17 NATURAL RUBBER

17.1 Overview

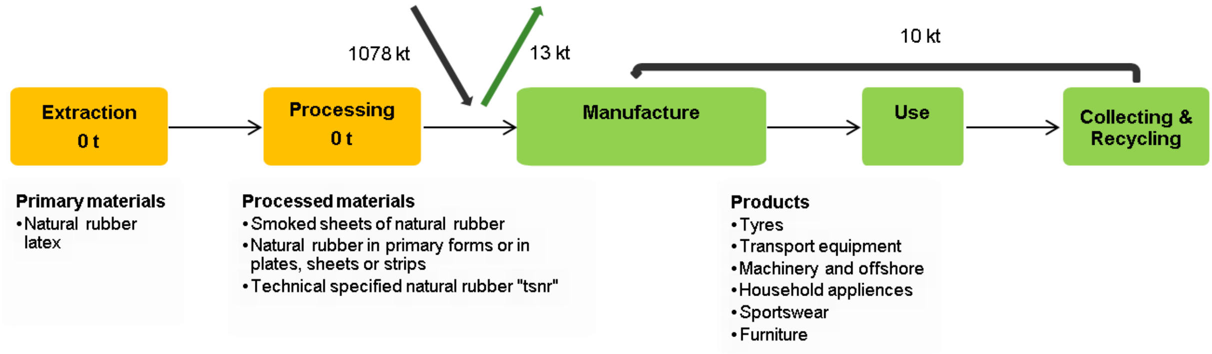

Figure 205: Simplified value chain for natural rubber, data on trade represents average between 2012 and 2016, extraction and processing occurr only outside the EU.

Natural rubber is primarily harvested from the rubber tree *Hevea brasiliensis*. Although native to the Amazon region, over 90% of natural rubber is now produced in Southeast Asia. The tyre industry is the largest consumer of natural rubber, accounting for around 72% of the annual demand (in 2017). Use of natural rubber in European value chains is dominated by the tyre industry, whereas in Asia the General Rubber Goods (GRG) applications in high-tech industries play an important role. There are many uncertainties in natural rubber production for both end-user and producer given the biotic nature of the raw material.

The trade assessment is based on four products groups, with CN codes 40011000 (Natural Rubber or Latex, whether or not pre-vulcanized, considering 60% of Natural rubber content), 40012100 (smoked sheets of natural rubber), 40012200 (technically specified natural rubber (TSNR)), 40012900 (natural rubber in primary forms or in plates). Quantities are expressed in natural rubber content in all the assessment.

In 2018, the global production of natural rubber achieved 13,869 kt (IRSG, 2019). Natural rubber production is dominated by Thailand and Indonesia, which accounted for more than 62% of global production in 2018.

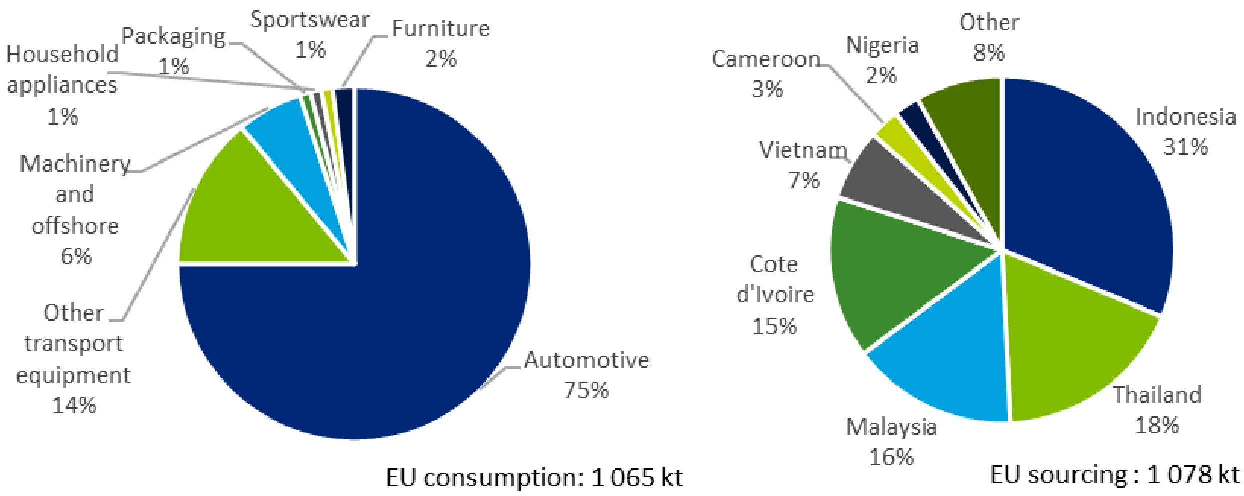

Figure 206 : End uses and EU sourcing of Natural Rubber, average 2012 to 2016 (Eurostat 2019b).

