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Gaps and Misalignments in Policy Implementation of Circular Economy

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Abstract

This article examines the persistent gaps and misalignments in the implementation of circular economy policies across EU Member States, despite the existence of a comprehensive EU-level regulatory and strategic framework. Drawing on the European Green Deal, the 8th Environment Action Programme, and the Circular Economy Action Plan, the study evaluates how legislative, institutional, and economic factors shape national performance. Using the EU Circular Economy Monitoring Framework as a reference point, the analysis focuses on low-performing Member States to identify structural obstacles such as delays in transposing EU directives, insufficient enforcement capacity, weak inter-agency coordination, limited investment, skills shortages, and inadequate consumer awareness. The findings show that policy adoption often outpaces operational readiness, with implementation gaps most apparent in waste management, material productivity, recycling infrastructure, and secondary raw materials markets. Additionally, small or import-dependent economies face scale constraints that inhibit the development of circular value chains. The article argues that achieving EU-wide circular economy objectives requires not only harmonised legislation but

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also enhanced administrative capacity, robust monitoring systems, targeted financial instruments, and stronger integration of the circular economy into industrial, labour, and fiscal policies. Ultimately, the analysis highlights that the circular economy transition is as much a governance challenge as it is an environmental and economic imperative.

1.1 Introduction

Humanity's current consumption patterns exceed the planet's regenerative capacity to such an extent that sustaining them in the long term would require the resources of multiple Earths (United Nations, n.d.). In response to these unsustainable trajectories, the circular economy has emerged as a systemic alternative to the prevailing linear model of production and consumption. Recognized as a transformative post-production business model, the circular economy seeks to extend product life cycles through reuse, refurbishment, and recycling, thereby reducing waste generation and conserving natural resources. It has been defined as "an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes … to accomplish sustainable development" (Kirchherr et al., 2017).

Beyond its environmental rationale, the circular economy is increasingly framed as an instrument of socio-economic transformation. It is projected to generate approximately 700,000 new jobs in the EU (Cambridge Econometrics, Trinomics and ICF, 2018) and to contribute to the ecological, social, and economic dimensions of sustainability (Stahel, 2019, p.4.). Given that transforming industrial sectors and value chains typically requires several decades, decisive action must be taken in the near term to achieve a fully circular economy by 2050 (European Commission, 2019, p.7.).

Against this background, the EU has developed an extensive legal and policy framework — including the European Green Deal, the Circular Economy Action Plan (CEAP), and alignment with the Sustainable Development Goals — intended to guide Member States in operationalising the circular transition. However, the existence of comprehensive EU-level frameworks does not automatically guarantee effective national implementation.

Despite notable progress, circular economy policy implementation across Member States continues to face persistent challenges. National frameworks frequently exhibit delays in transposing EU directives, partial or inconsistent incorporation of legal requirements, limited enforcement capacity, and insufficient integration of consumer protection and social considerations. Such gaps generate misalignments between EU-level ambitions and domestic regulatory realities.

While EU policy design in the field of the circular economy has received considerable scholarly attention, research on policy implementation and outcome evaluation remains comparatively underdeveloped. In particular, empirical studies assessing implementation effectiveness — especially with regard to social outcomes — are limited (Zhang et al., 2025). Existing literature further indicates that European circular economy strategies tend to prioritise sustainable product-oriented instruments such as eco-design and extended producer responsibility, often driven by bottom-up regulatory and market-based initiatives. Although important, this emphasis may obscure broader governance challenges related to cross-sectoral coordination, institutional capacity, and enforcement coherence.

This article addresses this gap by examining the extent to which national circular economy frameworks converge with EU benchmarks and by identifying structural implementation misalignments across selected Member States. Through comparative analysis grounded in EU performance indicators, the study seeks to illuminate the institutional and regulatory factors that hinder effective circular transition. By shifting analytical focus from policy formulation to implementation dynamics, the chapter contributes to a more nuanced understanding of governance barriers within the EU's circular economy agenda.

The following section therefore assesses EU benchmarks as a reference point for evaluating national implementation gaps and regulatory convergence.

1.2 Methodology

1.2.1 EU Policy benchmarking

The first stage establishes the European Green Deal, the 8th Environment Action Programme, and the Circular Economy Action Plan as the primary normative and strategic benchmarks. These instruments articulate the EU's long-term environmental and circularity objectives, enabling conditions, and priority indicators. The EU Circular Economy Monitoring Framework — covering production and consumption, waste management, secondary raw materials, competitiveness and innovation, and global sustainability — serves as the principal evaluative tool for assessing progress.

Given the breadth of EU environmental legislation, this study does not attempt a comprehensive legal analysis. Instead, it focuses on selected policy targets and indicators that are most relevant for evaluating national implementation performance. The analysis adopts a governance-oriented understanding of implementation gaps, distinguishing between three interrelated

dimensions: normative misalignment (incomplete or delayed transposition of EU objectives), institutional fragmentation (dispersion of responsibilities across administrative bodies), and enforcement deficits (limitations in monitoring, compliance, and policy execution).

1.2.2 Cross-country comparative assessment

The second stage consists of a targeted comparative analysis of EU Member States demonstrating relatively weaker performance according to Eurostat circular economy indicators and recent country profiles produced by the European Topic Centre on Circular Economy (ETC-CE). Countries including Romania, Greece, Cyprus, Slovakia, Bulgaria, Finland, Lithuania, and others were selected because their performance patterns illustrate recurring structural challenges in the implementation of circular economy policies.

The comparative approach enables the identification of common barriers — including institutional fragmentation, limited recycling infrastructure, weak monitoring capacity, insufficient technical skills, and low private-sector engagement — while also acknowledging country-specific contextual factors such as market size, import dependency, or resource-intensive economic structures. The barriers were identified through qualitative content analysis of ETC-CE country profiles, with findings triangulated against trends observed in Eurostat indicator data in order to strengthen analytical reliability.

1.2.3 Scope and limitations

The study relies exclusively on secondary data sources, including reports and datasets from EU institutions, Eurostat, the OECD, UNDP, and ETC-CE country profiles. It does not incorporate interviews, field research, or proprietary datasets. While this approach ensures a high degree of methodological consistency and comparability, it also means that the analysis is shaped by availability and structure of existing indicators, the analysis is conditioned by the availability and structure of existing indicators, which may not fully capture national nuances or the most recent regulatory developments.

Nevertheless, the selected methodology provides a robust analytical basis for identifying structural patterns in circular economy policy implementation and for assessing the extent to which national governance frameworks align with EU-level objectives.

1.3 Research

1.3.1 Benchmark: EU requirements and policy objectives

While a detailed analysis of EU environmental legislation falls outside the scope of this chapter, it is important to acknowledge that the European Green Deal, the 8th Environment Action Programme, and the Circular Economy Action Plan (CEAP) provide the principal strategic and normative benchmarks for the transition to a circular economy within the EU. These instruments articulate long-term environmental objectives, define enabling conditions for implementation, and establish priority indicators against which Member States' progress can be assessed. Their benchmarking function is particularly important for evaluating the alignment of national policies with EU circular economy objectives.

At the same time, the EU framework also reveals one of the key governance challenges of circular economy policy. Although EU targets are legally binding, their implementation and interpretation vary across Member States, reflecting differences in administrative capacity, institutional coordination, and regulatory priorities. Consequently, the evaluation of gaps and misalignments in national circular economy policies in this chapter is conducted with reference to the objectives and indicators established in EU policy instruments, allowing for systematic comparison without undertaking a comprehensive legal analysis of the entire EU regulatory framework.

The EU has set clear strategic objectives and policy measures at both Union and national levels. For instance, highlighting the contribution of the circular economy to the reduction of greenhouse gas emissions, the expansion of sustainable and job-intensive economic activity, the EU Green Deal used as a reference point throughout this research chapter, calls for the adoption of an EU industrial strategy, a new CE action plan (European Commission, 2019). These initiatives place circularity at the centre of the EU's broader strategy for achieving climate neutrality and sustainable economic transformation.

At the policy level, several legislative and regulatory instruments collectively shape the EU's circular economy framework. The Circular Economy Action Plan, the Ecodesign for Sustainable Products Regulation, and the Directive on common rules promoting the repair of goods seek to extend product lifespans, facilitate reuse and repair, and strengthen consumer rights in the context of sustainable consumption. These measures are complemented by the Waste Framework Directive (European Commission, n.d.) and the 8th Environment Action Programme, which establish targets for waste prevention, recycling, landfill reduction, and environmental monitoring (European

Parliament and Council, 2022). Together, these instruments form the baseline against which national policy performance can be assessed.

