November 2023. A Technological Report

The Plastics Sector

In Catalonia











PLASTIX. A Technological Snapshot

ACCIÓ Government of Catalonia



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Prepared by ACCIÓ's Strategy and Competitive Intelligence Unit

Barcelona, November 2023







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- Analysis









1. Interreg Europe / Plastix



An interregional cooperation project for improving **circular economy** policies



www.interregeurope.eu/plastix











2. Definitions

- Definition of polymers
 Definition of plastics
- Bio-based plastic
- Plastic and polymer applications in Europe
- Importance of plastics for industry











Definition of polymer, plastic, bio-based plastic

Polymer: any of a class of natural or synthetic substances composed of very large molecules, called macromolecules, that are multiples of simpler chemical units called monomers.

Plastics are semi-synthetic organic materials derived from oil or petroleum. Plastics are produced by condensation and addition polymerization reactions.

Bioplastics are not a single material. This name denotes a series of materials that may or may not be biodegradable and are based on products of biological origin such as plants, cellulose, etc.



Sources: IEA, 2021; Britannica, Carnegie Mellon University, IUPAC
CataloniaConnects











Importance of plastics for industry

Plastics have applications in a wide variety of sectors and uses, from packaging and construction to healthcare and electronic applications.

The optimization of the use of plastics, as well as their recycling and reuse, are of great importance to prevent the contamination of seas and land-based ecosystems.



The development of New Plastics and more sustainable materials throughout their entire life cycle is a source of innovation and requires research in order to overcome technical and regulatory challenges.

> The development of new processes and production routes, eliminating the dependency on materials of fossil origin, drives change in value chains, incorporating new actors and raw materials.

Bioeconomy and waste to chemicals processes can encourage the reindustrialization of certain regions.





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Source: ACCIÓ CataloniaConnects

3. EU Policy

- European strategy for plastics in a circular economy
- Single-use plastics
- EU Mission: Restore our Oceans and Waters
- A European Green Deal
- Restriction of microplastics









EU initiatives

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The European Union has committed to the circular economy and the green transformation

100	Generalitat de Catalunya	Co-funded by the European Union	Source: the authors CataloniaConnects	
	Restriction of microplasticsOn September 27, 2023, the European Union (EU) issued Commission Regulation (EU) 2023/2055 to regulation synthetic polymer microparticles ('microplastics') as substances on their own and in mixtures. The provision in the new law will be implemented in phases, starting on October 17, 2023.			
	A European Green Deal	The European Commission has adopted a set of proposals to make the EU's climate, energy taxation policies fit for the purpose of reducing net greenhouse gas emissions by at least compared with 1990 levels.	ergy, transport and 55% by 2030,	
	EU Mission: Restore our Oceans and Waters	Aims to protect and restore marine and freshwater biodiversity and ecosystems, eliminate the blue economy carbon-neutral and circular.	pollution, and make	
	Single-use plastics	Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 or impact of certain plastic products on the environment	the reduction of the	
	European strategy for plastics in a circular economy	A vision for a smarter, more innovative and sustainable Europe, which extends from desig considering the needs of reuse, repair and recycling.	n to production	

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Europe

4. Main data. World

Global plastic production
Market size value of plastics
Plastic material production by region & Leading companies in the world





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Annual production of plastics worldwide from 1950 to 2021 (in millions of metric tons)

Global plastic production 1950-2021

- Global plastics production was estimated at 390.7 million metric tons in 2021, an annual increase of 4%.
- Plastics production has soared since the 1950s.
- Global plastic production has almost doubled since the turn of the century.
- Plastic production is set to continue growing due to rising populations, increased purchasing power, and further demands for plastic goods.
- The incredible versatility of this group of materials accounts for the continued growth in production year after year.
- In tandem with that growth, the market value of plastics also continues to grow.

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Market size value of plastics worldwide from 2021 to 2028 (in billions of U.S. dollars)

Global plastic market size value 2021-2028

- In 2021, the global plastics market was valued at 593 billion U.S. dollars.
- The plastics market is projected to grow in the coming years to reach a value of more than 810 billion U.S. dollars by 2028, recording a CAGR of 3.7% during the forecast period of 2022 to 2030.





