Impact of a Levy on Non-Recycled Plastic Packaging Waste on the Plastics Industry in the European Union

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***Abstract*— European Union policy aimed at reducing the negative environmental impact of plastics includes both Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment (the Single-Use Plastics Directive) and, since 2021, an EU own resource based on the mass of non-recycled plastic packaging waste. The structure of this own resource is laid down in Council Decision (EU, Euratom) 2020/2053, while the rules for its calculation and making available are specified in Council Regulation (EU, Euratom) 2021/770. The study applies institutional and legal analysis, statistical and secondary-data analysis, a review of the literature, and deductive reasoning. The analysis indicates that the combined effect of the relevant regulations does not imply the elimination of the plastics industry, but increases pressure to reduce single-use packaging, expand the use of secondary raw materials and develop recycling capacity. In Poland, the main risk concerns the insufficient efficiency of plastic packaging waste management, which increases both the risk of failing to meet recycling targets and the burden on the state budget under the EU own resource.**

Keywords— Single-Use Plastics Directive, plastics recycling, future of plastics, European Union own resources

I. INTRODUCTION

The European Union's climate policy aims to achieve climate neutrality by 2050. One of the important elements of this policy is the progressive reduction of the use of fossil hydrocarbons in the economy. The consequences of this process should be considered more broadly than merely in terms of reducing the use of oil and gas in the energy and transport sectors. This regulatory direction is reflected, among other measures, in Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment, commonly referred to as the Single-Use Plastics (SUP) Directive. In this context, the future of plastics, plastic packaging and an important branch of European industry naturally becomes a relevant research issue. This question is particularly significant for Poland, where the plastics industry constitutes an important and dynamically developing part of manufacturing. In parallel, on the basis of Council Decision (EU, Euratom) 2020/2053, an own resource based on the mass of non-recycled plastic packaging waste was introduced into the EU own-resources system from 2021, with a uniform call rate of EUR 0.80 per kilogram. This solution intensified the already ongoing debate on the future of plastic packaging and, more broadly, the plastics industry as a whole. Revenue from this source contributes to the European Union budget and forms part of the broader evolution of the EU own-resources system.

The aim of the article is to answer the following research question:

What consequences may the combined effect of Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 and the EU own resource based on the mass of non-recycled plastic packaging waste, established by Council Decision (EU, Euratom) 2020/2053, have for the plastics industry in the European Union and for the management of plastic packaging waste?

To achieve the research objective, institutional and legal analysis, analysis of statistical and secondary data, a review of the literature, and deductive reasoning supported by inference by analogy were applied. The adopted research procedure made it possible to combine an assessment of the legal and financial design of the analysed instruments with an assessment of their possible economic consequences for the plastics industry and the plastic packaging waste management system.

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The article is divided into five parts. The first part is the introduction. The second presents Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment and the EU own resource based on the mass of non-recycled plastic packaging waste. The third part presents the plastics industry from a historical and statistical perspective and discusses its development prospects, with particular emphasis on the European Union. The fourth part analyses and assesses the condition of the industry and the possible consequences of the analysed regulations for Poland. The article ends with conclusions summarising the analysis and presenting the principal findings.

II. Rationale for the EU Own Resource Based on Non-Recycled Plastic Packaging Waste

The future of crude oil, natural gas and hydrocarbons more broadly is the subject of continuing debate among policymakers, researchers, experts and consumers. The issue is important because crude oil is not only one of the world's principal energy resources but also a raw material present, directly or indirectly, in a very large number of products used in everyday life. Most national economies remain dependent on crude oil, either through imports or through revenues from its export. Developed economies, which account for a substantial part of global demand for energy resources, have declared a significant reduction in the use of fossil hydrocarbons, while EU climate policy requires a far-reaching decline in fossil-fuel use, particularly in energy and transport. The implementation of these policies will significantly affect the future structure of the global economy (Tetłak, 2022, pp. 50–59). Crude oil is a basic feedstock for petrol, diesel fuel and aviation fuel, while the petrochemical industry uses it in the production of numerous chemical products, including plastics, synthetic rubber, asphalt, tyres, lubricants, waxes, dyes, paints, cleaning agents, fertilisers, insecticides, plastic packaging, bottles, films, toys, cosmetics, pharmaceuticals and electronic products. According to industry and geological sources, more than 80% of crude oil is used directly for energy purposes and transport fuels, whereas the remaining share is used to manufacture other products; plastics account for approximately 4–5% of global crude-oil extraction (Polish Geological Institute – National Research Institute, 2020; Chemia i Biznes, 2016).

