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Economic and Regulatory Analysis of Plastic Waste Management in the EU, Italy, Argentina, and Brazil

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ABSTRACT

Plastic pollution poses significant environmental and economic challenges worldwide, necessitating effective waste management and circular-economy strategies. This study compares the plastics sectors of the European Union, Italy, Argentina, and Brazil, analyzing their economic structures and regulatory frameworks. Here, we conduct a multi-regional assessment combining economic data and policy analysis to reveal marked differences: the EU and Italy exhibit advanced, structured industries with comprehensive regulations that promote circularity, whereas Argentina and Brazil face fragmented policies and less developed recycling infrastructure. Our findings highlight that economic capacity, institutional frameworks, and technological advancement critically influence progress toward circular economy models. These insights underscore the need for coordinated international strategies and tailored national policies to enhance sustainable plastic management and mitigate environmental impacts.

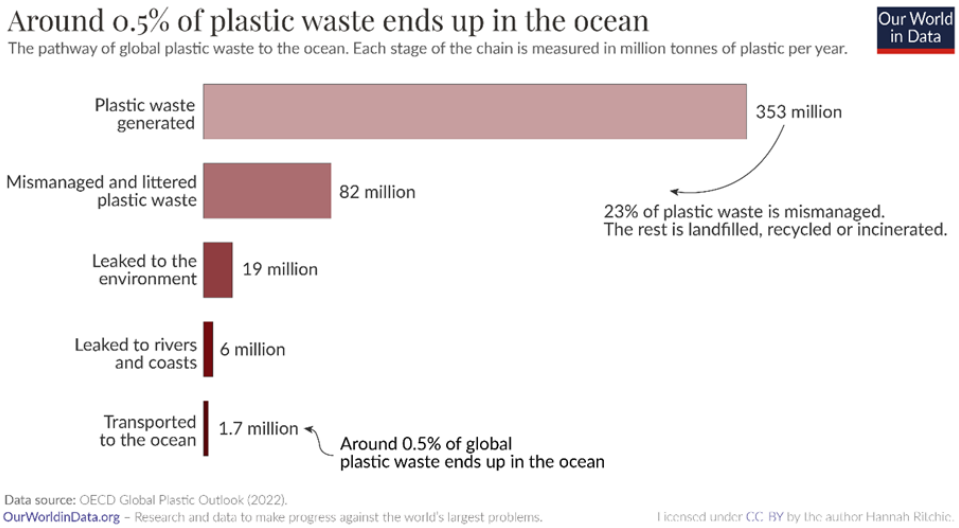
KEYWORDS: Plastic waste management, Circular economy, Environmental regulations, Plastic pollution, Sustainable development.

INTRODUCTION

Megatrends such as population growth and rapid urbanisation help explain changes in consumption patterns and the sharp increase in solid waste generation worldwide, particularly plastic waste (Federchimica, 2025). It is therefore essential to promote greener and more efficient forms of waste management, as well as collectively shared sustainable solutions and policies. These should be consistent with the regulations at different management levels (i.e., policy coherence). In this context, it is also relevant the concept of "territorial governance", which examines how citizens organise their lives in relation to public plans and policies. The usefulness of this concept lies in analysing the roles of different actors in a specific value chain, such as the plastic value chain. As a matter of fact, an analysis by da Silva highlights that, in Curitiba's plastic value chain, actors with controlling power over others are favoured (da Silva, Bolson, and Sauka. 2024). Currently, most of the world's population lives in cities, making these complex, constantly evolving systems the driving force behind research on urban sustainability. Urban management policies are designed to address residents' economic, social, health, environmental, and cultural needs. Studies such as Madruga et al. (2025) highlight how leveraging digital technologies, when guided by social and environmental principles, can help address the challenges of sustainable development in rapidly urbanising areas and contribute to creating greener, more efficient cities.