The 8th Environment Action Programme outlines six interconnected priority objectives relating to climate neutrality, resilience, zero pollution, biodiversity protection, and sustainable production and consumption. These objectives frame the EU's attempt to integrate environmental, economic, and industrial policy within a unified strategic framework while guiding Member States in aligning national policies with broader sustainability goals. (European Parliament and Council, 2022).

However, the coexistence of multiple thematic priorities may also complicate policy coordination at the national level. In Member States where responsibilities for environmental, industrial, and economic policy are distributed across several ministries or agencies, institutional fragmentation can create coordination challenges and weaken policy coherence. As a result, the effectiveness of EU circular economy strategies often depends not only on the quality of policy design but also on the capacity of national governance structures to ensure coordinated implementation.

Although the 8th Environment Action Programme addresses a wide range of environmental objectives beyond the circular economy, it remains particularly relevant for the present study because it identifies key enabling conditions necessary for achieving sustainability goals. These enabling conditions include effective policy implementation, enforcement mechanisms, mainstreaming sustainability across policy sectors, and the development of improved monitoring and evaluation frameworks. [1]

The Programme emphasises that monitoring progress should rely on a methodology capable of assessing the advancement of both the Union and Member States toward the priority objectives, using a set of headline indicators. (European Parliament and Council, 2022, art. 4.3.). While the set of indicators should remain sufficiently stable to ensure accountability and comparability, it may also be revised when necessary to reflect new policy developments and evolving measurement practices (European Parliament and Council, 2022, art. 4.2). The evaluation of progress therefore requires consideration not only of quantitative indicators but also of the enabling conditions necessary to achieve systemic change (European Parliament and Council, 2022, art. 4.1).

[1] The above are not the exhaustive list of enabling conditions. Fo the full list, please visit https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022D0591.

From an analytical perspective, these enabling conditions demonstrate that progress toward circularity depends less on the number of adopted strategies than on the effectiveness of their implementation architecture. Weak monitoring systems, fragmented institutional responsibilities, and inconsistent follow-up mechanisms can limit accountability even where a comprehensive legal framework exists.

In this context, while indicators play an important role in ensuring transparency and accountability, excessive reliance on quantitative measurements may obscure structural governance challenges or emerging policy issues. Effective monitoring of circular economy progress therefore requires a balanced approach that combines measurable indicators with qualitative assessments of policy integration, institutional capacity, and regulatory enforcement.

While the 8th Environment Action Programme addresses the circular transition within a broader environmental policy framework, the Circular Economy Action Plan, adopted in 2020, is entirely dedicated to advancing circularity within the EU. As one of the central pillars of the European Green Deal, the Action Plan places resource efficiency, waste reduction, and sustainable production and consumption at the centre of EU economic policy. It emphasises that the circular economy contributes to achieving climate neutrality, decoupling economic growth from resource use, and strengthening long-term competitiveness while promoting social inclusiveness (European Commission, 2020, p.2).

Unlike the Environment Action Programme, which primarily establishes strategic objectives and enabling conditions, the Circular Economy Action Plan provides a comprehensive roadmap of policy initiatives targeting specific product value chains, including electronics and ICT, batteries, vehicles, packaging, plastics, textiles, construction, buildings, and food systems. It also highlights the importance of developing additional indicators related to resource use, including consumption and material footprints, in order to better capture the environmental impacts associated with production and consumption patterns (European Commission, 2020, p.19).

The selection and design of appropriate indicators remain a major challenge in circular economy research. For instance, the OECD identified 474 circular-economy-related indicators across 29 studies conducted between 2018 and 2020, covering national, regional, and local levels of analysis (OECD, 2020). Given the large number of potential indicators, it is necessary to apply commonly agreed criteria to identify those most capable of capturing key trends in the transition toward circularity (United Nations Economic Commission for Europe, 2024, para. 53).

Despite extensive academic discussion, a unified and comprehensive methodology for measuring circular economy performance has yet to emerge (Remeikienė, Gasparėnienė and Bankauskienė, 2025). In the absence of such a system, this study relies on the indicators developed within the European Commission's Circular Economy Monitoring Framework, which remain the most widely recognised and policy-relevant tool for assessing circular economy progress in the EU (Mazur-Wierzbicka, 2021).

The Monitoring Framework groups indicators into five thematic categories: production and consumption, waste management, secondary raw materials, competitiveness and innovation, and global sustainability. Among these, indicators such as material footprint, recycling rates, and circular material use rate are particularly important for evaluating Member States' performance (Eurostat, n.d.-a).

The framework includes indicators measuring resource productivity, waste generation and recycling, circular material use rates, intra-EU trade in secondary materials, private investment in circular activities, employment in circular sectors, and patents related to recycling and waste management. Together, these indicators provide insight into how effectively economies decouple growth from resource use, develop secondary raw material markets, and support circular innovation. The set remains brief and straightforward, relying largely on existing data, while also identifying areas where new indicators are being developed, such as green public procurement (Eurostat, n.d.-b).

At the same time, the aggregated nature of EU-level indicators may conceal important national disparities. High EU averages can mask significant differences between Member States, highlighting the importance of disaggregated analysis in identifying structural implementation challenges and designing targeted policy responses.

Assessing circular economy progress therefore requires a multidimensional set of indicators. Production and consumption indicators should capture reductions in virgin material use alongside economic growth. Waste indicators should reflect both reductions in waste generation and improvements in waste management in line with the waste hierarchy, which prioritises prevention, reuse, and recycling over disposal. Indicators relating to secondary raw materials should demonstrate increased use and trade of recycled materials, while indicators of competitiveness and innovation should track private investment, patent activity, and employment in circular economy sectors (Remeikienė, Gasparėnienė and Bankauskienė, 2025).

Recent empirical research also suggests that not all circular economy indicators receive equal analytical attention. Experts often consider material

footprint, patents in recycling technologies, and dependence on imported materials to be the most significant indicators for evaluating circular economy performance, whereas indicators such as intra-EU trade or private investment are sometimes considered less central (Remeikienė, Gasparėnienė and Bankauskienė, 2025).

Finally, EU circular economy objectives are closely aligned with Sustainable Development Goal 12, which promotes responsible consumption and production patterns. Achieving this goal requires coordinated action by governments, businesses, and consumers to improve resource efficiency, stimulate technological innovation, and reduce waste generation (United Nations, n.d.). Although the EU has made measurable progress in several sustainability indicators — including energy productivity and the growth of the environmental goods and services sector — the circular material use rate remains insufficient to meet the EU's long-term objectives (Eurostat, n.d.).

Against this benchmark framework, the following sections examine how selected Member States perform across key circular economy indicators and identify structural implementation gaps that hinder alignment with EU policy objectives.

In order to assess the constraints undermining the effective implementation of circular economy strategies, this chapter examines legislative, policy, and institutional deficiencies at the national level and seeks to identify the principal obstacles to their realization.

1.3.2 Shortfalls in CE policy implementation

Despite the existence of EU-level requirements and strategic frameworks, several Member States continue to encounter difficulties in fully and timely transposing circular economy directives into national law. Delays in adopting updated waste management targets, incomplete provisions regarding extended producer responsibility schemes, and the absence of effective incentives for repair and reuse remain recurring issues across national legislative frameworks. In some cases, circular economy provisions are dispersed across multiple legislative acts, creating fragmentation that reduces regulatory clarity for both consumers and producers. Recent systematic reviews of circular economy policy research confirm that challenges related to policy coherence, unclear stakeholder responsibilities, and governmental inefficiency are recurrent implementation barriers across European contexts (Zhang et al., 2025).

