A PLASTIC INDUSTRY, BARRIERS AND OPPOTUNITIES: ARGENTINA

A.1 THE PLASTIC INDUSTRY AT NATIONAL LEVEL

A.1.1 Description of the national plastics industry

The plastics sector in Argentina is made up of raw material producers, distributors, the plastics processing industry, the plastics recycling industry, urban recyclers, chambers of commerce, and associations. It provides more than 56,000 direct skilled jobs, 224,000 indirect jobs, and 2,800 companies, representing just over 5% of the industrial workforce. Also involved in the activity are more than 150,000 urban recyclers present in several cities and more than 300 recycling companies located throughout all Argentine provinces. Of the total number of recycling companies, approximately 50% recover plastic material, employing at least 50,000 workers.

In the case of the plastics processing industry, four types of companies can be distinguished:

a) Medium-sized, domestically owned companies that produce differentiated products: These are generally family-owned businesses, which constitute the founding core of the plastics industry in Argentina. They possess modern machinery and equipment, and many of these firms are exporters. Some of these firms are active in the pipe, PVC compound, PS tray, PE film, and other segments.
b) Medium-sized companies that produce commodities: the typical case is that of producers of T-shirt bags and rolls of rolls for supermarkets.
c) Transnationals: These are mostly medium-sized or medium-large companies that entered Argentina by purchasing local firms or by setting up their own plants.
d) Small family businesses: They typically supply small market segments or perform work for third parties. They have a low level of technological sophistication.

Likewise, there are around 2,750 plastics manufacturing companies in Argentina, which directly employ 56,000 workers (CAIP).

Table A.1 Structure of the plastics industry in Argentina. Source: CAIP, 2024.

Year	Number of industries	Workers
1990	3500	38000
2000	2385	32300
2005	2285	45500
2010	2710	50600
2015	2810	55500
2020	2720	50300
2023	2750	56000

Regarding urban waste pickers, some aspects are detailed below to better understand the situation. According to data from the Argentine Federation of Carreros, Cartoneros, and Urban Recyclers (FACCYR), in 2023 there were an estimated 150,000 urban waste pickers working in Argentina. However, only 18,000 workers were registered with the Federation and organized into waste picker companies (the vast majority in urban waste picker cooperatives) distributed throughout all of Argentina's provinces.

Recycling is a fundamental component of the circular economy, as it is the main source of raw materials. There is a diverse universe of entities and self-employed workers who carry out this work on a daily basis. According to official data from the Ministry of Social Development of the Argentine Republic (2023), there are 385 production units dedicated to the recovery of recyclable materials throughout the country[1], most of whom are registered with the Argentine Federation of Urban Cart Collectors and Recyclers (FACCYR). These organizations bring together grassroots recyclers who collaborate with local collection and processing units—green centers, regional processing and logistics centers—and/or work on projects involving special waste streams and added value. This economic activity of informally recovering and selling materials found among waste has expanded significantly in Latin America following successive periods of socioeconomic crisis, as the task of recovering recyclables from waste serves as a means of subsistence. Urban recyclers, as a new social subject, are known as "cirujas" or "cartoneros" (Dimarco, 2007) in Argentina, "cachureros" in Chile, or "recicladores" in Colombia (Terraza and Sturzenegger, 2010; Paiva, 2013).

The plastics recovery sector is comprised of countless recycling companies, which come in various forms, including cooperatives, mutual funds, civil associations, and foundations; and self-employed recyclers, whose activities aim to enhance collection, recycling, and environmental care within the framework of the circular economy.

The sector that recovers plastics and other recyclable materials, at best, sells the recovered material directly to the recycling industry, making sales to local intermediaries under a very weak commercial relationship. Currently in Argentina, recycling companies are experiencing a significant crisis, mainly due to the precipitous drop in the prices of recyclable materials—including plastic—making the task unprofitable. The opening of imports directly impacts the national production process, and recycling companies are no exception.