The price of rubber has hovered between US$ 0.49 and 6.56 per kilogram over the last 19 years (2000-2019).The EU consumption (Figure 206) of natural rubber was around 1,065 kt (75% in automotive and 14% in other transport equipment). It was mainly sourced through imports, from Indonesia, Thailand and Malaysia (average 2012-2016, Figure 206). The EU consumption continued to increase in 2017 and 2018, achieving a value of 1,216 kt in 2018. Also, in 2018 the global share of the imports from Cote D'Ivoire increased of 20% of the total. There is no natural rubber production in the EU, neither any processing. The traded natural rubber materials are used directly in manufacturing.

The EU concumes natural rubber mainly in tyres. For this application it is not possible to substitute it with synthetic rubber.

The world production of natural rubber was about 13,869 kt in 2018 with 37% of production in Thailand and 25% in Indonesia. The main production (99%) of natural rubber originates from the rubber trees, grown mainly by smallholders in South East Asia (85%) (ETRMA, 2019a). Natural rubber is mainly harvested from the rubber tree *Hevea brasiliensis* in the form of latex. After harvesting, the latex can be refined into different rubber products and grades.

Natural Rubber is mostly used in a mix with synthetic rubber. Therefore, the recycling of rubber products does not permit a recycling or reuse of natural rubber *per se*, but of a mix of natural and synthetic rubbers. Today, with the available technology, there is only limited scope for recycling from product-to-new-product (ETRMA, 2019a). Less than 1% of natural rubber is functionally recycled in the EU.

Natural rubber is produced mainly by smallholders of natural rubber plantations. It is estimated that up to 20 million families are fully or partially dependent on rubber cultivation for their basic source of livelihood (ETRMA, 2019a).

Natural rubber supply may be highly affected by *Microcyclus ulei* (South American leaf blight). *Microcyclus ulei* is a fungal disease able to destroy young rubber trees. The impact of such disease was already demonstrated in South and Central America, where the disease destroyed the attempts made to increase the production of natural rubber in those regions.

Major increase in supply of the raw material cannot be adjusted within a few years, due to the long maturity period of rubber trees (5-7 years). This means that new natural rubber supply potential for a forecast period of 10 years has largely already been decided.

17.2 Market analysis, trade and prices

17.2.1 Global market analysis and outlook

The forecast of the worldwide supply of natural rubber is mainly determined by the following factors: demand for automotive and other transport equipment, oil prices, balance between markets for tyres and General Rubber Goods (GRG), and the development of synthetic rubber manufacturing technology. The International Rubber Study Group (IRSG) (IRSG 2018) estimates that global natural rubber (NR) production is expected to grow at an average of 2.1% per year during the period 2019-2027. Natural rubber consumption in the tyre sector is expected to grow by an average of 1.8% per year inbetween 2019 and beyond. While the global natural rubber demand by GRG is expected to increase by 4.4% in 2019, followed by deceleration in the subsequent years until 2027.

Table 92: Qualitative forecast of supply and demand of natural rubber

Materials	Criticality of the material in 2020		Demand forecast			Supply forecast		
	Yes	No	5 years	10 years	20 years	5 years	10 years	20 years
Natural rubber	x		+	+	N.A	+	+	N.A

N.A. information not available

These estimates show that supply and demand balance should be achieved in the next 7 years (estimates done until 2027). However, major phenomenon's such as plantation disease and economic growth in major developing economies (e.g. China and India) may not be accompanied by sufficient natural rubber production in an agricultural sector where plantations take 5-7 years to become productive (ETRMA, 2019b).

Since the main application of natural rubber is tyres, the demand for natural rubber is also controlled by the developments in the vehicle market. Although, China's vehicle market growth is slowing down 31 million new light vehicle registrations are expected for 2020, which lead to a 48.1% growth of new registrations since 2013 (Accenture 2013) and a car parc approaching 250 million in 2019 (Statistica 2019) nearing the one of the EU, with 268 million passenger vehicles in 2017 (ACEA, 2019). World light vehicle (passenger cars) new registrations reached 78.7 million in 2018 of which Europe only represent 19% and China a calculated 37.5% (ETRMA, 2019b). Over the last decade, the Chinese tyre market has therefore placed increased pressure onto the natural rubber market and will continuously increase its demand for both new vehicles and replacement of used tyres (ETRMA, 2019b).

It is important to highlight that the supply of natural rubber is also governed by the International Rubber Consortium Ltd. (www.irco.biz). This consortium was created in 2004 having the main producing countries (Indonesia, Malaysia and Thailand) as sole members. It has two main objectives: i) achieve long term price trend stabilised and remunerative to the farmers and, ii) maintain a supply-demand balance to ensure adequate supply of natural rubber in the market at fair prices.

17.2.2EU trade

The EU is a net importer of natural rubber. The EU imports averaged 1,078 kt per year of natural rubber, from 2012 to 2016. Exports observed during this period correspond to re-exports of natural rubber about 13 kt per year (average 2012 to 2016). This means that materials can originate from a country that is merely trading instead of producing the particular material. The latest available data suggests that imports continued to grow achieving 1,216 kt in 2018, see Figure 207[175].

[175] The criticality assessment was done for the average years 2012 to 2016.

