

Joint Master in EU Trade and Climate Diplomacy

Evaluating the Impact of the EU's Packaging and Packaging Waste Regulation: Pathways to a Circular Economy

Supervised by William Neale

Chloé Lachaux

2024

Statutory Declaration

ANTI-PLAGIARISM AND FRAUD STATEMENT

I certify that this thesis is my own work, based on my personal study and/or research and that I have acknowledged all material and sources as well as AI tools used in its preparation. I further certify that I have not copied or used any ideas or formulations from any book, article or thesis, in printed or electronic form, or from AI tools without specifically mentioning their origin, and that complete citations are indicated in quotation marks.

I also certify that this assignment/report has not previously been submitted for assessment in any other unit, except where specific permission has been granted from all unit coordinators involved, and that I have not copied in part or in full or otherwise plagiarised the work of other students and/or persons.

In accordance with the law, failure to comply with these regulations makes me liable to prosecution by the disciplinary commission and the courts of the Republic of France for university plagiarism.

Name: Chloé Lachaux

Date: 09.07.2024

Signature:

A handwritten signature in blue ink, reading "Chloé Lachaux", written in a cursive style. The signature is positioned below the "Signature:" label and is enclosed within a light blue rectangular box.

Acknowledgements

First of all, and most importantly, I wish to take this opportunity to express my gratitude towards my supervisor William Neale whose insightful guidance has profoundly shaped my understanding of the circular economy within a systemic context. His expertise and support have been instrumental in refining my thoughts and developing my thesis to its current form. Through a combination of online and in-person meetings, he provided invaluable advice that helped me to redefine my research focus and connect with key individuals in the field.

Secondly, I would like to thank the interview participants for their collaboration. By giving me valuable insights, I gain a deeper and richer understanding in international climate governance meaningfully. It has been an honour to have had the opportunity to speak with highly ranked UNEP, European Commission and European Parliament officials. These interviews helped me dig in and think about my future career in the circular economy world.

Last but not least, I want to thank my friends and family for the ongoing support during the period of my studies and within the last weeks of finalizing this thesis. This thesis represents a work that merges my personal values with my academic and professional pursuits. I wish to further gain experiences in this field.

Abstract

This study examines the equilibrium between ambitious environmental targets and practical stakeholder realities within the framework of the EU's Packaging and Packaging Waste Regulation (PPWR), which was voted on by the European Parliament in April 2024. As the most heavily lobbied regulation in the history of the European Parliament, the PPWR highlights the significant challenges of implementing substantial environmental reforms amid industrial resistance. Through an extensive literature review, expert interviews, and policy analysis, this research identifies key barriers to the effective implementation of the PPWR and proposes actionable solutions. The study underscores the growing imbalance in waste management and the exponential increase in waste, despite existing sustainable practices and policies.

The research critically evaluates the PPWR, acknowledging both its introduction of new sustainable practices and the disappointment it has caused among recycling industry stakeholders. The findings offer policy recommendations to determine whether the PPWR can effectively reconcile its ambitious environmental targets with stakeholder opposition. The study illustrates the regulation's challenges through the lens of various business innovations designed to comply with its requirements, highlighting the delicate balance between regulatory ambitions and practical implementation. This research aims to provide a nuanced understanding of the PPWR's potential and the broader implications for packaging waste management and circular economy practices in the EU.

Table of Contents

Introduction	7
Wider Context: Packaging Waste Management to Reach Climate Goals.....	7
Problem Setting and Research Question	8
Research Design and Methodology	8
1 Circular Economy and Growing Concern of the Packaging Waste Impact on Climate Change	12
1.1 Growing Concern of the SUP Packaging	13
1.2 Circular Economy Reusing Packaging Industry.....	19
1.3 Overview of Existing EU Policies and the rise of the PPWR	21
2 Industrial Transition and Intense Lobbying of the PPWR	26
2.1 Unpacking the PPWR: Influences from Unprecedented Lobbying	26
2.2 Single-Use Plastics in the Food Industry.....	29
2.3 Cardboard Exemption and the Paper Industry.....	33
2.4 Public Frustration and Criticism.....	35
3 Implication of PPWR - Will Circularity Stay a Niche Concept or Catalyse Business Innovation?	37
3.1 Opportunities for Improvement and Innovation.....	37
3.2 Recommendations for collaborative innovation: Business and Civil Society in Transition.....	41
3.3 Industry Lobbying: A Double-Edged Sword	49