Indicator	Period	Annual growth rate	Assessment
Consumption patterns			
Material footprint	2008–2023	– 1.7 %	↑
	2018–2023	– 0.6 %	↗
Consumption footprint	2010–2023	0.3 %	↘
	2018–2023	– 0.5 %	↗
Consumption of hazardous chemicals	2008–2023	– 2.4 %	↑
	2018–2023	– 5.4 %	↑
Energy productivity (*)	2008–2023	2.4 %	↑
	2018–2023	3.9 %	↑
Average CO_2 emissions per km from new passenger cars (*) ◎	Long-term assessment not possible due to break in time series in 2017		×
	2018–2023	Observed: – 5.9 % Required: – 8.6 %	↗
Green economy			
Gross value added in the environmental goods and services sector	2007–2022	5.3 %	↑
	2017–2022	8.1 %	↑
Waste generation and management			
Circular material use rate ◎	2008–2023	Observed: 1.7 % Required: 4.2 %	↘
	2018–2023	Observed: 0.3 % Required: 5.6 %	↘
Generation of waste	2008–2022	0.2 %	↘
	2018–2022	– 1.2 %	↑

Note: See Annex II for a description of the methodology used for the compound annual growth rate calculation and the trend assessment. For indicators without a target, the growth rates observed over the specified periods are given. For indicators with a quantified EU target (marked with a target sign ◎), both the observed growth rates and the growth rates that would have been required in the specified periods for meeting the target are given. See Table A.1 in Annex I for the full list of EU policy targets considered for monitoring in this report.
(*) Multi-purpose indicator.

Figure 1.1 Indicators measuring progress in SDG 12 2025 (Eurostat, 2025).

These recurring delays and inconsistencies suggest the presence of deeper structural constraints within national governance systems. In particular, limited enforcement capacity, fragmented administrative mandates across sectoral ministries, and insufficient incentives for private-sector engagement continue to undermine the practical realization of circular economy objectives. While EU policy frameworks establish ambitious targets and regulatory instruments, their effectiveness ultimately depends on the ability of Member States to translate these commitments into operational policies supported by adequate institutional and financial resources.

Empirical literature further indicates that policy implementation challenges have received considerably less scholarly attention than issues related to policy formulation. As a result, the mechanisms through which enforcement gaps, fiscal misalignment, and coordination failures influence real-world outcomes remain insufficiently understood (Zhang et al., 2025). This imbalance in the literature highlights the importance of examining not only the existence of legislative frameworks but also their practical application and institutional feasibility.

Given the broad scope of circular economy governance, a comprehensive examination of best practices across all Member States would exceed the limits of the present study. Instead, the analysis focuses on Member States demonstrating comparatively weaker performance in circular economy-related indicators in order to identify existing implementation gaps and structural barriers. Concentrating on lower-performing countries enables clearer identification of governance deficiencies that may be less visible in higher-performing contexts, where stronger institutional capacity and financial resources often mitigate implementation challenges. Moreover, such a comparative perspective illustrates how similar structural constraints—such as limited financing, insufficient technical expertise, and institutional fragmentation—manifest differently depending on national economic and administrative conditions.

According to empirical assessments of circular economy performance across the European Union, Romania, Greece, Cyprus, Slovakia, and Bulgaria rank among the lowest-performing countries in several key circular economy indicators (Škrinjarić, 2020). These countries therefore provide a useful analytical starting point for examining the practical challenges associated with circular economy policy implementation.

In addition to institutional and economic barriers, recent research suggests that existing evaluations of circular economy policies remain predominantly focused on environmental and economic indicators, while social dimensions of the transition receive comparatively limited attention. Factors such as skills development, behavioural change, and public awareness—although essential for the successful implementation of circular practices—are only marginally addressed in current policy assessments (Zhang et al., 2025). This imbalance further complicates the evaluation of implementation effectiveness, particularly in lower-performing Member States where social and institutional capacities play a critical role in enabling systemic change.

The following section therefore examines the performance of selected EU Member States based on statistical data collected by Eurostat (Eurostat, n.d.).

Four countries demonstrating the weakest performance across relevant indicators were selected for closer analysis. Certain indicators—such as the End-of-Life Recycling Input Rate (EOL-RIR) and EU self-sufficiency for specific raw materials including aluminium—were excluded from the comparison because they are reported at the EU or material-specific level rather than for individual Member States. While statistical indicators provide an important quantitative benchmark for assessing progress, they do not capture governance fragmentation, institutional capacity, or enforcement quality. Consequently, the present analysis combines statistical evidence with qualitative policy assessment in order to provide a more comprehensive understanding of existing implementation gaps.

To examine implementation gaps in practice, the analysis below is structured around several key indicators derived from the EU Circular Economy Monitoring Framework. These indicators—covering material consumption, waste generation and management, recycling performance, and circular material use—provide measurable benchmarks for assessing how effectively Member States translate EU circular economy objectives into practice. By examining these indicators in selected lower-performing countries, the analysis highlights structural weaknesses that hinder progress toward circularity.

1.3.2.1 Material consumption

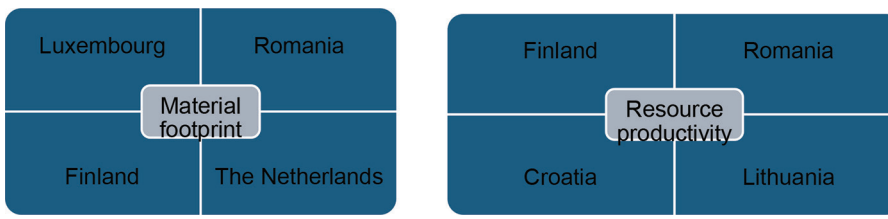

Figure 1.2 Material footprint and resource productivity in different countries.

Material footprint and resource productivity are key indicators for assessing whether economic growth is becoming less dependent on primary resource extraction. Excessive domestic material consumption (DMC) has also been associated with broader sustainability challenges. Empirical studies suggest that high levels of material consumption do not necessarily translate into improved social development outcomes. In particular, research indicates that the impact of excessive DMC differs across levels of economic development and may hinder human development in less developed countries, where environmental degradation and resource overexploitation place additional pressure on social and institutional systems (Zéman et al., 2025, pp.

11–12). These findings underline the importance of reducing material intensity and strengthening circular resource use rather than relying on continued growth in raw material consumption. High material consumption combined with low resource productivity therefore suggests that economies continue to rely heavily on linear production models, thereby limiting progress toward circularity.

Based on Eurostat data, several Member States – including Finland and Romania- demonstrate comparatively weak performance in both indicators. Although the underlying reasons differ across countries, the evidence suggests that policy ambition alone does not automatically translate into improved material efficiency.

Finland provides an illustrative example of this implementation gap. The country has actively promoted circular economy initiatives and has undertaken significant analytical work to support the transition. For example, the report "Material Flows of Finland's National Economy: Impacts, Actual Development and Circular Economy Scenarios for 2035", finalised in February 2024, represents the first comprehensive attempt to model future circular economy pathways and assess their environmental and economic impacts (European Topic Centre on Circular Economy, 2024a). Moreover, Finland has introduced voluntary initiatives under the Green Deal framework, through which organisations commit to reducing natural resource consumption and implementing circular business practices (European Topic Centre on Circular Economy, 2024a).

Despite these initiatives, Finland's raw material consumption per capita remains more than three times higher than the EU average, while the added value generated from natural resource use remains among the lowest in the EU (European Topic Centre on Circular Economy, 2024a, p.11). National policy targets aim to ensure that total primary raw material consumption in 2035 will not exceed the level recorded in 2015 (European Topic Centre on Circular Economy, 2024a, pp.11–12). However, evidence suggests that significant barriers remain at the firm level. A skills gap appears to be one of the most important obstacles to implementation: although many companies report intentions to integrate circular practices, a large share lack the technical knowledge required to operationalise these plans. According to recent surveys, 69% of companies have not conducted emissions calculations, material reviews, or life-cycle assessments. Additionally, 51% of companies do not organise training for personnel on circular economy practices, while only a minority provide individual or continuous training (European Topic Centre on Circular Economy, 2024a).

Finland's case therefore demonstrates an important challenge in circular economy policy: the existence of advanced strategic frameworks does not

necessarily guarantee effective implementation when business-level capabilities workforce skills remain insufficient. This disconnect between policy ambition and operational uptake reflects what may be described as an implementation paradox in EU circular economy governance.

Similar governance challenges[2] can be observed in Romania. Although the country has adopted several policy initiatives aimed at promoting circularity, coordination between central and local institutions remains weak, which limits effective implementation (European Topic Centre on Circular Economy, 2024b, p. 23). In practice, insufficient vertical coordination between national and subnational authorities undermines the translation of policy commitments into operational outcomes. Romania's experience therefore highlights the importance of governance coherence and administrative coordination in achieving circular economy objectives.