The introduction of Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment may be considered in this broader context. The European Commission's proposal justified the initiative primarily by the need to prevent and reduce marine litter from single-use plastic products and fishing gear containing plastics, while placing the initiative within the wider transition towards a circular economy and support for reusable alternatives, innovative business models and bio-based solutions (European Commission, 2018). Industry representatives and commentators interpreted this regulatory direction much more critically, at times describing it as a legislative offensive against the plastics industry. In 2020, statements made in the public debate, including by EU Commissioner Virginijus Sinkevičius, indicated that the Commission was also examining the consequences of possible further restrictions on plastic packaging. The issue is complex because Directive (EU) 2019/904 defines plastic broadly as a material consisting of a polymer, as defined in Article 3(5) of Regulation (EC) No 1907/2006, to which additives or other substances may have been added and which can function as a main structural component of final products (Directive (EU) 2019/904, Article 3(1)). The direction of the debate was also reinforced by an appeal by more than 70 large companies for a global agreement to reduce plastic pollution, in which the development of recycling was presented as requiring complementary measures to curb the growth of plastic waste (European Commission, 2018; Wójcicki, 2020; Rudzki, 2022).

On 1 January 2021, a new EU own resource based on non-recycled plastic packaging waste began to apply. Its legal basis is Council Decision (EU, Euratom) 2020/2053, while the detailed rules for calculating and making available this resource are laid down in Council Regulation (EU, Euratom) 2021/770. The amount due from a Member State is calculated on the basis of the mass of non-recycled plastic packaging waste, using a uniform call rate of EUR 0.80 per kilogram. Annual lump-sum reductions apply to certain Member States, including Poland. It should be emphasised that this mechanism does not impose a direct EU charge on undertakings producing or using plastic packaging; the Member State is liable to the EU budget, while the manner in which the economic burden is transmitted depends on national legal arrangements (Council Decision (EU, Euratom) 2020/2053; Council Regulation (EU, Euratom) 2021/770). This own resource complements the existing sources of financing of the EU budget:

- traditional own resources, consisting mainly of customs duties; Member States retain 25% of the amounts collected to cover collection costs;
- the VAT-based own resource, calculated using a uniform call rate of 0.3% applied to the harmonised VAT base, which is capped at 50% of a Member State's GNI;
- the GNI-based own resource, calculated using a uniform rate applied to Member States' GNI and adjusted each year so as to balance EU budget revenue and expenditure.

Compared with the 2014–2020 Multiannual Financial Framework (MFF), the current own-resources system introduced important changes to the ceilings applicable to EU own resources. Council Decision (EU, Euratom) 2020/2053 increased the permanent ceiling for annual appropriations for payments from 1.20% to 1.40% of EU GNI and set the ceiling for annual appropriations for commitments at 1.46% of EU GNI. In addition, these ceilings may be temporarily increased by up to 0.6 percentage points exclusively to cover liabilities arising from the borrowing used to finance NextGenerationEU, with the temporary increase applying no later than the end of 2058 (Tetłak and Lachowicz, 2023, pp. 113–121; Council Decision (EU, Euratom) 2020/2053).

The largest contributors to this own resource include the largest economies and countries in which a substantial mass of non-recycled plastic packaging waste is generated, including

Germany, France, Italy, Spain and Poland. The amount of the contribution is determined primarily by the mass of such waste, taking account of the annual lump-sum reductions available to some Member States, while population size is only an indirect factor. The plastic own resource was estimated at approximately EUR 6 billion in the 2022 EU budget. Expert assessments of this resource as a source of EU budget revenue are not unequivocal. Its simple design, relatively low collection costs and distribution of the burden are assessed positively, whereas its transparency, stability, fiscal yield and contribution to EU financial autonomy are assessed less favourably (Cieślukowski, 2022, pp. 210–225).

