilizers Europe)

The figure below illustrates the projections for the European Union's total use of fertilizers from 2020 to 2025. For 2025, total fertilizer consumption in the EU is projected to be around 12.5 million metric tons.

⁴¹ Statista

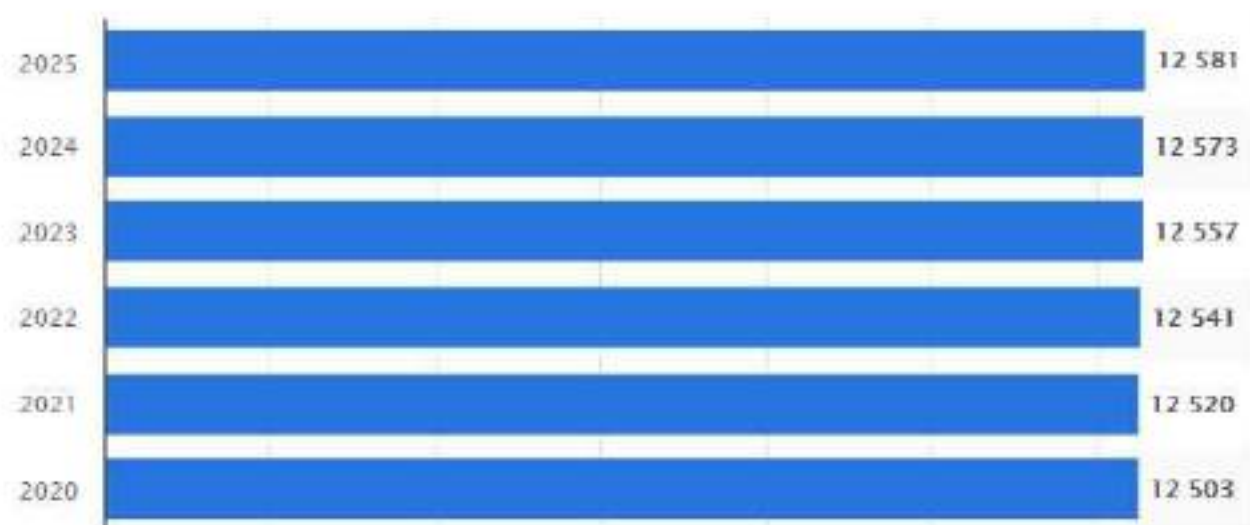


Figure 41: Expected total fertilizer use in the European Union from 2020 to 2025 (Source: FAPRI-ISU World Agricultural Outlook)

5 Outlook of the sectors and next steps

In this deliverable we presented the state-of-the-art market conditions in a preliminary version. In summary it can be concluded that China alone is worldwide leader in almost all analyzed markets, except the production of agro-chemicals, where in aggregation with Asia-Pacific, China is still top ranked leader. In some of the above investigated markets some very slow price decrease was observable since 2018, but as world economics started to slow down even later on, the volume of price falls were intensified especially since the end of 2019. The outlook of these sectors is expected to have even more negative trends in the short and medium term, especially with the corona virus outbreak in 2020 March and April.

The most immediate problems with the COVID-19 pandemic across Europe in the described industries are the following:

- Disruption of the steady supply chain in the various above mentioned sectors and therefore serious liquidity problems;
- Some industrial production plants could be shut down due to postponement of orders or cancellation of orders. This is especially true in the automotive and building sectors, directly effecting steel, aluminium, cement and ceramic sectors
- Increasing absenteeism of employees on sick leave; especially in the agro-sector, where seasoning is a critical impact.
- Disturbances are expected in logistics and transport, generating major delays on the supply side and in the shipment of products in both industries, including by-products and even generated waste;
- Shortage in supply of personal protective equipment such as masks, gloves, glasses, disinfectant;
- Industrial plant closures of raw material processes might indirectly affect the supply of essential goods such as food, drinks and pharmaceuticals;
- In some sectors, the production plants are in a continuous (24/7) operation. In these sites the production cannot be stopped without the risk of stopping the operations permanently.

According to recent interview with the previous President of the Hungarian National Bank, one of the indirect impact of the COVID pandemic is that some industrial plants in China will be shut down permanently and will be substituted with new market players from the Asia (e.g.: Vietnam). These new market players will try to defend their market position even after the cease of the pandemic. In general one conclusion of the virus outbreak could be the shortening of the industrial production chains and automation technologies could be intensified. However, it is also expected that the global industrial production fundamentals will not be changed and China will very probably not lose its

number one worldwide status in industrial production. Controversially, it is also expected that the epidemic has some positive effect on industries with high energy demand, as the oil prices have plummeted to historical lows.

Market investigators say that it is still to be seen what the characteristics of the economic depression followed by the pandemic will be. Some economics expect “V” characteristics where the downfall will be followed a quick regeneration of markets, however some expert say that the recession will be “L” type where the recovery will take probably even 1-2 years. According to other market experts “U” and “W” type of recovery scenarios cannot be completely closed out as well.

According to the director of the International Monetary Fund, the first sign of positive trends is to be seen around the end of 2021.