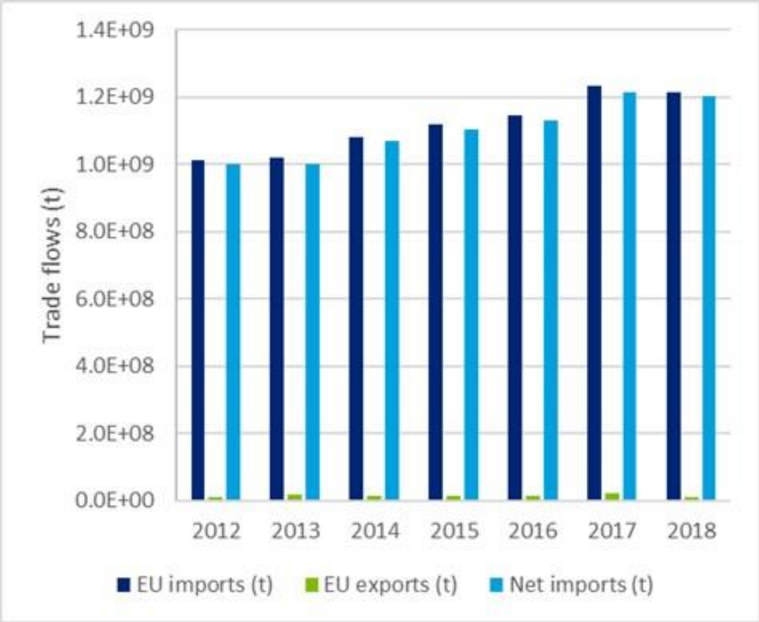

Figure 207: EU trade flows for natural rubber (Eurostat 2019b)[176]

The main suppliers for the EU are Indonesia (31%), Thailand (18%), Malaysia (16%), Côte d'Ivoire (15%) (average 2012-2016,Figure 208). In 2018 the share of imports from Cote d'Ivoire increased to 20% of the total (Figure 209), diversifying the of supply risk otherwise heavily concentrated on Indonesia, Thailand and Malaysia.

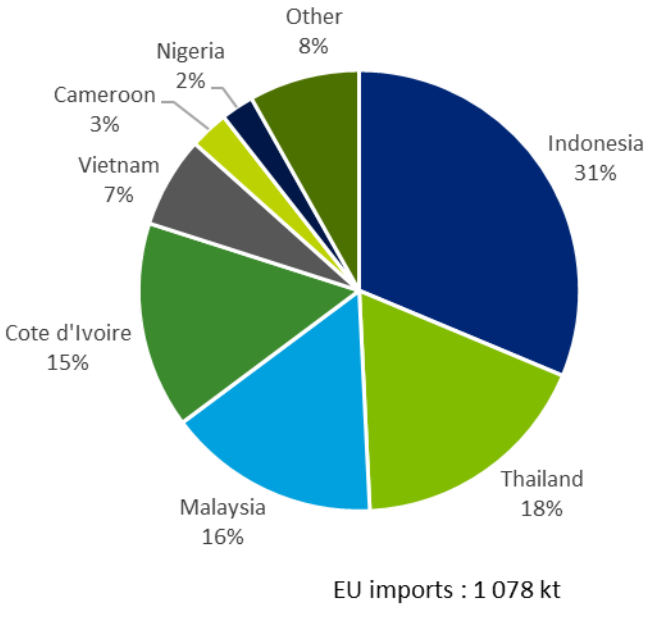

Figure 208: EU imports of natural rubber, average 2012-2016 (Eurostat 2019b)

[176] The 2017 and 2018 data were not used in the criticality assessment.

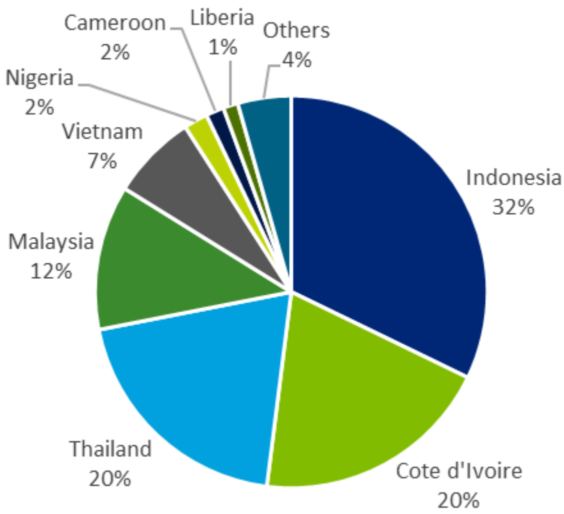

Figure 209: EU imports of natural rubber, 2018 situation (Eurostat 2019b)[177]

Around 1.2% of the imports are exported outside the EU as re-exports. There is no, domestic production in the EU of natural rubber.

17.2.3Prices and price volatility

Natural rubber is a commodity traded at three main trading platforms: SICOM/SGX (Singapore Commodity Exchange/Singapore Exchange), TOCOM (Tokyo Commodity Exchange) and SHFE (Shanghai Futures Exchange).