The arguments concerning the nature of the mechanism are therefore not unequivocal. Some of its features suggest an incentive or quasi-sanctioning function, whereas others are clearly fiscal. Assessing its economic significance requires consideration of the condition and importance of the plastics industry in Europe. For the purpose of this article, it is also necessary to present the position of the industry in Poland.

III. The Importance of the Plastics Industry in the European Union Economy

The history of plastics can be traced to 1862, when Alexander Parkes presented household objects made from a previously unknown, man-made material at the International Exhibition in London. The widespread use of synthetic materials accelerated after Leo H. Baekeland invented Bakelite in 1907, a material named after its inventor that contributed to a revolution in the manufacture of electrical equipment. Bakelite is a thermal insulator and does not conduct electricity, demonstrating that materials with highly specific properties could be produced from compounds not occurring naturally and adapted to particular needs. Scientific laboratories have since continuously developed new materials that rapidly find industrial applications. Their innovative properties support the development of modern technologies and technological progress, especially in sectors in which synthetic materials are difficult to replace. It is now difficult to imagine the automotive and food industries, packaging, aviation and aerospace, digital technologies, construction, transport, medicine, sport or renewable energy without plastics. By the end of the 1980s, global plastics production by volume had exceeded steel production. Plastics have therefore changed the modern world, not only positively but also negatively. Their principal advantages – low cost, durability, low weight, the ability to replace other materials, diversity and broad utility – are simultaneously among the sources of their environmental impact. Plastics degrade very slowly in the natural environment, and more than 150 million tonnes are estimated to be present in the oceans. One of the most visible illustrations of the problem is the Great Pacific Garbage Patch in the Pacific Ocean between Hawaii and California. It covers more than 1.5 million square kilometres and has been estimated at approximately 79,000 tonnes. Research conducted within The Ocean Cleanup project has also shown the substantial role of fishing and other identifiable sources in its composition. The Great Pacific Garbage Patch represents a serious threat to marine ecosystems and illustrates the scale and persistence of plastic pollution (Chemia i Biznes, 2022; National Geographic Polska, 2023).

Waste-management practices among consumers and societies also remain an important part of the problem. Proper management of plastic waste is made more difficult by continuing growth in demand for plastics and by the insufficient pace at which solutions capable of reducing their adverse environmental effects are introduced.

Because of their functional advantages, plastics have become one of the most widely used groups of materials in the world. Global plastics production has grown almost continuously for more than seventy years. Between 1950 and 2017, their use increased more than two hundredfold, and only the COVID-19 pandemic temporarily interrupted the growth in production (Table 1).

Table 1. Global and European plastics production, 1950–2021 (million tonnes)

Years	1950	1976	1989	2002	2009	2017	2018	2019	2020	2021
Global production	1.7	47	99	204	250	349	365.5	374.8	375.5	390.7
European production	0.35	19.8	27.4	56.1	55	64.4	58.1	56.2	53.9	57.2
Europe's share of global production (%)	20.6	42.1	27.7	27.5	22.0	18.5	15.9	15.0	14.4	14.6

Source: Author's own compilation based on PlasticsEurope, Plastics – the Facts 2012, p. 6; Plastics – the Facts 2021, p. 12; Plastics – the Facts 2022, p. 10.

A persistent decline in Europe's share of global plastics production has been visible since the end of the 1980s. The slight increase recorded in 2021 did not reverse the longer-term trend. More recent data confirm its continuation: in 2024 European plastics production amounted to 54.6 million tonnes and Europe accounted for only 12% of global production, compared with 22% in 2006. At the same time, global production increased to 430.9 million tonnes in 2024 (PlasticsEurope, 2025). These developments indicate that the global plastics market continues to expand while Europe's relative production position is weakening. Long-term forecasts of global plastics production nevertheless remain upward (Table 2).