Plastics are among the most widely used industrial materials, valued for their versatility, low cost, and broad applicability across sectors such as public transport, construction, telecommunications, consumer goods, nutrition, and medical care (Simone and Conti, 2022). Our focus is on plastics, which are among the most widely used industrial materials due to their versatility, low cost, and broad applicability. We can find plastic applications in a wide array of our daily life activities, ranging from public transport to construction, from telecommunications to consumer goods, from nutrition to medical care (Simone and Conti, 2022). The need to implement plastic regulations stems from the fact that, despite its crucial role in the sectors mentioned above and, more generally, in our society, plastic is now one of the primary sources of pollution. However, growing environmental concerns have led to stricter regulations and the emergence of circular economy models. Numerous researchers have widely analysed plastic pollution due to its effects on jeopardising biodiversity and the welfare of all living beings. It is estimated that approximately 82,000,000 tonnes of plastic waste worldwide are inadequately managed, and about 1/4 of these are released into the environment, contaminating both terrestrial and aquatic ecosystems (Ritchie, 2023). Figure 1 provides an overview of the amount of plastic generated, mismanaged, leaked into the environment, and ultimately transported to the ocean.

Figure 1:The path followed by plastic before reaching the ocean



Source: Ritchie, 2023; https://ourworldindata.org/how-much-plastic-waste-ends-up-in-the-ocean

In addition to their risks to ecosystems and human health, plastics contribute substantially to global greenhouse gas emissions. In 2019, plastics were responsible for around 1.8 gigatonnes of GHG emissions (about 3.4% of global emissions), with roughly 90% originating from fossil-fuel-based production and conversion processes (OECD, 2022).

The far-reaching impacts of plastic pollution on biodiversity, food webs, and human well-being have led to a growing body of scientific research focused on finding effective solutions (Aragaw and Mekonnen, 2021; Rochman, 2016; Simone and Conti, 2022). The purpose of the study is to provide an overview of the plastic sector and its effects on society in the selected areas. Here we consider:

I. An economic perspective focusing on the plastic industrial structure in the selected areas

II. A multi-regional analysis of the different scenarios in terms of regulation and plastic waste management.

III. An overview of the steps implemented by the EU, Italy, Argentina, and Brazil towards a circular economy.

Moreover, the present work could serve as a helpful tool for outlining future policy directions toward more efficient, environmentally sustainable waste management.

To conduct this study, we have applied a traditional method of research composed of three steps:

Definition of the study's purpose and the keywords (above reported), ensuring association with the research queries.

Research: The sources have been searched using databases like Google Scholar and ResearchGate. Additionally, relevant reports were retrieved through online research using specific search engines. National and international regulations were also consulted and implemented. The systematic search process was documented.

Source selection and information extraction: The most relevant sources were selected from those gathered in the previous step, using criteria of relevance, timeliness, and reliability. As a result, the study utilised the most pertinent data and information related to its objectives.

ECONOMIC PERSPECTIVE OF THE PLASTIC SECTOR

In this section, we analyse the plastic industry in the selected countries from an economic perspective. We intend to provide a more consistent and meaningful economic comparison across the selected regions.

In the European Union, the plastic sector constitutes a large and complex industrial system. It is estimated that in 2024, around 1.5 million people were employed across more than 50.600 companies, a lower figure than the 51.700 firms registered in 2023 (Plastic Europe 2025; Plastic Europe 2024). Over a year, turnover also increased: in 2024, it amounted to approximately 398 billion euros, up from approximately 365 billion euros the previous year (Plastic Europe 2025; Plastic Europe 2024). Since 2022, Europe has become a net importer of both plastic production and conversion (Plastic Europe 2025). Lastly, comparing Europe's share in global production in 2023 and 2024, we do not notice significant differences, with Europe maintaining 12%. On the other hand, we notice an increase in the share of circular plastics in production, moving from 14.8% to 15.4% (Plastic Europe 2025; Plastic Europe 2024).