B.1.2 Geographical and economic distribution

The plastics industry has a geographical distribution concentrated in urban and industrial centers, as can be seen in Figure 1, among which AMBA, Córdoba, Santa Fe, and Mendoza

[1] These official data are from 2023 where the Argentine State developed an active policy ofAdvice and support through financing for supplies, machinery, work tools, equipment, clothing, and safety equipment for the development of recovery companies. In turn,The sector had been strengthening thanks to strong market prices for recyclable materials. Numerical data on the number of production units and urban recyclers can be found at: https://www.argentina.gob.ar/capital-humano/familia/inclusion-laboral-y-economia-popular/argentina-recicla/mapa-federal-de

stand out (CAIP, 2024). Meanwhile, recycling companies are present in at least 19 provinces, articulated through initiatives such as the Federal Recycling Map, which seeks to strengthen inclusive and sustainable waste management. This map can be viewed at the following link:“Recycling Map”This Federal Map provides visibility into the recycling value chain and seeks to strengthen Integrated and Inclusive Urban Solid Waste Management (ISUWM).

Regarding Recycling Companies or Production Units, the Federal Recycling Map shows that they are distributed throughout all of Argentina's provinces, primarily in the largest cities. Generally, these Production Units do not only process plastic, but also recover other materials such as cardboard, paper, glass, etc. The materials recovered vary in each location, depending on the quantity and quality of the materials most commonly found, the predominant economic activity, the existing buyers, and the market price. Without a doubt, plastic, in its various forms, is one of the materials with the highest recovery rates, along with cellulose and some metals.

Then, regarding the geographical distribution in Argentina of the companies corresponding to the plastics processing industry (CAIP, 2024) it is presented in the following figure:

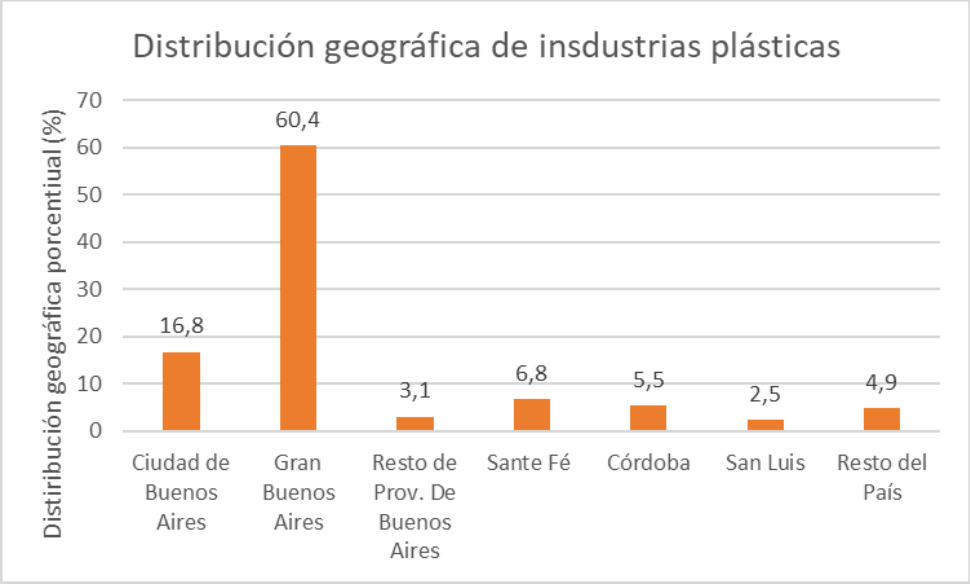

Figure A.1 Geographic distribution of the plastics industry in Argentina. Source: CAIP, 2024.

B.1.3 Main plastic products

Regarding the most relevant polymers in the Argentine market, the following stand out: low- and high-density polyethylene (LDPE and HDPE), polypropylene (PP), polyvinyl chloride (PVC), and polyethylene terephthalate (PET). Table A.2 presents the production, imports,

exports, and apparent consumption in tons reported for 2023. Additionally, Figure A.2 shows the evolution of annual per capita plastic consumption in Argentina from 2000 to 2023.

The plastic collection industry adapts to demand, based on market prices and the type of material prevalent in each location. Generally speaking, the plastics with the highest recovery rates are PET, HDPE, LDPE, and PP. These are processed according to the industry's needs (color separation, different qualities, etc.).

Table A.2 Apparent consumption of plastics in Argentina. Source: CAIP, 2024.