Table 2. Forecast of global plastics production to 2050

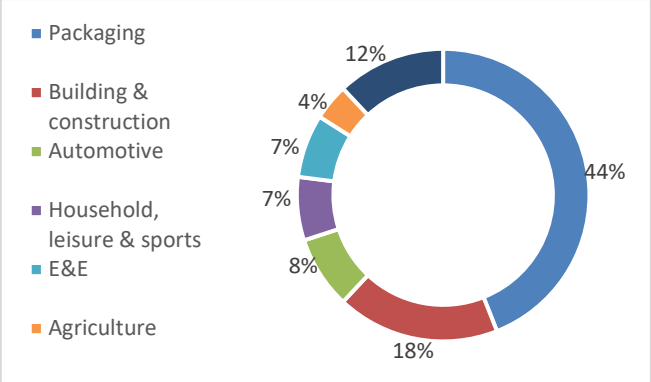
Years	2025	2030	2035	2040	2045	2050
Production (million tonnes)	445	483	516	546	570	589

Source: Rękawek (2022).

The forecast presented in Table 2, prepared in 2022, assumed that global plastics production would reach 445 million tonnes in 2025 and 589 million tonnes in 2050, which would represent

an increase of approximately 51% compared with 2021. More recent data show that global plastics production had already reached 430.9 million tonnes in 2024 (PlasticsEurope, 2025, p. 2). The global plastics market was also forecast to grow from USD 457.73 billion in 2022 to USD 643.37 billion by 2029, corresponding to a compound annual growth rate (CAGR) of 5.0% over 2022–2029 (Rękawek, 2022). These forecasts illustrate not only the economic potential of the industry but also its fiscal significance. Figure 1 presents the share of plastics used in the principal application segments of the global economy in 2021.

FIGURE 1. GLOBAL PLASTICS USE BY APPLICATION SEGMENT IN 2021 (%)

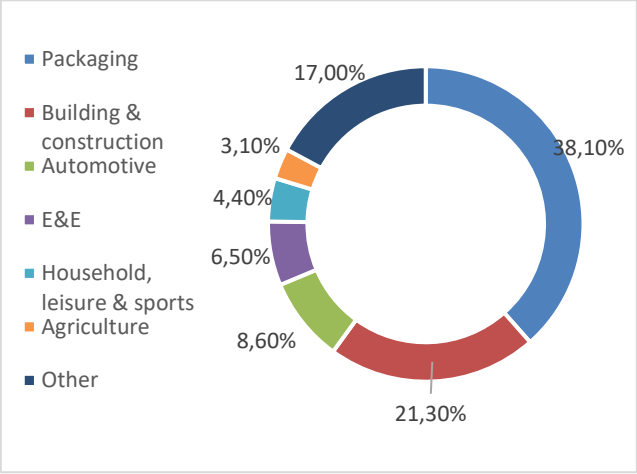


Source: PlasticsEurope, Plastics – the Facts 2022, p. 22.

As shown in Figure 1, as much as 44% of the 390.7 million tonnes of plastics produced globally in 2021 was used for packaging.

Plastics production in Europe (EU-27+3: Norway, Switzerland and the United Kingdom) amounted to 57.2 million tonnes in 2021 (Table 1), while demand from European plastics converters reached 50.3 million tonnes. The structure of demand by application segment is presented in Figure 2.

FIGURE 2. DEMAND FROM EUROPEAN PLASTICS CONVERTERS BY APPLICATION SEGMENT IN 2021 (%)



Source: Plastics Europe, Plastics – the Facts 2022, p. 35.