The plastic sector in Italy, characterised by numerous highly skilled SMEs, is large and economically significant. In 2023, the sector's turnover was approximately 58.4 billion dollars, placing Italy second among all European member states. The sector generated an added value of 15.3 billion dollars and employed around 164,000 workers—more than the automotive sector, representing about 4% of national manufacturing employment (TEHA, 2025). The Italian plastics value chain is highly diversified, with the transformation phase playing a particularly prominent role, accounting for about 74.8% of total plastic turnover, which is 7.5% higher than the European average (TEHA, 2022). From a competitive standpoint, Italian plastics manufacturing faces substantial pressure linked to energy costs, increasingly stringent European environmental regulations, and intensified global competition (TEHA, 2025). At the same time, several strategic recommendations have been put forward to enhance this sector's competitiveness. These include encouraging the use of secondary raw materials (recycled plastics), supporting the development of bioplastics, and speeding up the authorisation procedures for new circular-economy plants (Federchimica, 2025). The plastic sector also displays a strong international orientation, as in 2024, Italian exports of plastic production amounted to around 25 billion dollars. A substantial share of exports was directed at other European member states, but a significant share was also directed at non-European countries (TEHA, 2025).

We now turn to Mercosur, the South American trading bloc established in 1991 (Figure 2). The members are Argentina, Brazil, Paraguay, and Uruguay, and together they form the sixth-largest economy in the world, with a population of around 270 million (Council of the European Union, 2025). When considering Mercosur countries, we must also mention the relationship that Venezuela and Bolivia have with this trading bloc. The former, in 2012, entered a partnership with the trading bloc, but its membership was suspended in 2017; the latter, by contrast, has concluded the accession protocol, but its ratification is still pending in the Mercosur parliaments (Council of the European Union, 2025).

Figure 2: Representation of Mercosur countries

Source: Council of the European Union, 2025; https://www.consilium.europa.eu/en/infographics/eu-mercosur-trade/

Argentina's industrial structure is characterised by a well-developed injection moulding process, which represents the core activity in the country's plastic value chain. From the standpoint of production and trade, the local industry processed about 1.42 million tonnes of plastic raw materials in 2022 (U.S. Commercial Service, 2024); however, Argentina remains import-reliant for production equipment and inputs. Machinery is primarily imported from the United States and European countries such as Italy and Germany. At the same time, imports of plastic raw materials are also significant, with Brazil serving as a key supplier (U.S. Commercial Service, 2024). These characteristics present both challenges and opportunities: foreign companies, particularly manufacturers of machinery and resins, find substantial local demand, which could attract further multinational investment. (U.S. Commercial Service, 2024). This factor could attract other multinationals to invest in the area. At the same time, recycling and circular practices are still at an early stage of development, leaving space for future investments in circular transformation policies and technologies.

Focusing now on Brazil, the country is the leading plastics producer in Latin America; in 2023, plastics production amounted to roughly 7 million metric tonnes, generating 123.4 billion Brazilian reais (Statista, 2025). Despite this substantial output, the long-term trend in transformed plastics production has been downward compared with earlier years; in 2010, production amounted to around 8.7 million tonnes. Both amounts show a significant increase compared to 2022, when production was 6.7 million metric tons, and 117.5 billion were generated (Statista, 2025). Another growth is registered also in terms of companies and employees operating in the industry. More specifically, among the 11.339 companies and the 343.861 employees registered in 2022, in 2023 the number of firms rose to 12.400, and the number of jobs to 363.400 (Statista, 2025). Although the country has a robust domestic industry, it imports a significant share of processed and semi-processed plastics, with the United States representing a major actor in this context. On the export side, Brazil supplies processed plastic to other Mercosur countries, such as Argentina, which remains its principal trading partner (Statista, 2025).

REGULATORY APPROACHES IN THE SELECTED COUNTRIES

This section outlines the different environmental waste regulations across the areas under analysis to highlight disparities in policy approaches to the environmental effects of plastic production and consumption.