List of Abbreviations

CEAP = Circular Economy Action Plan

CSR = Corporate Social Responsibility

DRS = Deposit Return Systems

EC = European Commission

EU = European Union

EPR = Extended Producer Responsibility

F&B = Food and Beverages

HoReCa = Hotels, Restaurants, And Cafes

JRC = Joint Research Centre

LCA = Life Cycle Assessment

LDPE = Low-Density Polyethylene

MEPs = Members of the European Parliament

NGO = Non-Governmental Organisation

ORD = Own Resource Decision

PFAS = Per- And Polyfluoroalkyl Substances

PPWR = Packaging and Packaging Waste Regulation

SFSCs = Short Food Supply Chains

SUPD = Single-Use Plastic Directive

UN = United Nations

WFD = Waste Framework Directive

Introduction

Wider Context: Packaging Waste Management to Reach Climate Goals

The EU's Green Dream: Carbon Neutrality by 2050

The European Union is ambitiously striving to become the first continent to achieve carbon neutrality by 2050, with the European Union (EU) Green Deal as a cornerstone of this transformation. The adoption of circular economy principles is expected to yield substantial environmental, social, and economic benefits. Notably, it could generate a net economic benefit of €1.8 trillion by 2030 (McKinsey, 2015).

Plastic Fantastic? The Challenge of Plastic Waste

Since the 1950s, the use of plastic has surged twentyfold, with 76% of all plastic ever produced no longer in use, having been lost to the environment, incinerated, or landfilled (Geyer et al., 2017). Plastic, despite its utility and innovation potential, poses a significant environmental challenge. The production of plastic generates approximately 430 million tonnes of waste annually, with a third being single-use plastic. The environmental impact of plastic waste is starkly illustrated by the Great Pacific Garbage Patch, which is estimated to cover an area three times the size of metropolitan France (Blot et al., 2021). With plastic production expected to triple by 2060, a comprehensive review of the entire plastic production value chain is crucial (OECD, 2022).

Reuse and Recycle: A Circular Solution

A key focus in addressing plastic pollution is the reuse of packaging. This strategy aligns with the goals of both the EU and the United Nations' (UN) Global Plastic Treaty to end plastic pollution (Hitt et al., 2023). The Packaging and Packaging Waste Regulation (PPWR) is central to this ambition, aiming to reduce packaging waste and promote circular economy objectives. This regulation represents a significant turning point in efforts to combat desertification, climate change, and biodiversity loss.

Industry Pushback: The Clash of Economic Interests

By supporting a harmonized European approach to the circular economy, the key priority in the first EU Action Plan for a Circular Economy was to reuse and recycle plastic (Somlai et al., 2023). Despite the clear environmental benefits, the concept of reusable packaging has faced scrutiny from industries and associations that economically benefit from the plastic industry. This paper addresses the research gap in analyzing the costs versus benefits of a scaled and optimized reuse system. This analysis is particularly pertinent as the PPWR faces opposition from industries that question the feasibility of

transitioning to a reuse system. Concerns raised include the environmental credibility of reuse systems, customer acceptance, required behavioural changes, and fears of substantial investments and operational costs (Peeters et al., 2023).

Problem Setting and Research Question

Balancing Act: Ambitious Targets vs. Practical Realities

The primary challenge in implementing the PPWR lies in balancing the ambitious environmental targets set by the EU with the practical realities of stakeholder resistance. Industries and associations that benefit economically from the current plastic paradigm often oppose the transition to reusable packaging systems. They raise concerns about the environmental credibility, customer acceptance, necessary behavioural changes, and substantial investments required for such a shift (Peeters et al., 2023). This study aims to assess whether the PPWR can effectively reconcile these ambitious targets with the opposition it faces. The regulation's complexity and potential impact are underscored by the emergence of various business innovations designed to comply with its requirements.