CataloniaConnects









Distribution of global plastic materials production in 2021, by region

Plastic material production worldwide by region 2021



5. Main data. Europe

Plastic industry in Europe

Europe's share of global plastic material and Leading companies in Europe









Plastic industry in Europe





57.2 Mt production in 2022





More than 10 Mt of post-consumer plastics waste were sent to recycling in 2020



In 2021, about 5.5 Mt of post-consumer recycled plastics were reintroduced in the EU27+3 economy, an increase of about 20% compared to 2020

The European plastics industry (EU27) ranks 8th in Europe in industrial value-added contribution, positioned after the manufacturing of electrical equipment







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Share of global plastics materials produced in Europe from 2014 to 2021

Europe's share of global plastic material production 2014-2021

- In 2021, European (EU27+3) plastic production accounted for 15% of the total global production of plastics materials.
- This made Europe the third-largest plastic producing region worldwide that year.
- However, the preponderance of the plastics industry in the world has been decreasing since 2006

Leading companies in Europe





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Source: Plastic Europe, Statista CataloniaConnects



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6. Bio-based plastic

Production capacity of bioplastics worldwide and distribution of biobased bioplastics market

Distribution of bio-based bioplastics market









Production Capacity of Bioplastics



Bio-based & Bio-attributed plastic production by regions of the world (2023)



The global production capacity of bioplastics increased by 16% in 2021 to 2.4 million metric tons. Biodegradable bioplastics accounted for 1.6 million metric tons of the total capacity in 2021.

Growth is expected to continue in the coming years, with projections showing that global production capacities of bioplastics could reach 7.6 million metric tons by 2026. The main production capacity is located in Asia





Source: BioPlastic Europe, Statista, Plastics Europe 2023 *Estimated values

Distribution of bio-based bioplastics market

Global bio-based plastic market shares 2021, by segment



In 2021, the packaging segment accounted for almost half the global bio-based bioplastic market. Rigid packaging had the largest share of the market, at 24%, with flexible packaging representing 19%.



Forecast bioplastic production capacity worldwide 2026, by market segment (in 1,000 metric tons)



- Flexible packaging
- Agriculture & horticulture
- Automotive & transport
- Building & construction
- Electrical & electronics

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- Consumer goods
- Textiles (include non-woven and fibers)
- Coatings & adhesives
- Others

Source: BioPlastic Europe, Statista



7. Recycling

- Plastic end of life treatment in the world
- Europe. Plastic end of life treatment
- Waste treatment Packaging plastics
- Recycled content in Europe

















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Source: UN Beat plastic Pollution. 2023

Europe. Plastic end of life treatment





In 2020, 35% of post-consumer plastic waste was sent for recycling, but across Europe, 23% was still sent to landfill Landfill









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Source: Plastic Europe 2022
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Waste treatment Packaging plastics

Increase in the recycling rate of plastic packaging since 2018

In 2020, the overall European recycling rate for post-consumer plastic packaging reached 46%, compared with 42% in 2018, an increase of around 9.5%.













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Source: Plastic Europe 2022
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Recycled content in Europe

In 2021, 5.5 million tonnes of post-consumer recycled plastics were used in new products and parts in the EU27+3, amounting to a recycled content rate of around 10% in plastic conversion and an increase of around 20% compared to 2020.

Recycled content in new products



Agriculture, farming &...025%Building & Construction018%Packaging009%Electrical & Electronics003%Automotive003%Houseware, leisure & sports003%Others005%







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Source: Plastics Europe
CataloniaConnects

8. Chemical Recycling

- Plastic recycling approachesPlastic recycling
- Types of chemical recycling
- Post-consumer recycled plastics production in the world













Plastic recycling

Mechanical recycling

Mechanical recycling is a recovery process that, through temperature and grinding, converts plastic waste into a recycled material that can be used for the same application or for a different one.

In this process, the polymer chain is maintained, that is, there is no chain breakage, except for that due to possible degradation of the polymer itself.





Generalitat de Catalunya Government of Catalonia Dissolution recycling

Dissolution recycling is a recovery operation in which plastic waste is subjected to the action of solvents and other chemical agents through which the different polymers are dissolved and thus separated from the entire waste.