The price of rubber has hovered between US$ 0.49 and 6.56 per kilogram over the last 19 years (2000-2019)., see Figure 210. The price volatility is mainly influenced by shifting demand from industry and shifting supply as a result of influences from the environment (e.g. weather conditions).

Figure 210: Prices for natural rubber, 2004-2019 (Data from Indexmundi, 2019)

[177] This data was not used in the criticality assessment

17.3 EU demand

17.3.1 EU demand and consumption

The average annual consumption of natural rubber in the EU was ,1,065 kt over the 2012-2016 period. The annual consumption is constantly increasing and achieved 1,216 kt in 2018.

17.3.2 Uses and end-uses of natural rubber in the EU

Figure 211presents the main uses of natural rubber in the EU.

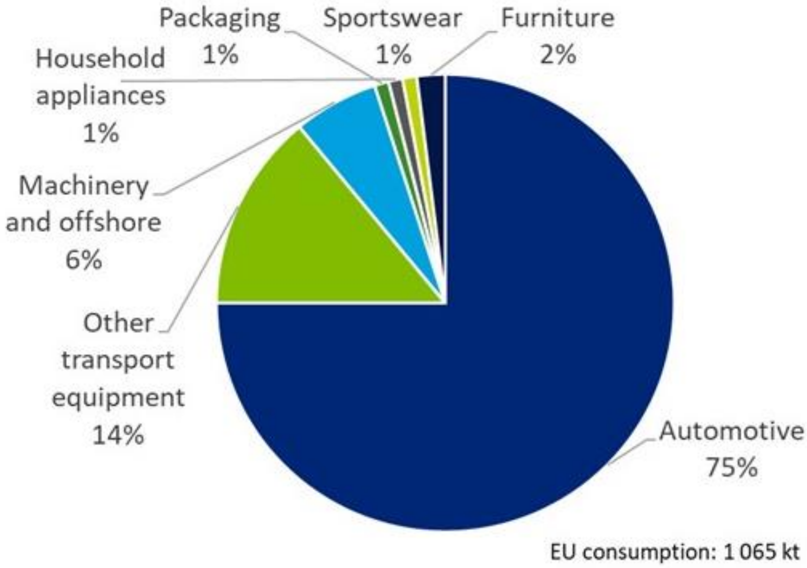

Figure 211: EU end uses of Natural rubber. Calculated taking into account (ETRMA, 2016)

The tyre industry uses up to 72% of natural rubber consumed in the EU, plus 3% in other automotive parts. A common car tyre contains 15% natural rubber by weight and a truck tyre will contain on average 30%. The remaining content of tyres consists, among others, of synthetic rubber, carbon black and silica as tyre fillers, steel cord and wires to provide strength, and other chemicals such as oils and zinc oxide.

Other General Rubber Goods (GRG) uses can be divided into three categories: industrial products, such as moulded and extruded products, belting, hose and tube. These products are generally used in machinery and household goods. Another class of applications are final consumer products, such as footwear, toys, sports and leisure goods; and latex products, such as dipped goods, thread, adhesives, carpet underlay, gloves and condoms.

Relevant industry sectors are described using the NACE sector codes (Eurostat 2019a), in Table 93.

Table 93: Natural rubber applications, 2-digit and associated 4-digit NACE sectors, and value added per sector (Eurostat 2019c)

Applications	2-digit NACE sector	4-digit NACE sector	Value added of sector (millions €)
Packaging	C22 - Manufacture of rubber and plastic products	22.11 Manufacture of rubber tyres and tubes; rereading and rebuilding of rubber tyres	75 980
Household appliances	C27 - Manufacture of electrical equipment	27.51 Manufacture of electric domestic appliances	80 745
Machinery and offshore	C28 - Manufacture of machinery and equipment n.e.c.	28.13 Manufacture of other pumps and compressors	182 589
Automotive	C29 - Manufacture of motor vehicles, trailers and semi-trailers	29.10 Manufacture of motor vehicles	160 603
Other transport equipment	C30 - Manufacture of other transport equipment	30.12 Building of pleasure and sporting boats	44 304
Furniture	C31 - Manufacture of furniture	31.02 Manufacture of kitchen furniture	26 171
Sportswear	C32 - Other manufacturing	32.30 Manufacture of sports goods	39 160

17.3.3 Substitution

Today 99% of the natural rubber consumed in the world comes from areas were *Hevea brasiliensis* trees. These trees can be cultivated mainly in tropical forests, close to the equator. Therefore, there is a particular EU interest in developing additional natural sources that can grow in other geographical regions and notably in Europe.

Research is focused on developing natural rubber from alternative plant sources of latex, that can grow in other geographical regions and notably in Europe. More specifically, scientists are looking at using *Parthenium argentatum* (guayule) and *Taraxacum koksaghyz* (Russian dandelion) as alternative rubber and latex sources. These are the only other species known to produce large amounts of rubber with high molecular weight. The EU-PEARLS (Production and Exploitation of Alternative Rubber and Latex Sources) project was a European research project that investigated the possibility of using the natural rubber from these two alternatives. The project consortium proved that the natural rubber extracted from these trees could substitute the one extracted from *Hevea brasiliensis*. However, there are still significant challenges to reach the industrialisation stage of these alternative natural rubber sources, any significant market change will be absent (at least) in the very short term (ETRMA, 2019a). This is particularly due to the absence of production capacity in the EU to convert the plant extract into raw rubber, which today is imported from third countries.