Raw material	Production (t)	Import (t)	Export (t)	Apparent consumption (t)
LOW DENSITY POLYETHYLENE	397476	240676	150108	488044
HIGH DENSITY POLYETHYLENE	283406	89326	89333	283399
PVC	194865	10392	48084	157173
POLYPROPYLENE	316773	96020	45661	367132
POLYSTYRENE	58146	3904	8974	53076
EXPANDABLE POLYSTYRENE	20800	7989	58	28731
PET	178100	54476	8725	223851
ABS	(3)	9147	s/d	9147
SAN	(3)	986	59	927
PHENOLIC RESINS	1105	5235	250	6090
POLYESTER RESINS	4600	9768	6143	8225
POLYAMIDE (1)	500	16895	3577	13818
POLYETHERES	0	31841	2531	29310
COCLOPÉMERO EVA (2)	0	242	69	173
POLYCARBONATE (2)	-	8338	196	8142
MELAMINE RESINS	-	21103	399	20704
OTHER RAW MATERIALS	s/d	280124	33283	246841
TOTAL	**1455771**	**886462**	**397450**	**1944783**

Notes: Data for Low Density Polyethylene include those for Linear Low Density Polyethylene. - (1) Data for Polyamide 6 and 66 - There is no local production of Polyamides 11 and 12. - (2) There is no local production - (3) There was no local production.

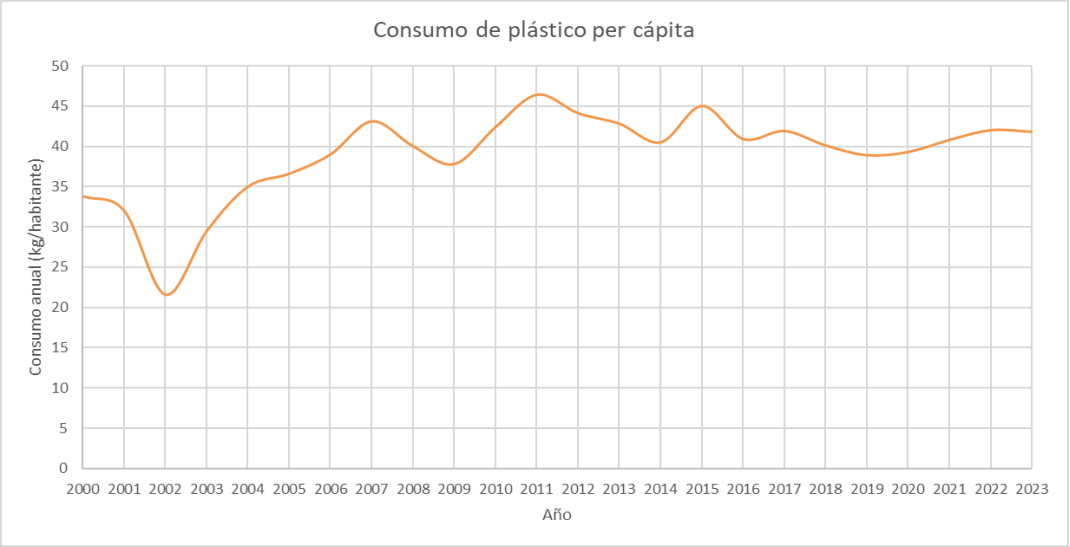

Figure A.2 Evolution of per capita plastic consumption in Argentina (in kg/inhabitant) between 2000 and 2023. Geographical distribution of plastics industries in Argentina. Source: CAIP, 2024.

B.1.2 Main end applications of plastic products at the local level

In Argentina, the aforementioned plastic materials are used in sectors such as packaging, construction, automotive, agriculture, and household appliances. A more detailed percentage distribution is presented in Figure A.3.