Other Member States face additional structural barriers that affect their material consumption performance. In Luxembourg, for example, implementation challenges are linked primarily to limited data availability and institutional fragmentation. The public administration remains organised along linear sectoral structures, with segmented competencies and budgetary responsibilities, which complicates the coordination of circular economy initiatives (European Topic Centre on Circular Economy, 2024c, p. 17). The Luxembourg case demonstrates how data scarcity can undermine evidence-based policymaking: without reliable metrics and monitoring systems, authorities face difficulties in designing targeted incentives or assessing the effectiveness of policy measures.

In the Netherlands, although the transition to a circular economy has formally started, the pace of change remains insufficient to meet intermediate targets for 2030. Current policy discussions emphasise multiple interconnected challenges — including climate change, loss of biodiversity, environmental pollution, and economic vulnerability —which require stronger political prioritisation and cross-government coordination. Existing policy measures have not yet generated a significant acceleration in the circular transition (European Topic Centre on Circular Economy, 2024d, p. 13).

In Lithuania, one of the principal barriers affecting material circularity relates to insufficient recycling infrastructure and the limited size of the domestic market. A relatively small internal market constrains the development and scaling of sustainable products and circular business models,

[2] In addition to better informing all stakeholders, the document also highlights gaps in the existing legislation. Nevertheless, it deals with the secondary raw materials, and for this reason it is not indicated as a shortcoming under "material consumption" indicator.

thereby limiting private-sector investment in circular production systems (European Topic Centre on Circular Economy, 2024e, p. 15).

Finally, in Croatia, challenges are associated with the need to ensure fair competitive conditions for circular materials and products while simultaneously supporting technological innovation and environmental sustainability. Access to financial resources remains essential for developing new circular technologies and strengthening industrial transformation (European Topic Centre on Circular Economy, 2024f, p. 12).

Taken together, these cases demonstrate that weak performance in material footprint and resource productivity is rarely attributable to a single factor. Instead, it reflects a combination of governance challenges, including insufficient policy coordination, limited institutional capacity, inadequate market incentives, and gaps in skills and technological capabilities. Addressing these structural barriers therefore requires not only regulatory reforms but also broader efforts to strengthen administrative coordination, improve data availability, and support capacity-building across both public institutions and the private sector.

1.3.2.2 Waste generation

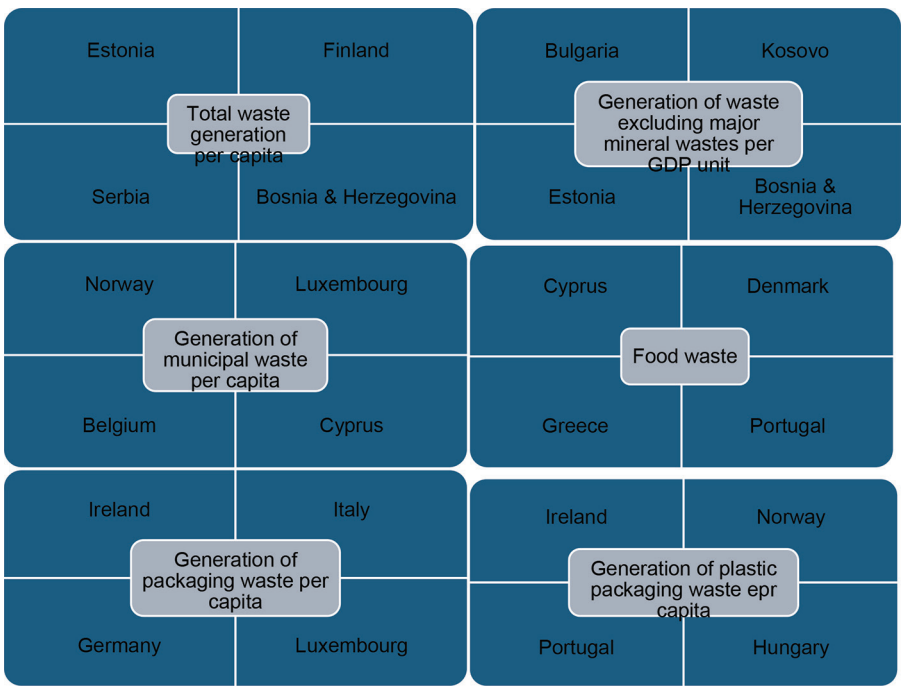

Figure 1.3 Waste generation in different countries.

Waste generation indicators—such as total waste generation per capita, waste generation excluding major mineral waste per GDP unit, municipal waste per capita, food waste, and packaging waste—provide important insights into the efficiency of material use and the extent to which economies remain dependent on linear consumption patterns. High levels of waste generation often reflect structural features of national economies, including energy systems, consumption patterns, and regulatory frameworks.

Waste prevention constitutes the highest priority within the EU waste hierarchy, which forms the basis of the Union's waste management strategy. However, existing policy frameworks and legislative instruments remain insufficiently developed to effectively promote waste avoidance. Addressing the waste problem therefore requires not only improvements in waste management but also a reconsideration of prevailing production and consumption patterns. Measures such as expanding sharing economy models and reducing unnecessary packaging could represent important initial steps toward lowering overall waste generation (Weghmann, 2023).

In addition to consumption patterns, waste generation is strongly influenced by the structure of economic activity across sectors. Sectoral analysis of waste generation in the European Union shows that certain economic activities are responsible for disproportionately high levels of waste production. The largest volumes of waste generated per capita are associated with the mining and quarrying sector, followed by construction activities. Similar patterns can be observed across different years, suggesting that waste generation in these sectors is largely structural. Other sectors that contribute significantly to waste volumes include manufacturing, as well as water supply, sewerage, waste management and remediation activities. Households also represent a considerable source of waste generation. Moreover, comparative data indicate that in many EU Member States the amount of waste generated per capita increased between 2010 and 2018, highlighting the persistent challenge of decoupling economic activity and consumption patterns from waste production (Angheluță et al., 2021). These sectoral patterns demonstrate that waste reduction strategies must address not only consumer behaviour but also production structures in resource-intensive industries.

In Estonia, high waste volumes largely stem from oil shale–based energy production, while the absence of a dedicated circular economy monitoring framework limits visibility and integration of circular practices into national policy. (European Topic Centre on Circular Economy, 2024g, pp. 13–15). Ireland's waste generation is strongly linked to over-consumption patterns and high levels of food waste. Although national plans address plastics, food waste, and biodiversity, progress is hindered by low public awareness

and limited cross-sectoral coordination, reflecting the broader challenge of developing policy responses for complex, multi-sectoral issues (European Topic Centre on Circular Economy, 2024h, pp. 13, 24). Institutional challenge to develop policy for a complex cross-sectoral issue remains and is indicated as a high barrier (European Topic Centre on Circular Economy, 2024h, p. 24).

In Finland, the concept of circularity is widely recognised at the policy level; however, practical implementation remains uneven. Many companies are slow to adopt concrete circular practices due to persistent skills gaps and the lack of practical guidance. Survey data indicate that 51% of companies do not organise training for personnel on circular economy practices (European Topic Centre on Circular Economy, 2024a). Bulgaria similarly faces governance challenges, including institutional fragmentation and weak long-term coordination, although the 2022–2027 Circular Economy Strategy foresees the establishment of a Circular Economy Council to improve policy coherence (European Topic Centre on Circular Economy, 2024i, p. 20).

Structural economic constraints also influence waste generation and circular transition. In Cyprus, the shift toward circular models is hindered by limited market size, strong dependence on imports, insufficient incentives for businesses, and weak circular product design (European Topic Centre on Circular Economy, 2024j, p. 16). These conditions illustrate how structural economic factors may restrict circular transition despite the existence of policy commitments, highlighting the importance of EU-level support mechanisms that account for differences in market scale and economic capacity. Greece faces similar implementation barriers, where administrative obstacles and consumer behaviour continue to impede progress (European Topic Centre on Circular Economy, 2024k, p. 16).

Regulatory barriers may also constrain circular practices. In Belgium, existing legislation prevents materials classified as waste from being utilised as secondary raw materials, despite technical and economic evidence demonstrating their potential value as inputs for other sectors. Current waste regulations therefore limit opportunities for cross-sectoral reuse and resource recovery (European Topic Centre on Circular Economy, 2024l, p. 28).