The widespread use of plastic also increases plastic waste, which is affecting global climate change. In more detail, greenhouse gas emissions from plastic production lifecycles are jeopardising global community goals to keep temperatures below 1.5 degrees Celsius. Moreover, it is estimated that by 2050, emissions from plastic production could reach 56 gigatons, accounting for 10-13% of the remaining carbon budget (Hamilton et al., 2019).

To contain and reduce the environmental impact of plastic, it is almost mandatory to implement ad hoc regulations that promote best practices for the proper management of plastic production and waste. It is, in fact, estimated that mismanaged plastic waste is the principal source of microplastic leakage. In 2019, around 22 Mt were dispersed into the environment; only 9% of the overall production was recycled, and 22% was mismanaged. Macroplastics (see note 1) are responsible for around 88% of the overall global plastic leaked registered due to incorrect collection and waste management; on the other hand, microplastics account for the remaining 12% (OECD, 2022). In such a context, it is relevant for countries and supranational organisations (such as the EU) to issue and implement specific regulations to ensure proper plastic collection and waste management, thereby protecting the environment.

As regards the European Union's norm "Strategy for Plastics in the Circular Economy", it states that producers shall (Simone and Conti, 2022; Conti, 2024):

a) adopt separate waste-collection and recycling systems for plastic items derived from fossil fuels, with increasing reliance on secondary raw materials throughout the production cycle.

b) produce, employ, and compost stoves composed of plant-based biopolymers of plant origin.

c) Use biopolymers to significantly replace fossil-based plastics in disposable tableware by December 31, 2023.

All member states have granted themselves two years to transpose this directive into national law. The framework sets a target that by 2025, at least 55% of municipal waste from households and commercial activities must be recycled; moreover, another goal is to increase this target to 60% by 2030 and 65% by 2035. In this context, it is also worth mentioning the SUP (Single-use Plastic) directive issued in 2019 which has at its goal to "reduce the impact of certain plastic products on the environment, in particular the aquatic environment, and on human health, as well as to promote the transition to a circular economy (CE) with innovative and sustainable business models, products and materials, thus also contributing to the efficient functioning of the internal market" (Directive (EU) 2019/904: Art.1).

With respect to the Italian normative framework, the main regulatory provision is represented by the Legislative Decree 8 November 2021, number 196, published in the Official Gazette number 285 on the 30th of November 2021 and entered into force on the 14th of January 2022. This norm was created in order to implement the EU Directive 2019/904 on single-use plastic (D.Lgs. n. 196, 2021). The scope of this decree aligns with the goals laid down by the European directive, namely to reduce the environmental and health impacts of plastic production and disposal and to promote the transition towards a CE (see section below)

(Confindustria, 2021). The norms set a restriction regarding placing on the market single use plastic (SUP) items (cutlery, plates etc..); moreover, the State, through the work solved by the Ministry of Ecological Transition (Ministero della Transizione Ecologica, MITE), must adopt a national strategy to combat plastic pollution; in detail, this strategy has the goal of raising consumers' awareness on reusable alternatives, correct waste management and SUP's environmental impact (Confindustria, 2021). Inside this regulatory context, it is also worth mentioning the Decree 5 March 2024 number 89, which establishes rules for financial incentives aimed at supporting companies that are adopting sustainable alternatives to SUP items; as a matter of fact, the goal is not only the reduction of plastic products but also to encourage the implementation of overall better materials (Decreto 5 marzo 2024). These aspects allow us to conclude that the Italian regulatory framework (as an extension of the European one) on plastics matters is a combination of prohibitions along with support for environmental innovation.