Research Question: To what extent can the adoption of the PPWR by the European Parliament significantly contribute to reducing packaging waste and aligning with circular economy objectives in the short to mid-term?

Research Design and Methodology

Research Design

This research seeks to evaluate the capacity of the European Parliament's (EP) adoption of the PPWR to achieve its stated objectives. Specifically, it endeavours to determine whether the PPWR is merely symbolic or represents a transformative regulation for the reuse industry. By analysing the regulation's potential to drive significant reductions in packaging waste and its alignment with circular economy principles, this study will provide insights into the effectiveness and impact of the PPWR in achieving sustainable environmental outcomes. Additionally, the thesis intends to provide a comprehensive analysis of whether a reusable and recycling packaging system can be achieved through the concurrent adoption of a more circular economy. The final objective is to determine whether current practices are beneficial in achieving a sustainable packaging system and to evaluate the long-term sustainability of packaging business innovations.

To address these aims, the following research objectives have been established:

1. **Analyzing the current packaging situation in the EU:** Examine the growing concern over packaging waste's impact on climate change and the implementation of the circular economy in the EU.

2. **Assessing the effectiveness of the PPWR:** Evaluate the role of the newly adopted PPWR in promoting reusable methods and its contribution to the objectives of the Circular Economy Action Plan (CEAP).
3. **Understanding resistance and practical challenges:** Investigate the resistances and practical challenges in aligning the PPWR with the objectives of the industrial sector. This includes assessing the influence of lobbying efforts that may push to lower the regulation's objectives and the alignment issues among the 27 member states of the EU.
4. **Identifying the long-term sustainability of reusable packaging:** Determine new policy instruments to aid the transition in collaboration with key stakeholders from different backgrounds. This objective seeks to understand whether the concurrent adoption of a reusable packaging system benefits the achievement of a sustainable circular economy.

By fulfilling these objectives, the research will provide a nuanced understanding of the PPWR's potential and the broader implications for packaging waste management and circular economy practices in the EU.

Methodology

The main object of analysis is the PPWR, specifically the European Parliament legislative resolution of 24 April 2024 on the proposal for a regulation of the EP and of the Council on packaging and packaging waste. Given the recent publication of this text, there is limited access to existing academic resources. Thus, official articles from European-centred newspapers such as Politico and EURACTIV have been used. Then, the literature narrative review of official policy documents, reports, and academic literature sourced from authoritative platforms such as the European Commission's official website and reputable academic databases will explore the theoretical framework of the PPWR to enable an in-depth analysis of the legislation. Moreover, existing studies on plastic packaging and food waste will be critically reviewed to understand the scope and effectiveness of current practices and regulations. The analysis will focus on the PPWR's goals and themes, considering the intertwined relationship between packaging waste and the plastic industry.

Rich and nuanced insights from different stakeholders directly linked to the construction of the PPWR reveal the extent of corruption and aggressive lobbying by various industrial players. Qualitative interviews were chosen to gain a better understanding of the power exercised by different actors in this political context. The purpose and questions of the interviews were refined based on the knowledge gained throughout the process (Cairns-Lee et al., 2022). Twelve interviews were conducted with individuals from governmental institutions related to the PPWR, independent think tanks, NGOs, and business practitioners. Participants originated from diverse industries, resulting in considerable

differences in their responses, which were closely aligned with their specific areas of expertise.