Taken together, these cases illustrate that high waste generation levels are not merely a consequence of consumption patterns but often reflect deeper governance and structural challenges, including regulatory rigidity, limited institutional coordination, insufficient business capacity, and structural economic constraints. Addressing these barriers is therefore essential for reducing waste generation and enabling an effective circular economy transition across EU Member States.

1.3.2.3 Overall recycling rates

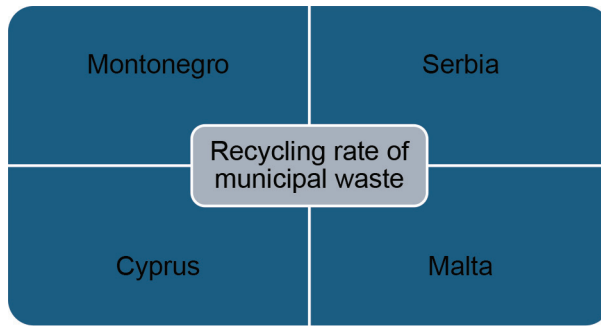

Figure 1.4 Recycling rate of municipal waste in different countries.

The recycling rate of municipal waste is a key indicator used to assess progress toward the circular economy, as it reflects the extent to which materials are reintroduced into production cycles rather than disposed of through landfilling or incineration. Despite the adoption of EU circular economy policies, recycling performance remains uneven across countries and is often constrained by structural governance, infrastructure, and market-related challenges.

In Montenegro, weak connectivity across regions, uneven digitalisation, and limited availability and quality of data restrict the capacity to generate comprehensive socio-economic insights and to effectively monitor circular economy progress. Although the country actively uses EU and other international funding programmes to support environmental protection, infrastructure, and agricultural development, persistent delays in strategy formulation and implementation continue to hamper policy effectiveness. At the same time, legislative alignment with EU standards is gradually progressing (European Environment Agency, 2025). While recycling rates have improved, several waste streams—including metals, plastics, textiles, food waste, electrical and electronic equipment, and batteries—continue to pose significant environmental and public health risks (Kaza et al., 2018). Policy recommendations therefore emphasise strengthening legal and financial frameworks, introducing technological standards, improving primary waste collection and recycling infrastructure, and developing monitoring mechanisms for waste reduction in line with circular economy principles (United Nations Development Programme, 2022).

Serbia faces similar implementation challenges, particularly in the area of circular material use (European Environment Agency, n.d.–Serbia). As to improve the overall recycling rates, it is recommended that Serbia conduct

a good baseline analysis (UNDP, 2021, p.46) on this topic, improve legal framework to achieve a higher recycling percentage in wood furniture industry (UNDP, 2021, p.53), raise capacities of public utility companies so that they can offer basic recycling infrastructure in plastics, and build the infrastructure for organic waste recycling (UNDP, 2021, p.54).

Structural barriers also affect recycling performance in EU Member States. In Cyprus, circular economy policies frequently lack clear operational guidance and effective enforcement mechanisms. At the same time, support for innovative product design and circular business models remains limited, while market conditions do not yet fully support the economic viability of circular initiatives (European Topic Centre on Circular Economy, 2024j, p. 17).

Economic structure also plays an important role in shaping recycling capacity. In Malta, the economy is dominated by small and micro-enterprises, which constitute the vast majority of businesses (European Topic Centre on Circular Economy, 2024m, p. 17). These enterprises often face constraints in financial resources, research and development investment, and production capacity, which limits their ability to adopt circular practices. Moreover, the strong focus on distribution rather than manufacturing reduces opportunities for material recovery and circular production systems. Although small firms demonstrate considerable flexibility, further efforts are needed to identify circular business opportunities and strengthen sustainability expertise among business owners and managers (European Topic Centre on Circular Economy, 2024m, p. 17).

Taken together, these cases illustrate that low recycling rates are rarely the result of a single factor. Instead, they reflect a combination of governance weaknesses, limited infrastructure, data gaps, and structural economic constraints. The persistence of these challenges indicates that progress toward a circular economy depends not only on legislative alignment but also on strengthening institutional capacity, improving monitoring systems, and expanding recycling infrastructure.

1.3.2.4 Recycling rates for specific waste streams

Recycling rates for specific waste streams provide a more detailed perspective on circular economy performance by capturing differences in how particular materials are collected, processed, and reintroduced into production cycles. Variations in recycling outcomes often reflect the interaction between consumer behaviour, waste management infrastructure, regulatory frameworks, and innovation capacity. Countries with higher public awareness and well-coordinated extended producer responsibility schemes tend to achieve

stronger recycling results, highlighting the importance of social and institutional capital in enabling circular transitions.

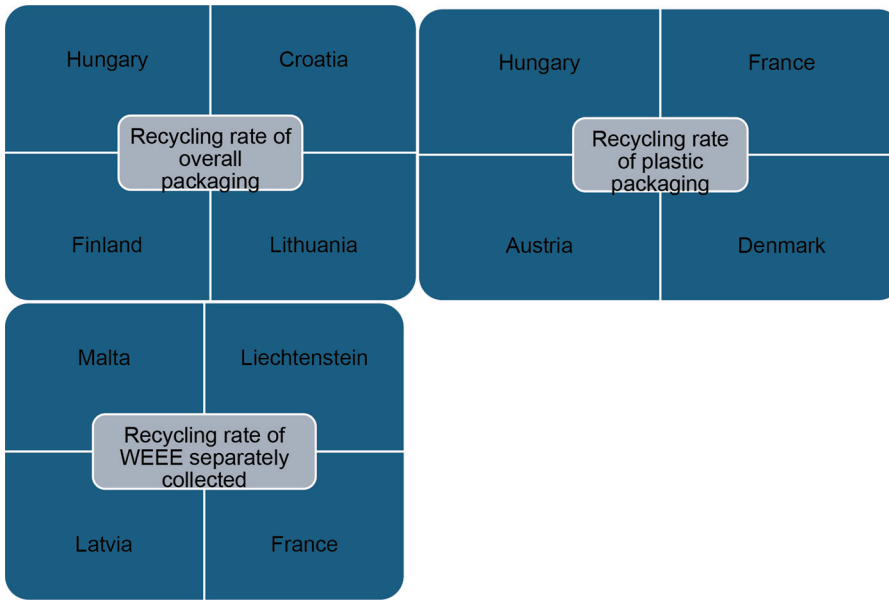

Figure 1.5 Recycling rates for specific waste streams.

Recent empirical analyses of packaging waste recycling in Central and Eastern Europe show persistent divergence from the EU-27 benchmark, particularly in countries such as Hungary and Romania (Giurea et al., 2026).

Hungary continues to face challenges in using material resources efficiently to generate economic value. The proportion of material resources obtained from recycled waste remains relatively low at 6.8%, significantly below the EU average of 11.9% recorded in 2019. At the same time, domestic material consumption exceeds the EU average, while recycling rates remain comparatively low. This combination points to persistent inefficiencies in resource use and waste management systems (European Topic Centre on Circular Economy, 2024n, p. 19). One of the key factors contributing to this situation is the absence of a comprehensive and integrated circular economy strategy (European Topic Centre on Circular Economy, 2024n, p. 19).

Evidence from packaging waste recycling trends in Central and Eastern Europe also illustrates persistent performance gaps relative to the EU-27 benchmark. Hungary displays sustained divergence from the EU reference trajectory, although their development paths differ (Giurea et al., 2026).

Hungary initially showed slight over-performance but gradually shifted toward persistent under-performance, suggesting declining effectiveness in the recycling system. Institutional analyses attribute these trends to policy instability, changing financing arrangements, and shifts in the allocation of responsibilities within the waste management sector. Similar governance challenges have been observed across several Central and Eastern European countries and are considered to have negatively affected recycling performance (Giurea et al., 2026).

In France, the transition toward a circular economy involves substantial financial and organisational costs. Establishing short circular loops often requires companies to cooperate with other actors along the value chain or to develop collective approaches, which may diverge from conventional business practices. Furthermore, the globalization of supply chains complicates the implementation of circular strategies, as firms often rely on geographically dispersed production networks that limit the feasibility of localized material loops (European Topic Centre on Circular Economy, 2024o, p. 21).