In Argentina, several studies have examined the effects of plastic pollution on local ecosystems (Ronda et al., 2021), and significant impacts have been documented in the estuary of the Rio de la Plata (Elisei Schicchi, Moreira, Eisenberg, and Simionato, 2023). From a regulatory standpoint, we must register the issuing of a series of both bilateral and multilateral policies aimed at protecting biodiversity in the area. In this regard, a normative framework is provided by the bilateral treaty of Rio de la Plata and the Mercosur environmental agreement, which both provide a context for the proper management of urban solid waste, such as plastics (Carman, Machain, and Campagna 2015). Analysing the Argentinian normative framework allows us to identify a relevant regulation issued in 2020 that serves to preserve natural protected areas. In detail, the Administración de Parques Nacionales (APN) approved a regulation that established progressive reductions and the prohibition of SUP, within protected national sites (Administración de Parques Nacionales, 2020). In the Buenos Aires province, the law on urban solid waste establishes that municipalities must develop integrated waste management plans for the reuse and recycling of generated waste; this norm aims to reduce by 30% within 5 years the trash brought to the dumps (Carman, Machain, and Campagna 2015). Furthermore, we must mention the Plastic Containers Law, which bans the use of polyethene bags and other plastic materials and promotes their substitution with biodegradable or degradable alternatives. As we will see in the next section, despite a regulatory framework, we must again acknowledge the significant impacts of plastics. The persistence of such effects stems from the lack of an efficient waste management infrastructure in urban areas and ports, as well as the delay in implementing regulations currently in force. To improve the efficiency of policies, it is necessary to better coordinate among jurisdictional agencies and promote participation between the public and private sectors (Carman, Machain, and Campagna 2015).

Lastly, for what concerns the Brazilian regulatory framework we must start our analysis from the National Policy on Solid Waste (NPSW); through the years this regulation has been complemented also by the issuing of decrees, national plans and initiatives (at both a municipal and state level) finalized at making steps towards CE (de Andrade and Araujo, 2025; Pereira, 2010). The NPSW (Federal Law No. 12.305/2010) is the fundamental legal instrument governing solid waste in Brazil. It has at its core multiple principles proper to the waste management implemented in developed countries:

• The shared responsibility for the product life cycle: according to this principle, a chain of individualised responsibilities is laid down in order to minimise waste generation as well as reduce impacts on the environment and on society. This "chain of responsibilities" involves actors ranging from producers to public urban cleaning services (Rutkowski, 2021; Pereira, 2010; Fraga Filho, 2024)

• Waste Management hierarchy: in the norm, a hierarchy prioritising non-production, diminution, reuse, recycling, solid waste management, and, ultimately, environment-aligned waste management (de Andrade and Araujo, 2025; Pereira, 2010)

• Economic and social recognition: the law recognises solid waste as an economic asset of social value and capable of creating income (Fraga Filho, 2024; Pereira, 2010)

• Inclusion of the "cartadores": this normative framework establishes as an objective of the national policy, the integration of informal collectors of reusable and recyclable materials (Pereira, 2010).

The NPSW also concluded the Sectoral Agreements (see note 2). As a matter of fact, in 2015, the government entered into agreements with companies in the cardboard, plastics, and other packaging sectors to progressively reduce landfill disposal (Rutkowski, 2021).

Additional plans and legislation also reinforce the proposed Brazilian regulatory framework:

• National Waste Recovery Plan (PLANARES): a road map concluded in 2022 that establishes guidelines for waste management through 2040 and has the aim of increasing the reuse of solid urban waste to 48.1% by 2040 (Fraga Filho, 2024).

• National Circular Economy Strategy: a plan that is presented in the decree number 12.082/2024 and that promotes the adoption of sustainable practices along the entire production chain (de Andrade and Araujo, 2025).

• National legal framework for basic sanitation services: established by Law 14.026/2020, which created new rules for basic sanitation in Brazil; specifically, it deals with solid waste by not only imposing deadlines to end environmentally improper disposal, but also urban cleaning and solid waste management services to be financially sustainable (de Andrade and Araujo, 2025).

• National Plan for Combating Marine Litter: this initiative has its focus on sea plastic pollution, as it is designed to manage marine litter more effectively, along with the promotion of research and public engagement (de Andrade and Araujo, 2025).