The choice of elastomer is at the heart of any substitution option. The elastomer presents certain mechanical property such as wear and tear resistance, stiffness, heat resistance and hysteresis. The most important synthetic rubbers are polybutadiene, butyl and halo-butyl, polyisoprene and styrene butadiene. Given the requirements of the substitution of natural rubber with synthetic rubber is limited to 2 percentage points in tyres. The substitution rate is higher for General Rubber Goods, depending on the specific application.

In packaging, household appliances, sportswear and furniture, plastics in general can be a substitute (European Commission 2017).

Synthetic rubber has been long used as an alternative or supplement to natural rubber. An example is styrene butadiene; however, these synthetic rubbers cannot match price and performance of natural rubber (van Beilen and Poirier 2007) in tyre applications. For example, synthetic rubber does not have an equally high molecular mass which defines the quality of the rubber and does not contain the non-rubber components which are found in the latex produced by rubber plants (Gronover, Wahler, and Prufer 2011). Natural rubber also exhibits greater resistance to tearing at high temperatures and builds up less heat from flexing. For this reason, truck tyres require a higher percentage of natural rubber than those for passenger cars.

17.4 Supply

17.4.1 EU supply chain

In 2018, the production of natural rubber containing goods within the EU amounted to 2 800 kt of General Rubber Goods (GRG) and around 5 100 kt of tyres. The rubber processing sector in the EU employed around 368 980 people directly in 2018 (ETRMA, 2019).

The EU is fully relying on imports (import reliance of 100%), where 1.2% of its imports are exported outside the EU as re-exports. There is no, nameworthy, EU domestic production of natural rubber. EU natural rubber production is still at an experimental development stage.

17.4.2 Supply from primary materials

17.4.2.1 Resources and reserves of natural rubber

Natural rubber is a biotic material which is harvested from rubber trees (*Hevea brasiliensis)*, mainly growing in tropical forests close to the equator. *Hevea brasiliensis* is a native species of the Amazon region, but has been introduced in several other regions for rubber production. At the moment, south-east Asian countries, mainly Indonesia and Thailand, are the biggest global producers and at the same time biggest suppliers of natural rubber to the EU.

Global resources and reserves*:* The overall acreage of national rubber plantations is estimated around 12 million hectares (FAO, 2019). The average yield between 2012 and 2016 was 1196 kg/ha (FAO, 2019). Rubber plantations are facing competition of other crops (palm oil, grains etc.) that together with the geographical constraints limits the flexibility to expand the total acreage of natural rubber plantations.

17.4.2.2 World and EU production

Global production has increased rapidly over the past 50 years. This increase has been mostly due to increased production in Thailand and Indonesia. The global production of natural rubber between 2012 and 2016 was 13 140 kt on average, dominated by Thailand and Indonesia, which account for more than 57% of global production. In 2016 the total production of Natural Rubber reached 13 497 kt. Figure 212 shows the global production. There is no production of natural rubber in the EU.

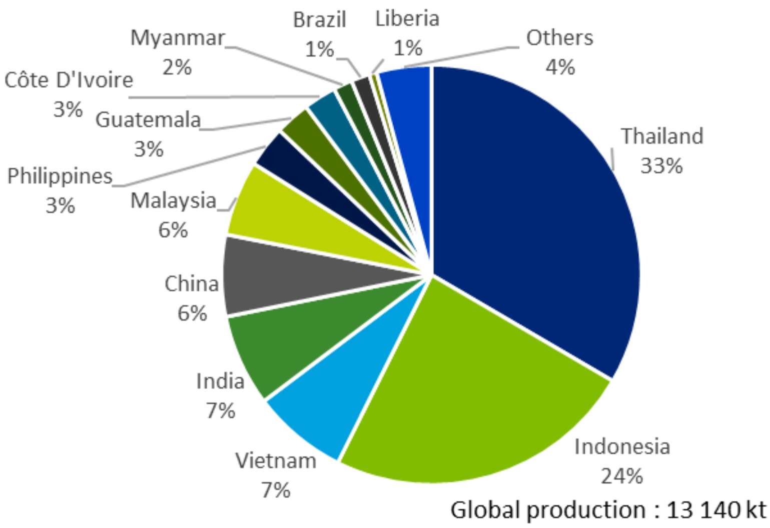

Figure 212: Global production of natural rubber in tonnes and percentage. Average for the years 2012-2016 (FAO, 2019).

17.4.3Supply from secondary materials/recycling

17.4.3.1 Post-consumer recycling (old scrap)

In terms of recycling, biotics are to be dealt differently than the majority of the abiotic materials. For the majority of the cases, the recovered biotic the equivalent to "old scrap" simply can't be re-used in the same application or with the same properties as the original raw material due to contamination issues. Natural rubber is mostly used in a mix with synthetic rubber to obtain the desired hard rubber product performances. With the available technology it is not possible to recycle rubber products and extract natural rubber from these mixtures, therefore recycling is always a mix of natural and synthetic rubbers.