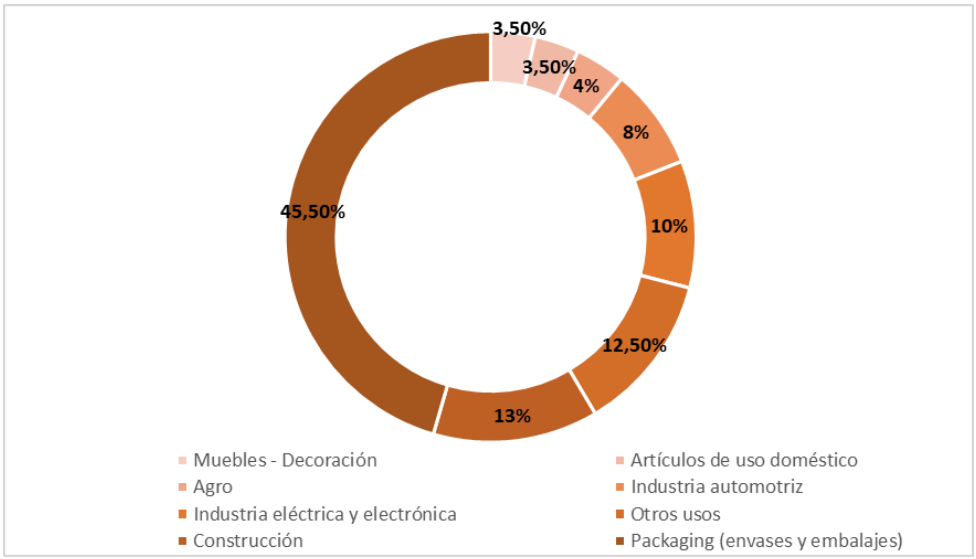

Figure A.3 Percentage distribution of end uses of plastic products in Argentina (2023). Source: CAIP, 2024

Analyzing Figure A.3, we can see that 13% of plastics are used in the construction industry, specifically in the manufacture of gas and water pipes, drains, cable sheathing, light fixtures, decking, wall insulation, window frames and profiles, door trim, and furniture. In the electrical and electronics sector, 10% of plastics are used in the production of cell phones, flash drives, computers, automated equipment, air conditioning units, and household appliances. In this case, plastic is used to make casings, insulation systems, and data conduction systems, among other components, thus reducing the weight and size of the equipment.

In transportation, plastics are part of the means of transport used daily to transport passengers, such as cars, buses, trains, subways, airplanes, etc. This sector uses 8% of the total plastic produced. The agricultural industry also consumes this type of material. Silo bags, seedbeds, greenhouses, and drip irrigation hoses are some of the products made from plastics. Recently, new applications have emerged, such as the manufacture of fence posts and vineyards made from plastic lumber, which is produced from recycled materials.

Another area where plastics are essential is medicine and healthcare. In this case, plastics are present in medication packaging, diagnostic and treatment equipment, and in plastic items such as gloves, masks, gowns, and medical materials that prevent the spread of disease. They also appear in other applications such as pill coatings, syringes, IV bags, catheters, disposable syringes, prosthetics and suture threads, and prosthetics, among many others.

Finally, it's worth highlighting that plastic materials are found in other products such as textiles, clothing, protective gear like helmets and knee pads, sports equipment like nets and ropes, fishing nets and gear, toys, stationery, eyeglasses, furniture, picture frames, posters, etc. They are also essential elements in innovative technologies such as robotics and 3D printing, as they have enabled the manufacture of a wide variety of products such as medical and dental implants, improving our quality of life. (Guide: Plastics in the Circular Economy. Ecoplas 2023).

B.1.3 Segments of the plastics production chain that have the greatest potential for adopting circular economy models

To conduct this preliminary analysis, based on the characteristics of the plastics value chain in Argentina, potential circular models include mechanical and chemical recycling, product eco-design, the substitution of virgin raw materials for recycled materials, and the creation of new markets for recycled materials. In turn, the adaptation and implementation of public policies, investment in technology, environmental education, and collaboration with urban recyclers are crucial factors in driving this transition. In this regard, the following strategies were identified:

1. Production of raw materials:

- Although more concentrated in large petrochemicals, there is potential to develop recycled or bio-based resins;
- investments in technology and incentive policies are required.

2. Transformation and manufacturing:

- processes can be adopted to incorporate recycled materials;
- designing products with recyclability in mind (ecodesign);
- implement more efficient and less wasteful production systems;
- innovate with bioplastics or biodegradable plastics that complement the circular economy.

3. Distribution and marketing:

- They can promote reuse models, return and resale systems;
- encourage the reduction of single-use plastics and promote responsible consumption.