Number	Type	Institution	Role	Date
#1	Government (Brussels)	European Parliament, DG ENVI	Administrator in charge of the PPWR	26.03.2024
#2	Trade association (Brussels)	New European Reuse Alliance	Public Affairs Coordinator	08.04.2024
#3	European Organisation (Brussels)	Environmental Bureau Agency	Circular Economy Program Manager	30.04.2024
#4	European Organisation (Brussels)	Environmental Bureau Agency	Senior Policy Officer for Circular Economy	04.05.2024
#5	Research Institute (Copenhagen)	Sustainability Consultant – Previously worked at Too Good To Go	Sustainability Consultant (Strategy and Circular Economy)	30.05.2024
#6	Non-Governmental Organisation (Paris)	Zero Waste France	Project Manager	30.05.2024
#7	European Sustainable Business Federation (Brussels)	Ecopreneur.eu	Senior Policy Advisor	09.06.2024
#8	International Organisation (New York)	UNEP	Secretary General	13.06.2024
#9	Government (Brussels)	European Commission	Policy Maker in charge of the PPWR	24.06.2024
#10	Media (Brussels)	EURACTIV.com	Journalist	26.06.2024

Table 1: Number of participants and sector and role and type of origin. Source: Author's own.

Scope and Limitations

The study focuses on a single-case study of single-use plastic in the European takeaway sector and the paper industry, allowing for a detailed examination of the sectors' characteristics and the influence of lobbying.

This research acknowledges the rapidly evolving policy landscape and the inherent complexity in fully analysing every aspect of the regulation. First of all, the redaction of this study occurred extensively between the months of May and June 2024, while PPWR was voted in April 2024. Thus, methodological limitations were influenced by time constraints and the recruitment methods employed. Secondly, significant challenge was posed by the upcoming European Elections, which made it difficult to secure interviews with MEPs and representatives from both the European Union and local governments due to their busy schedules. Consequently, some officials declined to participate in the study.

While reaching out to individuals via LinkedIn yielded numerous positive responses for interviews, there was a notable lack of representation from the private sector, particularly from key players in the take-away and paper industries. Requests for interviews with companies like McDonald's and CEPI were either rejected or ignored. Despite persistent efforts to contact these stakeholders through various platforms, professional emails, and intermediaries, the responses remained either negative or absent. This lack of engagement constrained the research, necessitating reliance on official documents to capture these companies' perspectives on packaging reduction.

Moreover, the absence of definitive funding allocations for implementing a reuse system within the EU limits the ability to project future impacts accurately. This study focuses on specific aspects and does not encompass other areas such as packaging labeling, recycling processes, manufacturer obligations, packaging conformity, deposit and return systems, green public procurement, or trade relations. Including these additional elements would have significantly influenced the study's conclusions.

Finally, due to the absence of clear funding allocations to adopt a reuse system within the EU, the research refrains from providing extensive projections on the future impacts of the circular economic system and its current adoption within the systems.

2 Circular Economy and Growing Concern of the Packaging Waste Impact on Climate Change

The unsustainable exploitation of Earth's resources has led to a significant ecological imbalance. Our current lifestyle is fundamentally incompatible with maintaining the planet's ecological stability (Bonneau, 2020). The Meadows report by the Club of Rome in 1972, "The Limits to Growth," was among the first to warn that infinite growth is unachievable in a finite world.

Planetary Boundaries and Their Transgressions

The concept of "planetary boundaries" was proposed by a team of researchers, including climatologists led by Johan Rockström and Will Steffen, in a 2009 article in the journal *Nature*. They identified nine central biophysical processes that regulate the stability of the Earth's environment and defined thresholds beyond which humanity enters "risk zones." As cited in the article: "Transgressing one or more of these thresholds can be detrimental or even catastrophic." The nine boundaries identified include climate change, biodiversity loss, disruptions in the nitrogen and phosphorus cycles, land use, freshwater use, ocean acidification, stratospheric ozone depletion, atmospheric aerosol loading, and chemical pollution. Alarmingly, three of these boundaries—climate change, biodiversity loss, and the nitrogen cycle—have already been breached (IPBES, 2019). The interconnectedness of these processes suggests that crossing multiple boundaries could lead to more severe and irreversible environmental impacts.