Consumer behaviour and public awareness also play a significant role in shaping recycling performance. In Lithuania, factors negatively affecting recycling rates include limited ecological awareness among consumers, high levels of consumption, insufficient waste-sorting practices, high repair costs, and limited recycling infrastructure (European Topic Centre on Circular Economy, 2024e, p. 15).

Technological and supply-chain barriers can further constrain recycling capacity. In Austria, major challenges arise in the areas of product design and material composition, as well as technological limitations in recycling processes and reverse logistics systems within supply chains (European Topic Centre on Circular Economy, 2024p, p. 19).

Similarly, social factors continue to influence circular economy development in Latvia, where public attitudes toward consumption and the lack of awareness-raising initiatives have been identified as significant barriers to improving recycling practices (European Topic Centre on Circular Economy, 2024q, p. 14).

Taken together, these cases illustrate that differences in recycling performance are shaped by a combination of governance structures, economic incentives, technological capabilities, and social behaviour. Improving recycling rates therefore requires not only stronger regulatory frameworks but also investment in infrastructure, innovation in product design, and sustained efforts to raise public awareness and encourage responsible consumption patterns.

1.3.2.5 Contribution of recycled materials to raw materials demand

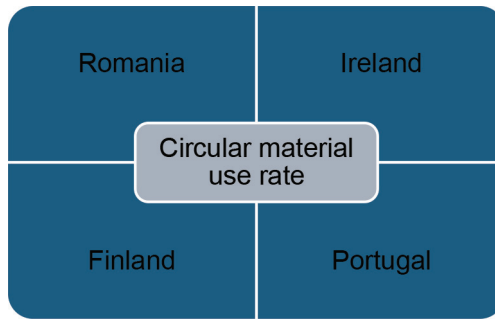

Figure 1.6 Circulare material use rate in different countries.

The circular material use rate measures the share of materials that are recycled and reintroduced into the economy, thereby reducing the need for the extraction of primary raw materials (Eurostat, n.d.-a; Skare et al., 2023). As such, the indicator provides an important measure of how effectively economies are able to close material loops and transition from linear production models toward circular resource use. Across countries, however, progress in increasing the contribution of recycled materials to overall material demand remains uneven and is often constrained by institutional, legal, and market-related barriers. In particular, the absence of clear definitions for secondary materials and insufficient market incentives frequently limit the effective reintegration of recycled resources into production systems. These patterns suggest that legal clarity and market design—rather than environmental ambition alone—play a decisive role in shaping circular outcomes.

Romania illustrates how regulatory ambiguity can hinder circular material flows. One of the key shortcomings lies in the lack of clear definitions and conditions for secondary raw materials, such as compost, to be reintroduced into the market (European Topic Centre on Circular Economy, 2024b, p. 23). In addition, the institutional framework governing circular economy policies shows insufficient coordination between central and local authorities, indicating significant potential for improving cooperation and policy implementation (European Topic Centre on Circular Economy, 2024b, p. 23).

Institutional and behavioural barriers also affect circular material use in other countries. In Ireland, difficulties in developing coherent policies for such a complex cross-sectoral issue, limited capacity among companies to identify circular opportunities, and insufficient consumer awareness have been identified as key obstacles to advancing circular economy practices.

Finland, by contrast, has taken steps to address these challenges through policy reform and investment in circular systems. Measures included in the

national Recovery and Resilience Facility Plan focus on reforming the Waste Act and promoting the reuse and recycling of key materials and industrial side streams (European Topic Centre on Circular Economy, 2024a, p. 13). These initiatives aim to strengthen the regulatory and institutional framework necessary to increase the circulation of secondary materials within the economy.

Portugal's experience illustrates both progress and persistent structural challenges. The country's circular material use rate increased from 1.8% in 2010 to 2.5% in 2013, largely as a result of declining domestic material consumption. After a period of stagnation until 2017—when the first Circular Economy Action Plan was adopted—the rate gradually improved, increasing by approximately 0.1% annually and reaching 2.6% in 2022 despite external shocks such as the COVID-19 pandemic and the war in Ukraine (European Topic Centre on Circular Economy, 2024r, p. 23). Nevertheless, the expansion of circular material use remains constrained by weak market competitiveness for circular products. Recycled materials and repaired products often remain more expensive than virgin materials or newly manufactured goods, leading consumers to choose cheaper but less sustainable alternatives (European Topic Centre on Circular Economy, 2024r, p. 35).

Taken together, these cases highlight that increasing the contribution of recycled materials to raw material demand requires not only stronger regulatory frameworks but also well-functioning markets for secondary materials. Without clear legal definitions, coordinated institutional frameworks, and economic incentives that make recycled resources competitive with virgin materials, progress toward circular material use will remain limited.

1.3.2.6 Trade in recyclable raw materials

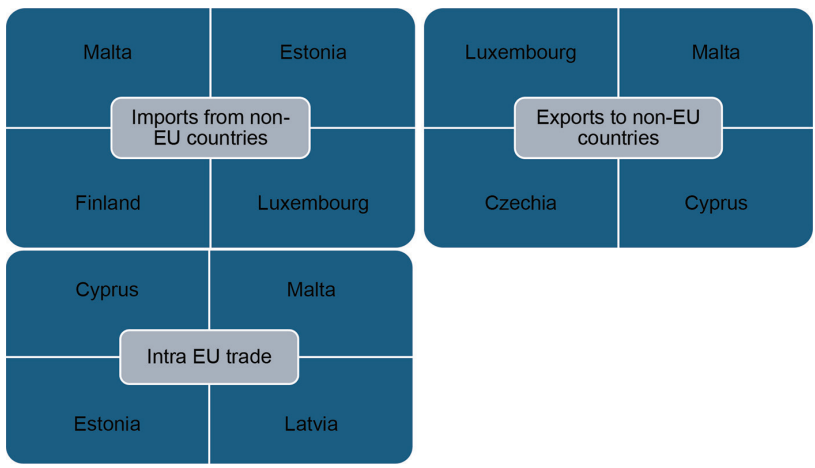

Figure 1.7 Trade in recyclable raw materials in different countries.

Trade in recyclable raw materials reflects an important dimension of the circular economy that extends beyond domestic waste management systems. This indicator serves as a key measure for assessing progress toward the circular economy (Mancini et al., 2019). The transition toward more efficient resource use and the development of a circular economy are closely connected with international trade. These interactions play an important role in enabling global value chains to improve the efficiency of resource use. In this context, key determinants shaping trade in recycled raw materials have been analysed, and this indicator has been treated as a central measure of circular economy development (Lingaitiene and Burinskiene, 2024).

In lower-income countries, waste often represents an important secondary resource. Waste collection constitutes a significant economic activity, while the recovery of materials from waste forms a key component of the circular economy (Lingaitiene and Burinskiene, 2024). Trade patterns demonstrate that the circular transition is not only an environmental objective but also a function of economic geography and market structures. In particular, small or highly open economies often depend on regional cooperation to close material loops, highlighting the strategic importance of integrated intra-EU circular value chains.

Luxembourg provides a clear illustration of this dynamic. According to Eurostat, the country ranks fourth in the European Union in terms of municipal waste recycling rates (Eurostat, 2025). However, a significant share of the collected waste is exported for recycling abroad, meaning that Luxembourg simultaneously imports and exports recyclable materials. This pattern largely reflects the country's small size and highly open economic structure, which limits the feasibility of developing large-scale domestic recycling facilities.

Similar structural constraints are evident in Malta, where spatial limitations and the small size of the national territory restrict the development of extensive recycling infrastructure and circular production systems (European Topic Centre on Circular Economy, 2024m, p. 17).

In Estonia, low levels of trade in recyclable raw materials appear to be linked to weak domestic demand for secondary materials. This situation is further aggravated by the absence of regulatory measures that would actively promote the use of recycled materials in production processes (European Topic Centre on Circular Economy, 2024s, p. 15).

Market competitiveness also plays an important role in shaping trade flows. In Czechia, the relatively low price of primary raw materials compared with secondary materials has traditionally reduced the competitiveness of recyclable raw materials on international markets, particularly outside the European Union (European Topic Centre on Circular Economy, 2024t, p. 21).

As a result, exports to non-EU countries have remained limited. Although recent economic disruptions have narrowed this price gap, insufficient investment in research, innovation, and advanced recycling technologies continues to constrain the production of high-quality secondary materials that could compete in international markets.