Over the years, we have seen several regulations (108 proposals between 1999 and 2021) aimed at reducing or banning plastic. Moreover, 214 state and municipal regulations have been adopted to restrict and prohibit SUP (de Andrade and Araujo, 2025).and Despite the Brazilian government's intentions, as shown in the issuance of these regulations, the results are still not those hoped for at the outset. Significant challenges persist, including infrastructural problems and monitoring of compliance with laws that slow progress towards a CE, which are fostered by the aforementioned set of regulations (de Andrade Araujo, 2025).

STEPS TOWARDS CIRCULAR ECONOMY DEVELOPMENT

To analyse the steps toward a circular economy, this paper examines a country's recycling rates. Starting with Europe. Figure 3 provides an overview of the plastic waste recycling rates achieved by European member states in 2022

(European Parliament, 2024); we can see that the leaders were Slovakia (59.6%) and Belgium (54.2%), while Malta achieved the lowest rates (16.4%) and Denmark (23.5%).

Figure 3: Recycling rates throughout European member states in 2022

Source: European Parliament, 2024; https://www.europarl.europa.eu/topics/en/article/20181212STO21610/plastic-waste-and-recycling-in-the-eu-facts-and-figures

Despite the efforts, the share of "circular" plastics remains modest compared to overall European plastic production. In 2024, circular plastic accounted for 15.4% of overall plastic production, and recycled plastic declined by around 7.8% from 2023 (Plastic Europe 2024). Let us have a look at the different structures that constitute the development of circular economy models in the different areas of our study.

The Italian model can be described as a structured CE in which waste management costs and the economic value generated by recycling are both internalised and regularised. The key pillars are the EPR (Extended Producer Responsibility) and the CONAI.

As regards the costs, the regulation states that the expenses associated with separate collection and the initiation of recycling are predominantly borne by private stakeholders (in line with the "who pollutes pays" principle) through the CONAI Environmental Contribution (CONAI, 2022). In detail, producers must cover the full amount, or at least 80% (if eligible for derogations) of the service costs, ensuring a stable financial flow to municipalities (ARERA, 2023). Such stability enables a more predictable planning of waste collection and recycling services. Another factor to consider is the growth in investments in the Circular Economy, which increased by 50.8% from 2012 to 2021. This increase is significantly higher compared to the European average of 18.5%. (Carapella, 2025).

On the value-creation side, Italy has developed a mature market for secondary raw materials derived from recycled plastics; it ranks among the top 10 European nations in terms of recycling rates, indicating that Italy is responsible for a large share of recycled products injected back into the market. More in detail, in 2022 the circular material use rate in Italy was around 19%, an higher percentage with respect to the 12% reached by the EU-27 average; moreover, considering the five major European economies (Italy, Germany, France, Spain and Poland) Italy ranks first in terms of waste recycling rate (OECD, 2024; Circular Economy Network, 2024). The value generated by this market is a significant contribution to national GDP, as the added value from certain circular economy activities in 2021 amounted to 43.6 billion euros, representing a 2.5% share of the national economy's overall value (Circular Economy Network, 2024). In this context, the EPR system, along with a structured recycling industry, enabled Italy to strengthen its competitiveness in the sector (European Environment Agency and ETC-CE, 2024; OECD, 2024). Such production has been successful not only in the internal market but also finds demand in foreign markets.

On the contrary, in the selected Latin American countries, CE models are frequently characterised by externalised costs and reliance on informal figures: The cartoneros (Argentina) or cartadores (Brazil). More in detail, the management of municipal solid waste relies overwhelmingly on local authorities and an extensive, poorly regulated, informal workforce: The cartadores, whose labour is structurally underremunerated and lacks social protection. Within this context, a significant share of the economic value generated by plastic recycling is created and captured informally, providing these workers with critical yet highly volatile income (EIU, 2017; Cappa et al., 2023; Terraza et al., 2010; Cook, Cano, and Velis, 2024). It is an occasion to highlight GDP's failure to account for social inequalities, as it focuses solely on the economic dimension (Conti, 2024). In fact, a comparative analysis conducted in Paraguay from 2010 to 2019 highlighted this discrepancy. Despite studies demonstrating an increase in GDP terms, social indicators have shown no significant increase (Baumgratz, da Silva, and Perondi 2024). In such a scenario, it is not easy to secure sufficient investment capacity to drive technological advances in the recycling industry and, consequently, advance towards a circular economy (Terraza et al., 2010; Schröder et al., 2020).