The purpose of this operation is to separate polymers, or even additives in order to obtain separated materials that can later be incorporated as recycled raw materials, without breaking the polymer chain.



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Chemical recycling or molecular recycling according to ISO 15270:2008 is the "conversion to monomer or production of new raw materials by changing the chemical structure of plastic waste through cracking, gasification or depolymerization, excluding energy recovery and incineration".











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Source: Chi

Source: Chemical recycling in Spain

Post-consumer recycled plastics production (mechanical & chemical) in the world

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Source: Plastics Europe Facts 2023
CataloniaConnects

9. Plastic Pollution

Plastic Pollution

UN Plastic treaty

Source of microplastics

Removal of microplastics: technologies and emerging techniques









Plastic Pollution

Every minute, the equivalent of one garbage truck of plastic is dumped into our oceans

- Plastic pollution has become one of the most pressing environmental issues, with impacts on ecosystems, biodiversity, climate and human health, as rapidly increasing production of disposable plastic products overwhelms the world's ability to deal with them.
- Plastic pollution can alter habitats and natural processes, reducing ecosystems' ability to adapt to climate change, directly affecting millions of people's livelihoods, food production capabilities and social well-being.
- Without new and effective control measures, plastic production is set to double in 20 years and plastic waste leaking into the ocean is projected to triple by 2040.

Intergovernmental Negotiating Committee (INC) to develop an international legally binding instrument on plastic pollution, including in the marine environment.

New EU restriction for intentionally added microplastics

UN Plastic

treaty

The EU has issued legislation to regulate microplastics under Annex XVII of REACH.







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Source: UN. Environment program, National Geographic, UNESCO, European Commission CataloniaConnects

Source of microplastics





It is estimated that more than a third of the microplastics floating in the oceans come from synthetic fabrics, which are produced in washing processes.

Car tires are the second most important source, with 28% resulting from erosion while driving.

Source: IUCN, 2019 Armstrong, Martin. "Where The Ocean's Microplastics Come From." Statista, Statista Inc., Aug 11, 2022, https://www.statista.com/chart/17957/where-the-oceansmicroplastics-come-from/









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Source: W. Gao, Y. Zhang, A. Mo, et al.; Dec 2022. Elsevier. FanLEStic-sea project 2021. Interre Baltic Sea Region; S. Singh et el.; Dec. 2021. Water Science & Technology Mohammad R Alrbaihat and Qusay Abu-Afifeh, Annals of Advances In Chemistry; HSPI Innoplastic; Wasser 3.0. EIB; Water Science & Technology vol. 84.





10. Plastic Sector in Catalonia

Plastic Sector in Catalonia
Plastic value chain in Catalonia
Ecosystem agents in Catalonia
Policies, Instruments and Initiatives in Catalonia

Success stories









Plastic Sector in Catalonia

Exports

860 companies









000

25,081

jobs



Catalonia's leading position in Spain 24% total sector's GAV; 25% of sector's turnover; 28% total exports.

89% exports to Europe



279,066 tonnes postconsumer plastics waste were sent to recycling in 2021



In Catalonia, the volume of production grew by 8.8% (2021)

Industrial Gross Added

Value: 4.8%

60% of plastic waste is recovered, either through material recovery (25%), which returns the plastic to the beginning of the production chain, or through its energy recovery (34%).







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Source: ACCIÓ, Informe anual Industria DGI, 2022 Government of Catalonia **Catalonia**Connects

Production of raw 97 materials that include production of polymers INEOS REPJOL Inovyn Shell bp **D** • BASF BOREALIS We create chemistry CLARIANT LYB LyondellBasell covestro Dow ELIX POLYMERS SEKISUI Ercros TDE BASF SONATRACH PropanChem S.A. ARKEMA