Taken together, these examples demonstrate that trade in recyclable raw materials is shaped not only by environmental policy but also by economic scale, market incentives, and technological capacity. Strengthening intra-EU circular value chains, improving regulatory support for secondary materials, and investing in advanced recycling technologies are therefore essential for expanding the role of recycled materials in international trade.

1.3.2.7 Private investment, jobs and gross value added related to circular economy sectors

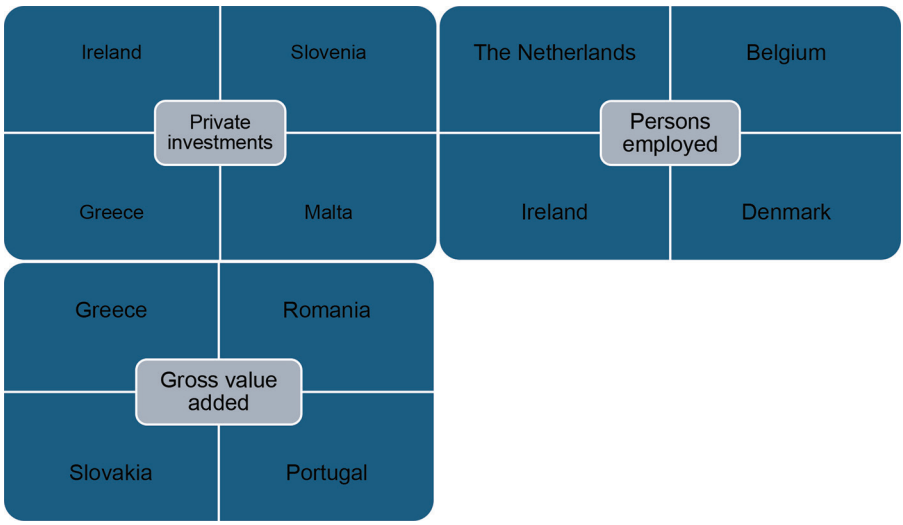

Figure 1.8 Economic dimensions of the circular economy in different countries.

The analysis of private investment in circular economy sectors provides important insight into the extent of business sector participation in the transition to more sustainable economic systems. In this regard, private investment increased in the majority of European countries between 2015 and 2021, indicating growing private sector engagement in sustainable economic models. This growth is closely associated with policy developments at both national and EU levels, particularly the European Green Deal and the Circular Economy Action Plan. Across the European Union, private

investment reached EUR 121,578 million in 2021, marking a 44.83% increase from EUR 83,946 million recorded in 2015 (Giucă et al., 2025).

This indicator captures the economic dimension of the circular economy by measuring private investment, employment, and gross value added generated by circular economy sectors. It provides insight into the extent to which circular activities contribute to economic growth and labour market development.

In Greece, REPowerEU investments—including those promoting energy efficiency, renewable energy sources, and pilot projects for biomethane and renewable hydrogen production—are closely aligned with circular economy objectives (European Topic Centre on Circular Economy, 2024k, p. 16). However, the production of recycled carbon fuels is not supported within this investment framework (European Topic Centre on Circular Economy, 2024k, p. 16). Additional initiatives, such as renovation and recharge and refuelling investments, are directly linked to circular economy priorities under the National Recovery Plan (European Topic Centre on Circular Economy, 2024k, p. 17).

Nevertheless, administrative barriers and consumer behaviour remain among the most significant obstacles to circular transition. Economic and legislative constraints further limit companies' ability to adopt circular business models (European Topic Centre on Circular Economy, 2024k, p. 16). These challenges not only hinder the effective implementation of circular initiatives but also discourage private investment by increasing regulatory uncertainty and weakening market incentives. As a result, the potential of the circular economy to generate gross value added and sustainable economic growth remains underutilised.

The gap between necessary investments and available resources has also been identified in Slovenia (European Topic Centre on Circular Economy, 2024u, p. 19). At the same time, engagement with the wider business ecosystem can foster experimentation and innovation, which are essential for addressing climate change effectively (European Topic Centre on Circular Economy, 2024u, p. 19).

In Malta, micro-businesses face resource limitations that hinder their engagement with circular economy initiatives (European Topic Centre on Circular Economy, 2024m, p. 17).

Within Slovakia's business sector, the limited availability of hazardous waste recovery facilities creates operational challenges for industry and may discourage foreign investment, particularly where companies face difficulties in meeting corporate environmental standards (European Topic Centre on Circular Economy, 2024v, p. 13).

In Portugal, several obstacles hinder the transition to a circular economy. These include limited support mechanisms for corporate financing, public policies that remain incomplete or insufficiently aligned with circular economy principles, inadequate capital investment in circular solutions, and a relatively weak entrepreneurial culture oriented toward circular practices (European Topic Centre on Circular Economy, 2024r, p. 34). Collectively, these barriers constrain both the development of circular business models and the broader adoption of sustainable practices.

The persistent financing gap and the weak alignment between national recovery plans and Circular Economy Action Plan (CEAP) priorities suggest that circular investment remains peripheral to mainstream industrial policy. Without stronger fiscal incentives and effective de-risking instruments, private capital is likely to remain underallocated to circular projects.

1.3.2.8 Innovation

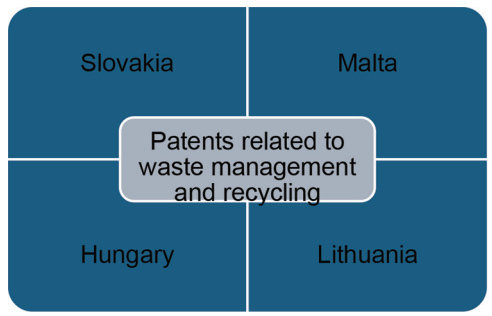

Figure 1.9 Patents related to waste management and recycling.

Research indicates that patent activity in the field of waste management has increased significantly over time. This trend reflects a growing recognition of waste as a valuable resource for producing new products, a potential source of energy, and an opportunity for generating economic benefits (Khaertdinova et al., 2021).

This indicator captures innovation performance in circular economy sectors by measuring the number of patents related to waste management and recycling, thereby reflecting the level of technological development and knowledge creation.

[3] However, there are still more countries with a zero result. To maintain a unified approach throughout the document, the last four countries from the list were selected.

At both national and institutional levels, Slovakia appears to lack a concrete implementation framework capable of translating circular economy strategies into operational measures. Insufficient interdepartmental coordination and limited engagement with the industrial sector further hinder progress, as platforms for dialogue and collaboration remain underdeveloped. In addition, awareness-raising initiatives and information campaigns promoting circular economy practices and disseminating best practices are still limited (European Topic Centre on Circular Economy, 2024v, p. 13).

Taken together, these shortcomings create an environment that is not conducive to innovation—particularly the systemic innovation required for a circular transition. The relatively low number of patents in waste management and recycling reflects weak innovation dynamics, suggesting that progress toward a circular economy is constrained by insufficient investment in research, development, and technological advancement.

More broadly, such innovation deficits reflect the lack of effective coordination between research institutions, industry, and government. This underscores that technological progress alone is insufficient to drive circularity without supportive governance frameworks and targeted funding mechanisms.

In light of these challenges in Slovakia, and similar structural barriers observed in other countries, there is a clear need to intensify efforts toward advancing the transition to a circular economy. While some countries require the development of separate waste collection systems, others must strengthen environmental policies and enhance innovation capacity to facilitate the implementation of technological solutions. In this context, patents serve as important systemic instruments for addressing these challenges. Environmental priorities linked to sustainable development place increasing demands on the scientific community to develop and refine ecological technologies. Patents, in turn, function as economic assets that enable the transformation of knowledge into practical technological applications (Khaertdinova et al., 2021).

1.3.2.9 Global sustainability from circular economy

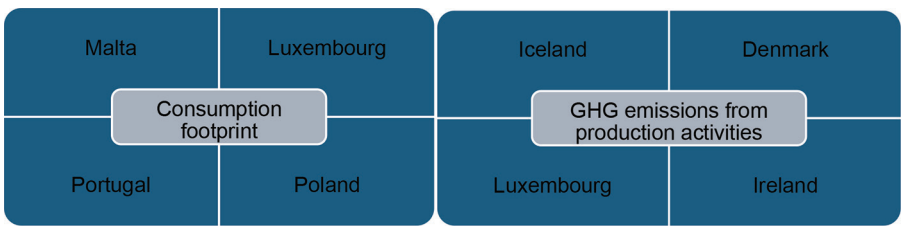

Figure 1.10 Environmental impact of economic activity in different countries.