The data in Figure 2 show that the share of plastics used for packaging in Europe was almost six percentage points lower than the global share. This difference may be interpreted as being consistent with the direction of EU policy aimed at limiting the environmental impact of plastic packaging; however, the data presented do not allow a causal relationship to be established, because the structure of plastics use is also influenced by the structure of industry and consumption and by the relative importance of individual sectors. The plastics industry, comprising producers of plastics in primary forms, converters, recyclers and manufacturers of processing machinery and equipment, remains an important part of the European economy. In 2021 it comprised approximately 52,000 companies; in 2024 the corresponding figure was about 50,650, predominantly SMEs, employing approximately 1.5 million people. Industry turnover amounted to approximately EUR 405 billion in 2021 and EUR 398 billion in 2024. In 2024 European plastics production stood at 54.6 million tonnes and Europe accounted for 12% of global production (PlasticsEurope, 2022, pp. 12–13; PlasticsEurope, 2025, p. 6).

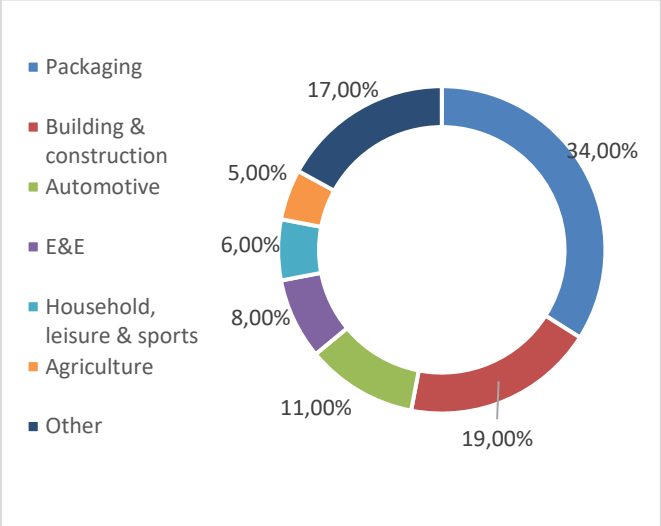
The figures clearly demonstrate the economic importance of the plastics industry in Europe, while at the same time showing a decline in the number of companies, turnover and Europe's global production share. The structure of the industry is also important: the majority of firms are SMEs, whose role extends beyond aggregate economic indicators and is particularly significant for local economies and communities.

IV. THE PLASTICS INDUSTRY IN POLAND IN THE CONTEXT OF EU PLASTIC PACKAGING WASTE POLICY

The plastics industry is an important component of the Polish economy. In terms of gross value added, it ranks third among branches of manufacturing, after food production and metal production. Approximately 8,000 companies operate in the sector; employment is estimated at around 200,000 people. Over the preceding several years the industry developed faster than many other branches of manufacturing: sold production more than doubled over a ten-year period, corresponding to an average annual growth rate of approximately 7.7%. In terms of the value of plastic products manufactured, Poland ranks among the largest producers in Europe. The plastics industry comprises several subsectors: (1) producers and suppliers of raw materials for processing, importers and wholesalers; (2) plastics converters, which form the largest subsector; (3) suppliers of machinery and technological solutions for converters; and (4) plastics recyclers. Demand for plastics from Polish converters has grown consistently and was estimated at approximately 4.1 million tonnes in 2020, while plastics consumption by individual users and industry was estimated at 3.4 million tonnes. Domestic plastics production, estimated at approximately 1.7 million tonnes, is insufficient to meet converters' demand, which is therefore partly covered by imports. The principal application areas of plastics in Poland are shown in Figure 3 (PKO Bank Polski, 2019; PlasticsEurope Polska, 2022, pp. 9–11). Packaging is the largest plastics application segment in Poland (Figure 3), and demand for raw material in this segment has continued to grow. Between 2013 and 2017, demand increased by 20%, reaching 1.12 million tonnes (Deloitte, 2019). Packaging accounted for 34% of total demand from Polish plastics converters, approximately ten percentage points less than the global share and four percentage