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Manufacturing: Plastic ╞╡ conversion and product manufacturing ΗĤ FABRIPLASTIC, S.L.U. IQAP αη*ησ Ecoplastic3D AOE PLASTICS & ancas artificial nature Zarray Ammeraal Beltech GEROSA TATAY **Kingspan** Flexico Amiblu incoplás> coemmo elenplast CREHAU Detp Ð JABIL DISERPACK, S.L. PLASTIC 85 nupik be Not Hate offer Berry inplacro nexeo EASTMAN AOE PLASTICS L VINK 🚫 PLÁSTICOS JUAREZ S.A. 🕻 unnox group RRPA AXILONE PLASHCOS Ansterly GCR spack TP2MIL (m)macresac,s.a. TECNOCLINIC 🚯 masplast 😱 🎭 Interreg Co-funded by the European Union Europe

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Ecosystem agents in Catalonia (I)



Ecosystem agents in Catalonia (II): Research and innovation centre





Pack Studios accelerates packaging innovation—enabling brands to quickly bring to market sustainable solutions for a dynamic and demanding world.

It has a connected network with extensive packaging experience in all aspects of the value chain and has global facilities designed to design, test and develop sustainable packaging.

Design packaging to be compatible with the existing recycling infrastructure in the region. From removing metallic layers to redesigning mixed-material closures, Pack Studios can help bring packaging designs for recycling to market quickly.

From snack bags to coffee containers and even toothpaste tubes, we've helped brands transition to recycling-ready mono-material structures.

Pack Studios is built on Dow's 125 years of experience delivering ground-breaking products and technologies.

https://www.dow.com/en-us/market/mkt-packaging/pack-studios.html











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Policies, Instruments and Initiatives in Catalonia

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MOnitoring Recyclates for Europe	MORE helps the plastics industry to become MORE circular by collecting the volume of recycled polymers that is used by plastics converting companies to create new products, and by stimulating a higher uptake of recycled polymers.	MPULS A L'ECONOMIA VERDA I A L'ECONOMIA CIRCULAR EDMPETERISTET - EPIDENCIA - INVOKCIÓ	The Strategy to promote the green economy and the circular economy of the Government of Catalonia. Its aims are to promot sustainable and inclusive growth, the circular economy, and the capacity for dialogue in companies and society as a whole.
 Industria de plásticos Española y Sostenible 	The Industria de Plásticos Española y Sostenible (Sustainable Spanish Plastics Industry) is a seal of approval that recognizes Spanish plastics companies that work for sustainability, also recognizing those that manage their impact at a social, economic and environmental level.	PACTE NACIONAL PER A LA INDÚSTRIA 2822-2825	The National pact for the industry is one of the strategic objectives for the Circular Economy. It places special emphasis on the prevention and management of waste and its reuse as new resources.
Operation Clean Sweep*	The Operation Clean Sweep® (OCS) is a global initiative of the plastics industry to prevent the emission of plastic particles (chips, flakes, dust) into the environment. The OCS is a voluntary program for responsible management.	Catakunya Circular Internet Academic Academic Academic	The Circular Catalonia innovation hub and meeting point f companies and institutions that provide solutions and strategies to consolidate the circular economy in Catalonia
-5	The ProACCIÓ Green program includes ACCIÓ's services, grants, and activities to boost sustainability and innovation.	PACKAGING CLUSTER	in the value chain of packaging. Promotes innovation, R+D, and actions of common interest to partners.
Agéncia de Residua de Residua de Calunya	The Circular Economy R&D Hub: grants for circular economy projects, specifically in the field of waste, by the Catalan Waste		competitiveness of companies in the sector, bringing together companies and environmental agents from the industry's entire value chain.
porta	Selective door-to-door collection (PaP, in its initials in Spanish) consists of delivering the waste to the municipal collection service in front of the door of the bouse, on certain days and times	de Interpreted catalana	companies provides information on the circular economy of the economic sectors. The Waste Cluster is a dynamic element of the
RIS3CAT 2030	The RIS3CAT 2030 is a regional funding program which promotes a sustainable, competitive industrial system. It is complementary to ELL Europing such as Horizon, LIEE and IL3	Barlomutre i disconomia circular	The 2020 Circular economy barometer of Catalan
	Law 7/2022: Waste and Contaminated Soil Law for a circular economy aims to reduce the sale and marketing of single-use plastic products. It levies a tax on manufacturers and importers of single-use plastics.	Entropy COT Correspondent	The Center for Industrial Technological Development (CDTI) Provides funding in the form of loans and grants for research, innovation and development projects. It is fundin
	The Spanish Circular Economy Strategy aims to reduce the consumption of materials and waste generation while increasing the reuse and reparation of waste.	A Circular A Circular A Circular	The Circular Economy PERTE (Recovery, Transformation and Resilience Plan) aims to reduce waste generation, prom treatment plants and increase digitalisation. It promotes the circular economy within companies. It has a budget of €492 M