These indicators capture the broader environmental impact of economic activity by measuring the resource intensity of consumption and the emissions generated in production processes. They provide insight into the extent to which circular economy practices contribute to reducing environmental pressures at both national and global levels.

Although Malta records relatively low domestic material consumption per capita in certain metrics (e.g., 10.1 tonnes per person, representing 71.2% of the EU average), its capacity to reduce its overall consumption footprint through circular economy measures remains constrained (European Topic Centre on Circular Economy, 2024m, p. 4). Structural factors—including small market size, limited economies of scale, strong dependence on imports, and infrastructure and logistical constraints—significantly limit the country's ability to implement circular solutions. In addition, the prevalence of micro-enterprises with limited capacity to adopt circular business models further restricts progress (European Topic Centre on Circular Economy, 2024m, p. 17).

At the same time, trends in larger economies reveal different challenges. According to the European Environment Agency (EEA, 2025), both Poland and Portugal experienced increases in their consumption footprints of more than 20% by 2023. In Portugal, this trend is associated with a continued reliance on raw material consumption and limited integration of circular practices. Empirical findings suggest that raw material use accounts for a dominant share of its performance under Sustainable Development Goal 12, while the contribution of circular material use remains comparatively low (Rabbi, 2025). A similar pattern can be observed in Poland, where, despite a more balanced distribution of indicators, the consumption footprint continues to exert significant pressure. These developments point to structural challenges, including consumption-driven growth models and insufficient diffusion of circular practices.

In addition to consumption patterns, greenhouse gas (GHG) emissions from production activities remain a key constraint on achieving global sustainability. Within the European Union, several countries exhibit relatively high emissions intensity in production, indicating weaker performance in the production dimension of the circular economy. According to recent Eurostat data, in 2023 emissions intensity per hour worked was highest in Denmark (16.8 kg CO_2-eq), followed by Ireland (13.5 kg/h) and Luxembourg (10.1 kg/h) (Eurostat, 2025).

This pattern is further reflected in broader emissions indicators. For instance, Ireland's total GHG emissions per capita reached approximately 11.6 tonnes CO_2-equivalent in 2022, significantly above the EU-27 average

of 7.5 tonnes (Central Statistics Office, 2025). Similarly, Denmark's carbon footprint per worker has been estimated at 24.66 tonnes CO_2-equivalent, compared to the EU average of 13.61 tonnes (European Commission, 2022).

Taken together, these findings suggest that progress toward global sustainability within the circular economy framework remains uneven. While some countries face structural constraints related to scale and market size, others are challenged by consumption-driven growth patterns and carbon-intensive production systems. This indicates that achieving meaningful reductions in environmental impact requires not only the adoption of circular practices but also broader transformations in production and consumption systems.

1.3.2.10 Resilience from circular economy

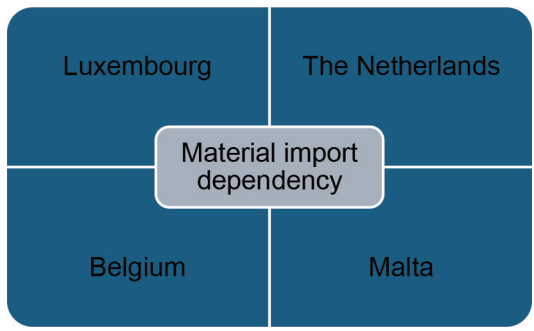

Figure 1.11 Material import dependency in different countries.

Material import dependency—the share of an economy's direct material inputs met through imports—constitutes a key resilience indicator within the circular economy, as it reflects exposure to external supply shocks and the limited capacity to close material loops domestically. Small, highly open economies with limited domestic extraction, as well as those specialised in trade-intensive activities, tend to exhibit higher vulnerability.

For example, Malta demonstrates a very high level of material import dependency, reflecting its near-total reliance on imported non-local raw materials. This significantly increases its exposure to upstream supply disruptions and constrains its ability to develop domestic circular solutions (European Topic Centre on Circular Economy, 2024m, pp. 17–18).

A similar pattern can be observed in the Netherlands, which—despite advanced circular economy policies and relatively efficient material use—remains highly dependent on imported raw and processed materials. This is largely due to its highly open economy and strong orientation toward trade

and re-export activities, which elevate import dependency across multiple material categories (OECD, 2025).

Belgium also exhibits a high level of reliance on imported raw materials, in contrast to several other EU Member States that benefit from domestic production of construction and industrial minerals (Nuss et al., 2017).

Taken together, these patterns suggest that resilience-oriented policy responses in such Member States should prioritise the development of secondary raw material markets, the diversification and strategic management of critical material supplies, and the strengthening of regional circular value chains. These measures can help reduce exposure to global supply chain disruptions while enhancing material self-sufficiency.

More broadly, high levels of import dependency across several Member States highlight Europe's structural vulnerability to global supply shocks. Strengthening regional circular systems and secondary material markets should therefore be understood not only as an environmental objective but also as a key component of strategic autonomy.

1.4 Conclusion

The assessment of circular economy (CE) policy implementation across European Union Member States demonstrates that, despite the existence of a comprehensive legal and strategic framework at the EU level, national performance remains fragmented and uneven. The European Green Deal, the 8th Environment Action Programme, and the Circular Economy Action Plan collectively provide a coherent policy roadmap. However, a persistent gap between EU-level ambition and Member State implementation continues to be evident, largely due to structural, institutional, and governance-related constraints. As highlighted in recent research, fragmented governance arrangements, unclear allocation of responsibilities, and insufficient coordination mechanisms remain key barriers to effective implementation.

A central finding of this study is that implementation challenges are closely linked to institutional fragmentation and weak coordination structures. In many Member States, responsibilities for CE-related policies are dispersed across multiple ministries and agencies, resulting in inconsistent transposition of EU directives and limited accountability. In addition, national monitoring systems often remain underdeveloped compared to the EU's indicator framework, constraining the ability of governments to track progress, identify policy gaps, and adjust interventions in a timely manner.

The analysis further demonstrates that differences in economic structure and capacity significantly shape circular economy outcomes. Smaller

and highly import-dependent economies, such as Cyprus, Malta, and Luxembourg, face structural limitations related to scale, market size, and resource availability, which constrain their ability to develop domestic circular systems. At the same time, resource-intensive economies, including Finland and Romania, encounter difficulties in decoupling material consumption from economic growth. In other cases, such as Portugal and Greece, limited access to finance and insufficient institutional coordination continue to hinder effective policy implementation.

Across multiple indicators, persistent gaps in investment, innovation, and infrastructure emerge as critical constraints. Although the circular economy is increasingly framed at the EU level as a driver of competitiveness and resilience, it is still frequently treated at the national level as a predominantly environmental policy domain. This narrow policy framing reduces incentives for private sector engagement and weakens integration with industrial, financial, and innovation policies. As a result, circular business models remain underdeveloped, and their contribution to employment and gross value added is not fully realised.

Moreover, the findings highlight that progress toward global sustainability and resilience remains uneven. High consumption footprints and carbon-intensive production patterns in several Member States indicate that circular practices have not yet been sufficiently integrated into broader production and consumption systems. At the same time, high levels of material import dependency in many economies underscore Europe's continued vulnerability to external supply shocks, reinforcing the importance of developing regional circular value chains and secondary raw material markets.

Finally, social and behavioural factors—including limited consumer awareness, insufficient education, and gaps in workforce skills—continue to constrain the transition toward a circular economy. Even in more advanced cases, implementation is often slowed by a lack of practical expertise and limited capacity within both public institutions and the private sector.

Addressing these challenges requires a shift from formal policy adoption toward coordinated, systemic, and enforceable implementation. Member States need to integrate circular economy objectives more effectively into broader economic and industrial strategies, while strengthening governance structures, improving policy coherence, and enhancing administrative capacity. At the EU level, greater emphasis should be placed on supporting data harmonisation, capacity-building, and the development of cross-border circular value chains.

Ultimately, strengthening governance, mobilising investment, fostering innovation, and developing human capital will be essential for translating

the EU's regulatory leadership into tangible and sustained circular economy outcomes across Europe.

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