4. Waste management and recycling:

- It is the segment with the greatest immediate potential;
- Argentina has a recycling sector that can grow significantly, both formally and informally;
- Incorporate selective collection systems, mechanical and chemical recycling, and recovery of plastic waste;
- The use of recycled plastics for the manufacture of new products reduces the use of raw materials.

As a preliminary conclusion, in Argentina, recycling and plastic waste management not only has the greatest potential, but there is also an immediate need to implement circular economy strategies to improve infrastructure and recovery systems. However, for a

systemic impact, it is also key to work at the transformation and manufacturing stages, using eco-design strategies that increase the recyclability of post-consumer products and reduce the generation of plastic waste that ends up in landfills. Additionally, it is important to mention that raw material production has potential, although it depends on raw material availability, technological investment, and industrial policies.

B.2 KEY FACTORS AND ACTORS IN THE TRANSITION TOWARDS THE CIRCULAR ECONOMY

B.2.1 Opportunities to promote the circular economy in the plastics sector

To promote the circular economy in the plastics sector, there are a wide range of key opportunities to improve sustainability, resource efficiency, and waste reduction. These opportunities can range from technological innovations to changes in business models, strengthening public policies, and raising consumer awareness. Among the key opportunities to promote the circular economy in this sector are:

a) Improve plastic collection and sorting systems:

Regarding collection logistics, improvements can be achieved by implementing geolocation and route optimization technologies that improve process efficiency and reduce costs.

Regarding sorting, in addition to incorporating technologies to sort plastics more quickly and accurately, it is necessary to work on on-site sorting of solid waste to facilitate the subsequent sorting process. This simplifies this stage of the plastics recycling chain and facilitates the mechanical recycling process.

It is also necessary to improve this system by promoting the creation of local recycling centers and plastic collection points to facilitate community management and reduce waste transportation. These centers' purpose is to decentralize the system and facilitate logistics.

b) Ecodesign and sustainable products:

Design for recyclability: Promote eco-design, where plastics are designed from the outset to be easier to recycle, using homogeneous materials and avoiding the use of additives that make recycling difficult.

Biodegradable or compostable plastics: Promote the development of alternative plastics that are biodegradable or compostable, especially in single-use applications, which could reduce the accumulation of plastic waste.

Material reduction in design: Innovate in the design of plastic products that use less material or recycled materials to reduce the amount of new plastics in circulation.

c) Innovations in processing technologies:

Chemical recycling: advancing chemical recycling technologies, which allow complex plastics to be broken down and transformed into more valuable monomers or products, without losing quality in the process.

Advanced recycling: Investing in new technologies that enable plastic recycling, maintaining the quality of the material after each recycling cycle.

d) Develop the market for recycled products:

Green certification and labeling: Promote the creation of labels and certifications that identify products made with recycled materials, encouraging consumers to choose sustainable products.

Markets for recycled plastics: Create a stable demand market for products made with recycled plastics, incentivizing producers to use these materials instead of virgin plastics through tax incentives or subsidies.

Boosting key industries: Promoting the use of recycled plastics in industrial sectors such as automotive, construction, and fashion, where demand for sustainable materials is growing.

e) Public policies and regulations:

Ban single-use plastics: Establish stricter regulations that limit or eliminate single-use plastics, promoting recyclable or biodegradable alternatives.

Incentives for innovation and recycling: Create tax incentives for companies that invest in recycling technologies, sustainable production processes, and the use of recycled plastics.

Recyclability standards: Establish clear regulations on plastics recyclability standards and requirements for their design and processing, facilitating the transition to a circular economy.

f) Consumer education and awareness:

Awareness campaigns: Conduct educational campaigns at the global and local levels to raise consumer awareness about the importance of waste separation and recycling, and the impact of their purchasing decisions.

Promoting waste separation: Establish more accessible and user-friendly collection systems, such as using different-colored containers to facilitate plastic sorting in homes and businesses.

Promoting the circular economy: Promoting understanding of the benefits of the circular economy in society, showing how it can contribute to waste reduction and sustainability.

g) Collaboration between sectors:

Business-to-business partnerships: fostering collaboration between plastics manufacturers, recyclers, researchers, and governments to share knowledge and develop innovative and scalable solutions for plastics recycling and reuse.