Primary natural rubber is currently only for an estimated 1% being replaced by secondary natural rubber (see Table 94 for underlying data).

The next figure shows the EU situation for used tyres. Tyres are the main application of natural rubber in the EU, as demonstrated in the previous section.

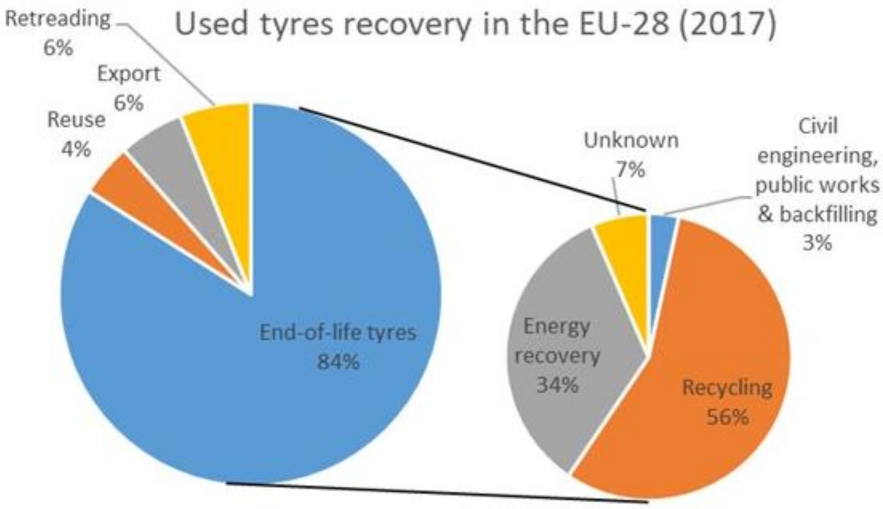

Figure 213: Used tyres recovery in the EU-28 in 2017. (ETRMA, 2017)

Since 2006, all EU member states are obliged to arrange a collection and recycling of end-of-life tyres. Collected data confirm a material recovery (recycling) rate of 56% and an energy recovery rate of 34%. An outstanding 7% is not fully accounted for.

Despite the high recovery rate reached for end-of-life tyres in EU, for the criticality assessment of natural rubber, it is important to highlight that tyre recycling features an open-loop recycling, meaning that end-of-life tyres (ELT)-derived rubber granulates are mainly downcycled in other applications than tyres as current tyre devulcanization technologies are not selective enough to get high quality devulcanization, which is requested to meet stringent technical performances imposed by EU regulation (tyre wet grip, rolling resistance, noise) as well as safety performances. Therefore, the current recycling of ELTs & End of-Life GRG products does not lead to a reduction of the natural rubber supply risk.

With regard to recycling, near 1.5 million tonnes (1,469 kt) of ELTs are annually processed for granulation and are used in a multitude of applications - such as synthetic turf, children playgrounds, sport surfaces, moulded objects, asphalt rubber, acoustic & insulation applications - substituting other raw materials than natural rubber (for example, virgin EPDM in synthetic turf, polyurethane in moulded objects).

For GRG the recycling of natural rubber products mainly occurs in a limited way, mainly due to the heterogeneity of elastomers used and the multitude of SMEs in the GRG sector making economies of scale difficult to get. End-of-life recycling of GRG products is limited either due to contamination issues (e.g. dismantling of End-of-life vehicle seals, tubes etc.) or due to the mere impossibility to recycle/collect the application (condoms, clinical gloves, etc.) (European Commission 2017).

Table 94: Material flows relevant to the EOL-RIR of natural rubber 2016 data

MSA Flow	Value (t)
B.1.1 Production of primary material as main product in EU sent to processing in EU	0.00
B.1.2 Production of primary material as by product in EU sent to processing in EU	0.00
C.1.3 Imports to EU of primary material	45 754
C.1.4 Imports to EU of secondary material	0.00
D.1.3 Imports to EU of processed material	1 098 797
E.1.6 Products at end of life in EU collected for treatment	N.A
F.1.1 Exports from EU of manufactured products at end-of-life	N.A
F.1.2 Imports to EU of manufactured products at end-of-life	N.A
G.1.1 Production of secondary material from post consumer functional recycling in EU sent to processing in EU	0.00
G.1.2 Production of secondary material from post consumer functional recycling in EU sent to manufacture in EU	10 004

N.A. not available at the time of producing this factsheet

17.4.4Processing of natural rubber

Natural rubber is mainly harvested from the rubber tree *Hevea brasiliensis* in the form of latex, which is a white emulsion. While latex can also be sourced from other tree species, its applicability is not as straightforward as that extracted from *Hevea brasiliensis*.

The rubber tree is a perennial crop that is harvested throughout the year. Natural rubber is extracted by making a cut in the bark of the rubber tree, commonly designated as tapping. The rubber can start to be harvested when the tree reaches at least 45 cm in circumference, which corresponds to a tree age of about six years. The maximum yield is reached around the fifth to the tenth year of tapping. A rubber tree is productive for 20 to 40 years, where the length of the productive period is largely determined by the tapping intensity. Afterwards replanting is required and the old tree can be harvested to provide wood for furniture.