points less than the European average shown in Figures 1–3. From the perspective of EU policy this may be regarded as a favourable structural characteristic; other waste-management indicators, however, are considerably less positive. According to Statistics Poland, 13.7 million tonnes of municipal waste were generated and collected in Poland in 2021, of which 5.4 million tonnes were collected separately. Plastics accounted for approximately 523 thousand tonnes of separately collected municipal waste (Statistics Poland, 2022). Estimates used in the analysis indicated that municipal waste collected in Poland in 2020 contained approximately 2.05 million tonnes of plastic waste, meaning that plastics accounted for roughly 14.6% of municipal waste, while only about one quarter was collected separately. As a result, a substantial share of plastic waste continued to be landfilled (Deloitte, 2019). Packaging waste accounted for the largest share of the plastic waste stream. Compared with 2018, the structure of plastic waste treatment had not changed substantially: approximately 27% of collected plastic waste was sent for recycling, 32% for energy recovery and the remaining 41% to landfill (PlasticsEurope Polska, 2022).

FIGURE 3. DEMAND FROM POLISH PLASTICS CONVERTERS BY APPLICATION SEGMENT IN 2020 (%)



Source: PlasticsEurope Polska, Plastics Industry 2022, p. 11.

These data raise serious concerns in the context of the recycling targets for plastic packaging waste that Poland is required to achieve under EU law. It is also important to distinguish recycling from energy recovery. Under Article 3(17) of Directive 2008/98/EC, recycling is a recovery operation in which waste materials are reprocessed into products, materials or substances for their original or other purposes; it includes the reprocessing of organic material but excludes energy recovery and reprocessing into materials intended for use as fuels or for backfilling. Recycling therefore requires not only an effective system of separate collection of packaging waste but also its actual processing and reintegration into production processes.

Directive (EU) 2018/852 introduced quantitative and time-bound targets for packaging waste, including:

- by 31 December 2025, recycling of at least 65% by weight of all packaging waste;
- by 31 December 2030, recycling of at least 70% by weight of all packaging waste.
- It should also be taken into account that Regulation (EU) 2025/40 on packaging and packaging waste (PPWR) has applied since 12 August 2026. The Regulation repeals Directive 94/62/EC, subject to specified transitional provisions, and establishes a directly applicable regulatory framework covering the entire life cycle of packaging. Article 52 maintains the principal recycling targets for 2025 and 2030, while Article 70 provides for the continued application of selected provisions of Directive 94/62/EC during transitional periods. The Regulation itself applies from 12 August 2026 pursuant to Article 71. From the perspective of this article, the PPWR therefore represents not a reversal of EU policy but its further development and strengthening (Regulation (EU) 2025/40, Articles 52, 70 and 71).

Table 3 presents the recycling targets for individual packaging materials.

TABLE 3. RECYCLING TARGETS FOR INDIVIDUAL PACKAGING MATERIALS IN 2025 AND 2030

Material	2025	2030
All packaging waste	65%	70%
Plastics	50%	55%
Wood	25%	30%
Ferrous metals	70%	80%
Aluminium	50%	60%
Glass	70%	75%
Paper and cardboard	75%	85%

Source: Regulation (EU) 2025/40, Article 52.

The recycling requirement for plastic packaging waste shown in Table 3 is lower than for most other packaging materials, apart from wood, which reflects, among other factors, the technical difficulty of recycling a significant proportion of the plastics used in packaging. Even with the lower required level, however, achieving the targets represented a major challenge in the period covered by the analysis, although the 2020 results could be regarded as relatively favourable. In 2020, the target for plastic packaging was 22.5% and was achieved by all Member States except France (21.4%) and Malta (10.2%); Poland recorded a recycling rate of 39% (Eurostat, 2023). The annual national recycling targets for plastic packaging waste through 2030 are presented in Table 4.

TABLE 4. ANNUAL RECYCLING TARGETS FOR PLASTIC PACKAGING WASTE THROUGH 2030

Year	Recycling target (%)
2022	30
2023	40
2024	45
2025	50
2026	51
2027	52
2028	53
2029	54
2030	55

Source: Regulation of the Polish Minister of Climate and Environment of 19 December 2021 on annual recycling levels for packaging waste through 2030 (Journal of Laws 2021, item 2375).