Collaborative business models: Establishing business models based on the rental, repair, or reuse of plastic products can help reduce the demand for new plastics and promote longer lifecycles.

h) Innovation in new materials:

Development of alternative plastics: Invest in research into new materials that can replace conventional plastics, such as bioplastics, plastics made from renewable resources, or plastics with improved recycling properties.

B.2.2 Barriers faced by companies in the transition to the circular economy

Among the weaknesses and/or barriers that local companies face in the transition towards a circular economy, the following can be mentioned:

a) **Few initiatives to convert production:** The plastic waste generated in the country shows a high contribution of those derived from disposable objects and packaging (single-use), with a short useful life, or those that use multiple materials, adhesives, labels, inks, or metallization in their production that make recyclability difficult. Furthermore, the percentage of recycled material incorporated into new products tends to be low. All of this demonstrates a limited incorporation of eco-design criteria in the business models linked to this trend, which could reverse this trend by producing more durable goods and/or easier to incorporate into recycling circuits. The initiatives deployed in this regard are specific and limited. For example, regulations that prohibit some single-use disposables such as straws and supermarket bags (the Autonomous City of Buenos Aires, as of theResolution 816/2019, prohibits the distribution of plastic straws; or the province of Buenos Aires, as of theLaw 13.868/2008(prohibits the distribution of non-degradable bags in supermarkets and similar stores). An example associated with a redefinition carried out at the product design level has been the incorporation of improvements in PET containers that minimize the amount of materials used in their manufacture, or the replacement, generally partial, of virgin materials with recycled ones. Another aspect of this problem is the widespread use of multi-plastic packaging that has significant difficulties in being recycled (pouch or doy-pack type). Although they are presented to consumers as "eco-friendly," they have received virtually no attention, either from the manufacturing/packaging industries or from the competent authorities in the matter.

b) **Raw material:** Obtaining post-consumer plastic waste generally presents problems of quantity, cleanliness, separation, quality, and continuity. The main solution is to implement source separation and separate collection.

c) **Recycling process costs:** These depend largely on the conditions in which the waste is received and the impact of electricity costs. The solution lies in proper separation and collection, as well as special rates for the recycling industry.

d) **Final product sales price:** Recycled products are capped at the price of virgin products, generally related to the value of raw materials. The solution to this problem is to require the processing industry to use a minimum percentage of recycled material. One

possible solution is to require the processing industry to use a minimum percentage of recycled material.

e) **Dependence on international commodity prices and exchange rates:** A recurring dynamic occurs when there is a drop in the price of oil (fixed internationally) and a decrease in the exchange rate. Both phenomena make the use of virgin material relatively cheaper than the possible recycled component. Consequently, whenever the international price of oil and/or the exchange rate decreases, so does the quantity of recovered plastics demanded by the recycling and processing industry as inputs for production, because the price producers are willing to pay is limited by the price of virgin material. Thus, these aspects linked to international trade impact the entire plastic waste recovery chain, affecting its profitability and, consequently, its demand, effective recycling, and the recyclers' prospects for social inclusion.

f) **Territorial asymmetries in the distribution of demand for recovered plastic materials:** Plastic waste generation occurs at uneven rates across the country, depending on population dispersion and socioeconomic characteristics. Demand for these materials is heavily concentrated in the large cities of the Pampas region. This causes the impact of logistics costs to decouple the prices of materials generated and recovered in remote locations from those close to these recycling and processing sites. It also incentivizes intermediation, generating negative marketing conditions, to the point of inhibiting the existence of economic incentives for their recovery. In response to this, grassroots recycling organizations are testing alternatives for collective sales directly to the recycling industry, defining or projecting possible multimodal transportation formats (rail-truck) and appropriate transportation for lightweight, high-volume materials (such as double-trailer trucks), as well as establishing regionalization criteria for their collection. However, the impact of logistics costs is the main obstacle to stabilizing this alternative.

g) **Lack of regulations for the implementation of differentiated collection schemes:** The lack of a packaging law aimed at establishing minimum budgets and the EPR (Recycling and Recycling Regulation) results in a lack of responsibility for the management and financing of the recovery chain for these materials. This occurs because producers often evade the responsibility of recovering and properly treating waste, while municipalities lack sufficient capacity (mainly budgetary) to do so. Thus, within recyclable plastics, when the exchange rate and international prices allow (as previously analyzed), a segregation develops between those prioritized for marketing and recovery over others (PET or HDPE over PVC or PP), given their demand that offers higher prices, greater stability, and better market access, while the rest practically lose interest in their recovery. In turn, the absence of EPR regulations leaves no useful tool to promote the redesign of materials at the production stage.