The long maturity period of rubber trees (5-7 years) means that the natural rubber supply potential for the forecast period of 10 years has largely been decided, and major increases in supply cannot be adjusted within a few years.

After tapping, the latex can be processed into different rubber products and grades. Traditionally, it is coagulated using formic or acetic acid, and then pressed between pairs of rollers to form sheets or 'crepes. In the final process, the natural rubber is washed and dried. Dried natural rubber is usually vulcanised, a chemical process that involves heating and the addition of sulphur or other cross-linking additives. This process improves the elasticity and durability of the untreated natural rubber. Vulcanised rubber is then further processed into different rubber products.

17.5 Other considerations

17.5.1 Environmental and health and safety issues

Natural rubber supply may be highly affected by *Microcyclus ulei* (South American leaf blight). *Microcyclus ulei* is a fungal disease able to destroy young rubber trees. The impact of such disease was already demonstrated in South and Central America, where the disease destroyed the attempts made to increase the production of natural rubber in those regions. Until the moment no records of such disease have been reported in Asia, in the countries where the majority of natural rubber is produced. However, several authors indicate that the low genetic variety of the Asian rubber plantations (the majority of the production comes from Brazilian tree clones, susceptible to the disease) makes them highly sensitive to this disease. If the disease would spread to Asia, the impacts on natural rubber production could be devastating (Invasive Species Compendium 2015).

Another example of a biological threat affecting supply of natural rubber is the case of the *Neofusicoccum ribis*, which causes leaf fall in natural rubber plantations in Indonesia. The expectation is that natural rubber output in Indonesia will drop by 15% in 2019 (ETRMA, 2019b).

The distribution of rubber plantations cross Southeast Asia coincides with four biodiversity hotspots (Sundaland, Indo-Burma, Wallace and the Philippines) supporting large number of endemic and and highly threatened species. Meeting global rubber demand while minimizing biodiversity and ecosystem service losses will be very challenging in the future (Warren-Thomas, Dolman, and Edwards 2015).

17.5.2 Socio-economic issues

Being a biotic material, sustainable sourcing of natural rubber focuses on the risk of biodiversity loss, on promoting good agricultural practices and on mitigating land ownership conflicts.

Natural rubber is mainly produced by smallholders in South East Asia. It is estimated that up to 20 million families are fully or partially dependent on rubber cultivation for their basic source of livelihood (ETRMA, 2019a). At the same time, rubber plantations can threaten the livelihood of indigenous communities which in some cases are subject to physical displacement and resettlement as in the case of the Orang Rimba community in the provinces of Jambi, Riau and South Sumatra, in Indonesea (EJ Atlas 2019).

As for other materials, due diligence systems (seeTable 95) are in place and they require ensuring decent working conditions and the respect of human rights along the value chain (SNR, CCCMC, 2017).

Table 95: Sustainable sourcing initiatives on Natural Rubber (SNR, CCCMC, 2017)

Initiative full Name	Lead Stakeholder	Geographical Focus	Short description
Sustainable Natural Rubber Initiative (SNR-i)	Multi-stakeholders	Global	The objectives of the SNR-i are to secure a global sustainable natural rubber economy that delivers benefits across the whole of the natural rubber value chain.
CCCMC and CSR Sustainable Natural Rubber Collaborative Platform	Business associations	Global	The Platform was launched by the China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters (CCCMC) and CSR Europe. It engages in practical actions to improve the level of sustainability in the natural rubber supply chain.
Tire Industry Project (TIP)	Industry	Global	Tyre Industry Project (TIP) serves as a global, voluntary, CEO-led initiative, undertaken by 11 leading tyre companies—representing approximately 65 percent of the world's tyre manufacturing capacity. Its aim is to proactively identify and address the potential human health and environmental impacts associated with the life cycle impacts of tyres to proactively contribute to a more sustainable future.

17.6 Comparison with previous EU assessments

Natural rubber was first assessed in 2014. The result of the 2014 assessment was an Economic Importance that was clearly above the criticality threshold (around 7.7); however, the supply risk score was below the criticality score with a numerical value of around 0.9. See Table 96.

The increase of supply risk from 0.9 in 2014 to 1.0 in 2017 and 2020 is mainly due to changes in the revised methodology regarding the calculation of the supply risk, recycling and substitution options. The calculation of the SR for natural rubber in the 2017 and 2020 assessments considered an import dependency of 100%, which was not considered in 2014. The 2017 and 2020 assessments reporting a final SR score of 1.0 (SR=0.9 in 2014) are also influenced by the lack of readily available substitutes for the identified end-use applications and the low EOL-RIR (1%). The differences in the economic importance from 2017 and 2020 are due to an update of the use shares that now reflects better the EU consumption of natural rubber, with an increase in the applications in other transport sectors beside "automotive".