FINAL REMARKS

In this context, it is also worth noting the need for a global plastic treaty. This need arises from the lack of significant results produced by national-level interventions. This need arises from the challenges and limitations observed in national-level interventions. The aim of obtaining a legally binding agreement was to enable coordinated actions across the entire lifecycle of plastic products. Moreover, the presence of such an act could facilitate harmonisation with the current environmental regulations.

Negotiations for what could have been the first treaty on plastic pollution have stalled after the recent Geneva bargaining session (Sanderson, 2025; Kim and Bridgewater, 2025). The August session was destabilised by the resignation of the committee's chair, Luis Vayas Valdivieso, Ecuador's ambassador to the UK (Ivanova, 2025; Sanderson, 2025) A global treaty could play an important role in addressing the effects of plastic pollution, as actions taken by individual nations face significant challenges (Samuel Winton, a researcher at Portsmouth University,

interviewed by Sanderson). Despite the advancements produced by the so-called "High Ambition Coalition" (composed of the European Union, the UK, and other countries), as well as a moderate position held by China, the opposition party (composed of Saudi Arabia, Russia, and Iran) is currently blocking the advancements towards reaching an agreement (Sanderson, 2025). To overcome such a scenario, it is necessary to adopt more flexible negotiating formats and agreements that fall outside UN frameworks (S. Winton interviewed by Sanderson, 2025). It is also crucial to mention that the absence of such an agreement has no capability in harming regional initiatives (like the ones implemented over the years by the EU), as the greater risk lies in the obtainment of a weak treaty that is focused solely on recycling and consumption and neglects the upstream phases like plastic production (Sanderson, 2025).

CONCLUSIONS

This work presents a comparison among four distinct contexts: the European Union, Italy, Argentina, and Brazil. Throughout the study, we have highlighted relevant differences in the economic structure of the plastic sector, in the policy approaches adopted, and in the level of development of circular economy models.

From an economic perspective, the analysis shows that European countries, particularly Italy, possess a highly structured plastic industry. Such a conformation can generate significant added value and exports by leveraging substantial technological capacity. Argentina and Brazil, on the other hand, have sectors that depend on foreign inputs and imported machinery; their industrial structures exhibit limited innovation and weak integration across the different steps of the plastic value chain.

From a regulatory perspective, the EU and Italy are implementing advanced, multilevel frameworks. These regulatory models combine bans, extended producer responsibility (EPR), and incentives to reduce reliance on plastic. Argentina and Brazil, on the contrary, display a fragmented framework featured by a limited enforcement capacity. As a matter of fact, in these countries, the effectiveness of the enforced policies is reduced by a lack of coordination and a weak waste management infrastructure.

Lastly, the proposed comparison shows that the transition towards a circular economy model depends on economic, institutional, and technological factors. The EU and Italy have taken steps towards a CE model, also thanks to the presentation of ambitious climate objectives. Argentina and Brazil face challenges in the shift from a linear to a circular model of production and consumption. However, we must mention that the developments implemented so far look promising.

In this context, the absence of a uniform regulatory framework and the current stagnation in negotiations to secure a treaty in this matter (see final remarks section) highlight the need for coordinated international strategies to achieve meaningful results.

NOTES

1. Plastic waste is commonly categorized by particle size into three main groups: microplastics, with dimensions between 1 µm and 5 mm; mesoplastics, ranging from 5 mm to 25 mm; and macroplastics, defined as items larger than 25 mm (Lippiatt, Opfer, and Arthur, 2013)

2. "Act of contractual agreement between the public authorities and manufacturers, importers, distributors or traders, with a view to the implementation of shared responsibility for the product life cycle" (Pereira, 2010)

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