Table 4 shows that between 2020 and 2025 the required recycling level for plastic packaging increased sharply, from

22.5% to 50%. In the light of the data available during the preparation of the analysis, achieving this level represented a major challenge. One of the principal barriers was the incomplete implementation of an extended producer responsibility (EPR) system for packaging, which affected the municipal waste management system as a whole and plastic packaging waste in particular (Tetłak, 2023, pp. 60–61). The issue remained current in 2026. Legislative work on draft Act UC100 on packaging and packaging waste continued, with version 4.0 of the draft published in August 2026, and the proposal was intended, among other purposes, to implement a new EPR model (Ministry of Climate and Environment, 2026). More than 997 thousand tonnes of plastic packaging are placed on the Polish market, of which approximately 678 thousand tonnes are attributable to households. According to the data used in the analysis, the recycling rate was around 40%, which meant that a substantial part of plastic packaging waste was not recycled. Some packaging entered mixed municipal waste, while material recycling of certain packaging formats remained technically difficult because of the type and composition of the plastics used. The burning of plastic waste in households was an additional problem; estimates cited by industry representatives suggested that the phenomenon could affect several to more than ten percent of the waste stream that might otherwise be directed to recycling (Zielona Gospodarka, 2023). These conditions significantly constrained the possibility of rapidly increasing plastic packaging recycling rates.

Failure to comply with the applicable recycling obligations under EU packaging law may lead the European Commission to initiate infringement proceedings against a Member State. A financial penalty does not arise automatically when a recycling target is missed; its imposition requires the procedure provided for under EU law, and any monetary sanction is ultimately determined by the Court of Justice of the European Union. Independently of infringement proceedings, a larger mass of non-recycled plastic packaging waste directly increases the basis used to calculate the Member State's contribution under the own resource established by Council Decision (EU, Euratom) 2020/2053.

V. Conclusions

The analysis indicates that the plastics industry is likely to remain an important component of the global economy for decades. Plastics are difficult to replace in the manufacture of many modern products and, because of their properties, enable the mass production of a broad range of goods. The disappearance of European producers from the plastics market would therefore be economically difficult to justify, while relocating production outside Europe without changing consumption patterns would not solve the environmental problem. The central paradox is that extremely durable materials are widely used for single-use products, which have become a significant source of environmental pressure. Measures undertaken by the European Union to reduce this pressure are therefore justified, although a blanket ban on plastic packaging would be an excessively simplified response. Some life-cycle assessment (LCA) studies indicate that replacing plastic packaging with other materials does not in every case reduce total environmental impacts (Milewski, 2020). The structure of the industry is also relevant: it consists predominantly of SMEs, whose significance lies not only in their contribution to the EU economy but also in their role in local communities.

The plastics industry is also highly important to the Polish economy, where it ranks among the largest branches of manufacturing in terms of gross value added. The structure of demand from Polish plastics converters contains some favourable features from the perspective of EU policy, as packaging accounts for 34% of plastics demand. The management of plastic waste, and packaging waste in particular, nevertheless remains a matter of concern in the context of the recycling targets established under EU packaging legislation and now consolidated in Regulation (EU) 2025/40. The analysis based on the data available during preparation of the article indicated a significant risk of difficulties in achieving the required recycling levels. Failure to achieve the applicable targets increases the Member State's contribution to the EU budget under the own resource based on non-recycled plastic packaging waste and, where obligations under EU law are infringed, may also result in infringement proceedings and, at a later stage, financial sanctions.

The analysis therefore supports the conclusion that the combined effect of regulations limiting the use of selected plastic products and the own-resource mechanism based on the mass of non-recycled plastic packaging waste does not lead to the elimination of the plastics industry. Instead, it increases pressure to change the industry's structure, reduce the share of single-use packaging, expand the use of secondary raw materials and develop recycling capacity. In Poland, the principal problem is not the importance or scale of the plastics industry itself, but the insufficient efficiency of the plastic packaging waste management system, which increases both the risk of failing to meet the required recycling targets and the burden on the state budget arising from the EU own resource.

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