Table 96: Economic importance and supply risk results for natural rubber in the assessments of 2011, 2014, 2017, 2020 ((European Commission 2011)(European Commission 2014)(European Commission 2017))

Assessment	2011			2014			2017			2020	
Indicator	EI	SR		EI	SR		EI	SR		EI	SR
Natural rubber	N/A	N/A		7.7	0.9		5.4	1.0		7.10	1.00

17.7 Data sources

17.7.1 Data sources used in the factsheet

(ETRMA), European Tyre & Rubber Manufacturers Association (2016). THE RUBBER GOODS FACTS & FIGURES.

(ETRMA), European Tyre & Rubber Manufacturers Association (2017). ELT Management in Europe - Volumes Situation 2016.

(ETRMA), European Tyre & Rubber Manufacturers Association (2019a). A Sustainable Natural Rubber Supply Chain 2019 draft 2.

(ETRMA), European Tyre & Rubber Manufacturers Association (2019b). Personal communication from expert Morten Petersen.

(ETRMA), European Tyre & Rubber Manufacturers Association (2019c). The ETRMA Statistics Report. 48. https://doi.org/10.1021/jp980049f

Accenture. (2013). China ' s Automotive Market. In Current. Retrieved from https://www.statista.com/statistics/285306/number-of-car-owners-in-china/

EJ Atlas. (2019). Plantation companies grab Orang Rimba indigenous land on Sumatra, Indonesia | EJAtlas. Retrieved November 5, 2019, from https://ejatlas.org/conflict/palm-oil-companies-grab-orang-rimba-land

European Automobile Manufactures, A. (2019). EU Key Figures. Retrieved from https://www.acea.be/statistics/tag/category/key-figures

European Commission. (2011). Critical raw materials. Retrieved July 8, 2019, from https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en

European Commission. (2014). Report on critical raw materials for the EU - Critical raw materials profiles. Retrieved from https://ec.europa.eu/docsroom/documents/11911/attachments/1/translations/en/renditions/pdf

European Commission. (2017). Study on the review of the list of critical raw materials. Non-critical raw materials factsheets. https://doi.org/10.2873/876644

Eurostat. (2019a). Annual detailed enterprise statistics for industry (NACE Rev. 2, B-E). Retrieved July 7, 2019, from https://ec.europa.eu/eurostat/en/web/products-datasets/-/SBS_NA_IND_R2

Eurostat. (2019b). Easy Comext database. Retrieved from http://epp.eurostat.ec.europa.eu/newxtweb/

Eurostat. (2019c). Statistics on the production of manufactured goods (PRODCOM NACE Rev.2). Retrieved July 14, 2019, from Prodcom - Statistics by Product website: https://ec.europa.eu/eurostat/web/prodcom

Food and Agriculture Organization of the United Nations, F. (2019). FAOSTAT. Retrieved from http://www.fao.org/statistics/en/

Gronover, C. S., Wahler, D., & Prufer, D. (2011). Natural Rubber Biosynthesis and Physic-Chemical Studies on Plant Derived Latex. Biotechnology of Biopolymers, (June 2011). https://doi.org/10.5772/17144

Indexmundi. (2019). Rubber Monthly Price - Euro per Kilogram. Retrieved from https://www.indexmundi.com/commodities/?commodity=rubber&months=240&currency=eur

International Rubber Study Group IRSG. (2019). Rubber Statistical Bulletin.

Invasive Species Compendium, I. (2015). Information on Microcyclus ulei (south American leaf blight of rubber). Retrieved from http://www.cabi.org/isc/datasheet/33893

IRSG, I. R. S. G. (2018). The World Rubber Industry Outlook Review and Prospects to 2027.

Statistica. (2019). Car parc in China from 2007 to 2018 (in millions). Retrieved from https://www.statista.com/statistics/285306/number-of-car-owners-in-china/

Sustainable Natural Rubber & China Chamber of Commerce of Metals, S. C. (2017). Guidance for Sustainable Natural Rubber. 61. Retrieved from http://www.cccmc.org.cn/docs/2017-11/20171107204714430892.pdf

van Beilen, J. B., & Poirier, Y. (2007). Establishment of new crops for the production of natural rubber. Trends in Biotechnology, 25(11), 522–529. https://doi.org/10.1016/J.TIBTECH.2007.08.009

Warren-Thomas, E., Dolman, P. M., & Edwards, D. P. (2015, July 1). Increasing Demand for Natural Rubber Necessitates a Robust Sustainability Initiative to Mitigate Impacts on Tropical Biodiversity. Conservation Letters, Vol. 8, pp. 230–241. https://doi.org/10.1111/conl.12170

17.7.2 Data sources used in the criticality assessment

ETRMA (2016)a THE RUBBER GOODS INDUSTRY AT A GLANCE Available at: http://www.etrma.org/uploads/GRG%20Facts%20and%20Figures%20final.pdf

FAOstat website (2019) Available at: www.fao.org/statistics

Eurostat Comext (2019). International trade in goods database (COMEXT) Available at: http://ec.europa.eu/eurostat/data/database

ETRMA factsheet edition 2017.

European Commission (2017) Study on the review of the list of Critical Raw Materials– Critical raw materials factsheets.

Plastics Europe, Plastics – the Facts 2017

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