Thus, the transition to a circular economy for plastic waste requires integrating multiple scales. Material recovery efforts, which by Argentine regulations are local, must be linked to dynamics and critical points that operate primarily at the national and subnational levels.

B.2.3 Key players in the transition to the circular economy

The transition to a circular economy in the plastics sector is undoubtedly a challenge that requires the collaboration of society as a whole. All actors in the value chain are fundamental to the transition to circular models and can play different roles.

a) **Public sector:** To support the migration to circularity by creating an enabling environment to foster sustainable production and consumption models through regulations, economic incentives, and coordination between the knowledge sector and the private sector to foster research, development, and innovation (R&D&I) to drive solutions to common challenges, among others.

b) **The private sector,** which encompasses both companies and the chambers or associations that represent them, must migrate from a linear production model to a production logic based on the circular economy. The sector can promote various actions for this transition, including: measuring the circularity of its products and services and evaluating its progress; incorporating ecodesign to produce goods and services with the lowest possible environmental impact; generating synergies to foster industrial symbiosis and thus ensure the utilization of 100% of byproducts; using raw materials from waste or renewable sources; selling in bulk or with reusable packaging; optimizing resources; and implementing new logistics circuits for the delivery of goods and services through shared economy or servitization strategies (product as a service), among others.

c) **Knowledge sector:** universities, research centers, technology linkage units, institutes, national and international agencies, and organizations can finance and promote R&D&I projects to generate circular solutions to various problems. The synergy between this sector and the private sector is key to laying the foundation for new businesses and innovation-based solutions.

d) **Social sector:** Society can also contribute to the emergence of circular solutions, as well as the cultural shift needed to drive the transition. The tools at their disposal to demand more sustainable production and supply include participation in social mobilizations, awareness-raising campaigns, and participatory budgeting, as well as their individual consumption decisions, among others.

e) **Media:** They play a fundamental role in cultural change. They are both spokespersons and shapers of public opinion, and generate consumer and thought trends. The dissemination of circular economy initiatives, as well as habits that people can adopt in their daily lives, are just some of the actions this sector can take.

B.2.4 Relationship between factors and actors

In the transition to a circular economy, stakeholders (governments, businesses, universities, cooperatives, civil society, and international organizations) must interact dynamically, influenced by regulatory, economic, technological, social, and environmental factors. For example, regulatory frameworks established by the State, such as waste management laws or extended producer responsibility (EPR), directly impact how companies design their products or manage their waste. Universities, in turn, provide technical knowledge and generate training and innovation spaces that inform both the productive sector and public policies. Cooperatives and recyclers, often in coordination with local governments, play a key role in waste collection and recovery, and are social actors that require formalization and support. These ties are strengthened or weakened depending on the availability of economic incentives, appropriate technology, and social acceptance, highlighting the need for collaborative governance to move toward a circular model. The above represents an ideal that does not exist in Argentina. Although there are interactions of this type at the provincial or local level in some cases, there is no organized system at the national level.

B.2.5 Policies and strategies to strengthen relationships between stakeholders

To strengthen relationships between stakeholders in the circular economy and improve their interaction with the factors that shape it, it is essential to implement integrated, multisectoral policies.

First, it is essential to establish a clear and progressive regulatory framework at the national level that unifies criteria and obligations. Likewise, economic incentives (subsidies, tax benefits, or access to specific financing) must be promoted for companies and cooperatives that adopt circular practices.

Universities and research centers need support to develop applied technologies and technical training programs, which in turn boost employability in green sectors.

Another strategy could be to institutionalize multi-stakeholder dialogue spaces, such as regional roundtables or circular innovation platforms, where common goals can be agreed upon and joint action plans mapped out.

Finally, environmental education and the implementation of sustainable public procurement can act as social multipliers to consolidate a long-term circular culture. These purchases represent a process by which government entities acquire goods, services, and works in a

way that minimizes negative impacts on the environment, promotes social inclusion, and generates long-term economic value.