Success stories

ACCIÓ	Generalitat de Catalunya Government of Catalonia	Europe	Co-funded by the European Ur	nion CataloniaConnects
	The objective of the project Foodwaste for food waste from the fruit and vegetable processing inc to obtain a fibre-based packaging material for the	pack is to valorize dustry as a resource agri-food industry.		The SOFLEX project is a commitment to the development of thermoformable flexible mono-material.
IFLEX	IFLEX has developed a new pioneering reprintin Tetrabricks.	g service for		Delafruit has developed a study to implement single-material solutions with the aim of promoting the circular economy in the packaging industry.
Engage REN	ENGAGE.REN products can help the footwear i become more sustainable through the use of bid	ndustry oplastics.	LyondellBasell	LyondelBasell is one of the largest producers of polymer compounds and licensor of polyolefin technologies. Produces advanced solutions in food safety and access, clean water, fuel efficiency, etc.
NOVELL	Cafès Novell introduces the first Nespresso-co compostable coffee capsule on the market.	mpatible	TATAY	TATAY recovers and reintroduces into the production process 100% of the waste generated and prioritizes the use of raw materials.
Dan*np artificial nature	DAN*NA develops and produces high value-ade biomaterials and bioplastics.	ded new	VEnvirotech	VEnvirotech specializes in the transformation of organic waste into Polyhydroxyalkanoate (PHA) bioplastics.
ZICLA	Zicla transforms waste into innovative products needs of cities. The VECTORIAL System allows configurations for the construction of bus platfo	that address the multiple rms.	SEA2SEE	Sea2see designs and produces optical frames and sunglasses using exclusively recycled marine plastic waste.
	PICVISA has developed a robot that separates pother waste in recycling plants.	plastic from	SADAKO	Sadako designs, develops and applies computer vision technology for the recycling industry.
elenplast	Elenplast is focused on plastic production and transformation. The company uses high- and low polyethylene in its production process.	v-density	GROUP	GCR Group employs green energy sources for production processes and develops efficient plastic solutions. They use recovered plastic as a raw material, which originates from post-industrial waste.
CLARIANT	Clariant has implemented high-performance pol with non-sustainable textile flooring disposal in t manufacturing industry.	ymers to cope he carpet	ARCESSODYNAMICS	ArcessoDynamics implements the circular economy in polyurethane (PU) foams by chemical recycling through catalytic glycolysis.
ecoplanta	The Ecoplanta project contributes to municipal management by using non-recyclable materials circular chemicals and advanced biofuels.	solid waste to produce	MARINA	Marina Textil is involved in a project for the chemical recycling of laminated textile waste.

11. Analysis

PESTELRecommendations





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Plastics sector analysis











Recommendations

For Businesses

- Factor in recyclability and reuse when designing products (eco-design)
- Choice of materials that allow recycling
- Prevent material losses in all processes of the value chain that could harm the environment.
- Chemical recycling research
- Incorporate recycled materials in product formulation
- Use bio based materials

For Policy makers

- Improved selective collection schemes and sorting
- Increase recycling rates
- Strong guidance regulations
- Tax or ban on landfill
- Improve funding for R&D and new companies
- Improved wastewater treatment
- Improved consumer awareness





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We would like to thank all those companies and institutions that have contributed to this study for their time and sharing their knowledge.











Thank you!

Passeig de Gràcia, 129 08008 Barcelona

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Check the report here

https://www.accio.gencat.cat/ca/serveis/bancconeixement/cercador/BancConeixement/eic-el-sector-quimica-catalunya

More information about the sector, news and opportunities http://www.accio.gencat.cat/ca/sectors/quimica-plastics/

Check the **project's** website here

https://www.interregeurope.eu/plastix





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