B.2.6 Plastic recycling in Argentina

According to the recycling index developed by the civil association Ecoplas and the Chamber of the Plastics Recycling Industry (CAIRPLAS), more than 4 million tons of plastic were recycled in Argentina between 2003 and 2023, preventing the emission of more than 5.7 million tons of carbon dioxide. Argentina recycles 15.12% of its total plastic, which is "good" compared to the region, despite lacking accompanying legislation. The EPR law is opposed by companies—although Brazil, Chile, and Uruguay already have similar laws for all types of materials, and Spain enacted it in 2011, and the amount of recycled packaging grew 37-fold—in a context where multinationals offset the targets they fail to meet in Argentina with those they over-meet elsewhere in the world.

Although global recycling rates are relatively low (13.5% worldwide), more and more nations are dedicating their efforts to improving these levels, especially in Europe, where several countries have recycling rates above 50%. For example, in Switzerland, recycling is mandatory, and those who fail to comply face fines that can exceed €10,000 in the most extreme cases. Non-recycled material is incinerated and generates energy for more than 250,000 homes. To give a few examples, 83% of plastic bottles are recovered. Other highly relevant cases are Sweden and Norway, which recycle so much waste that they were forced to import waste from the rest of Europe. This happened because their inhabitants do not produce enough waste to fully supply their recycling plants. It is well known that the Nordic countries have a genuine environmental commitment to improving the well-being of their citizens and the natural environment of their regions. Outside of Europe, only one country on the list has levels above 50%, and that's South Korea. South Korea allocates 2% of its GDP to environmental programs, making them mandatory and offering certain benefits to incentivize its citizens. The other countries on the list are Austria, Germany, Belgium, and the Netherlands.

B.2.7 Relationship between the Academy and the Plastics Industry at the national level

There are different stages of academic-industry engagement. In some universities and/or associated research institutes, it is more incipient than in others, depending on the location and the place that plastics recycling occupies on the public agenda in different regions. PLAPIQUI, in particular, maintains active engagement with the industrial sector and plastics recycling through applied research, technological development, and transfer projects. Drawing on its experience in process engineering and materials science, the institute works on the design and optimization of technologies for the mechanical, chemical, and energy

recycling of plastic waste, especially those that are difficult to recover, such as mixtures, materials with mineral fillers, or those originating from complex streams such as WEEE. It also collaborates with companies in the petrochemical sector, recyclers, and packaging manufacturers, providing technical assistance, advanced material characterization, and analysis of physical, thermal, and mechanical properties. This engagement also extends to the public and social spheres, through training, services to cooperatives and municipalities, and participation in circular economy strategies. In this way, PLAPIQUI provides scientific knowledge and practical tools to improve the efficiency, traceability, and sustainability of plastics recycling in the region.

For its part, UNRN develops strong collaboration with the recycling sector through outreach activities that prioritize links with urban recyclers and social organizations. A core part of its work focuses on promoting comprehensive waste management with a territorial approach, conducting source separation workshops on its campuses and supporting community processes linked to recycling. Within this framework, it actively collaborates with cooperatives and recycling groups, strengthening their organizational and technical capacities and promoting practices that recover both organic and inorganic waste. This strategy combines training, support, and direct action, with a strong commitment to the social and solidarity economy. Unlike approaches more focused on technology or industry, UNRN places special emphasis on the social component of recycling, recognizing and supporting the key role played by informal sector workers in building a fair and inclusive circular economy.

B.2.8 Innovation in the plastics industry

The Argentine plastics industry is advancing in the incorporation of new technologies such as advanced recycling, a strategic alternative for the revaluation of plastics, as it complements the traditional mechanical method responsible for recovering post-consumer materials from domestic, industrial, commercial, and agricultural applications. In this regard, Resolution No. 220/2023 approved the agreement between YPF S.A. and the Ministry of the Environment of the Province of Buenos Aires for the development of a pilot test for pyrolysis of plastic waste, one of the advanced recycling technologies. It is important to highlight that this technology allows for the production of recycled materials with the same quality as virgin materials and contributes to reducing the amount of waste disposed of in landfills. Therefore, it contributes to the mitigation of greenhouse gas emissions, which have a direct impact on the climate change crisis affecting the planet.

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