The Importance of Sustainable Development

Humanity's pressure on Earth's natural systems underscores the need for sustainable development practices to remain within safe limits. The interaction between different ecosystem disruptions can amplify the effects of climate disasters, making them more detrimental. Sustainable development is vital to mitigate these risks and ensure the long-term viability of our planet's ecosystems.

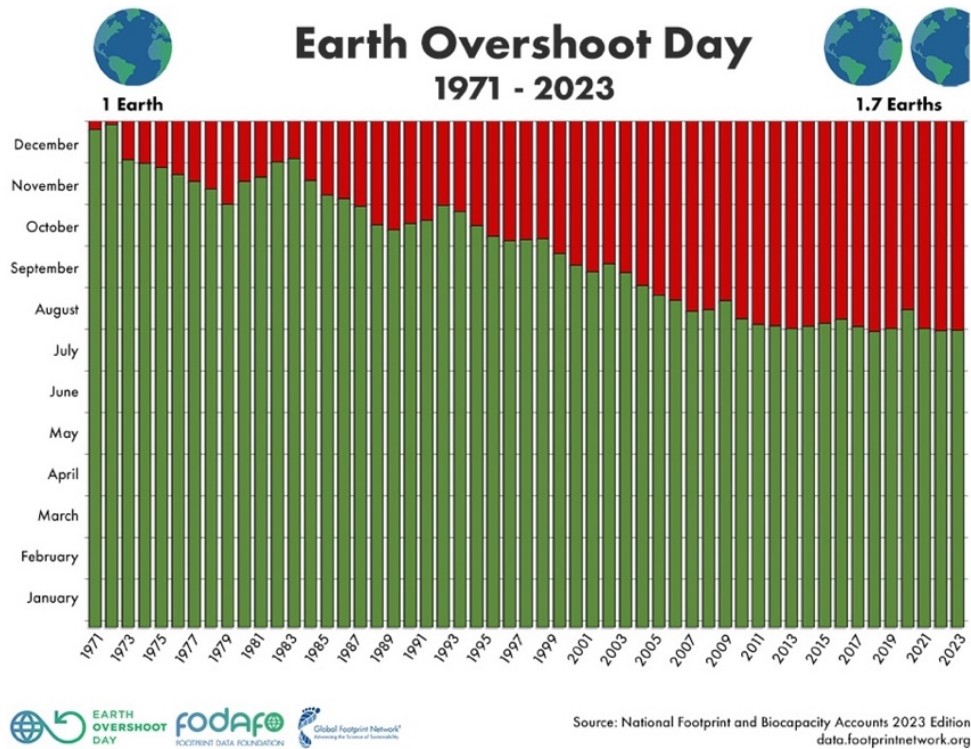


Figure 1: Past Earth Overshoot Days from 1971 to 2023. Source: (Earth Overshoot Day, 2023).

The graph provided illustrates Earth Overshoot Day from 1971 to 2023, based on UN statistics. The green bars represent the number of days each year that Earth's biocapacity can sustain humanity's ecological footprint, while the red bars indicate the period of overshoot. Earth Overshoot Day is calculated as follows:

$$(\text{Planet's Biocapacity} / \text{Humanity's Ecological Footprint}) \times 365 = \text{Earth Overshoot Day}$$

Figure 1 depicts that in 2023, Earth Overshoot Day fell on August 2nd, indicating that humanity exhausted the planet's annual resource budget by that date and operated in overshoot for the remainder of the year. The trend of advancing Earth Overshoot Day emphasizes the growing ecological deficit and the urgent need to address it.

2.1 Growing Concern of the SUP Packaging

Packaging Waste Generation

Waste Generation Management is one of today's biggest environmental Challenges the world is facing. The increase of waste production is due to the growing population as well as the urbanization and economic development processes (Voukkali et al., 2023). The combination of an accumulation of waste and the lack of an efficient waste collection,

management, and treatment ecosystem has led to catastrophic and irreversible consequences on the environment, ecosystems, and marine life (Seyed et al., 2023).

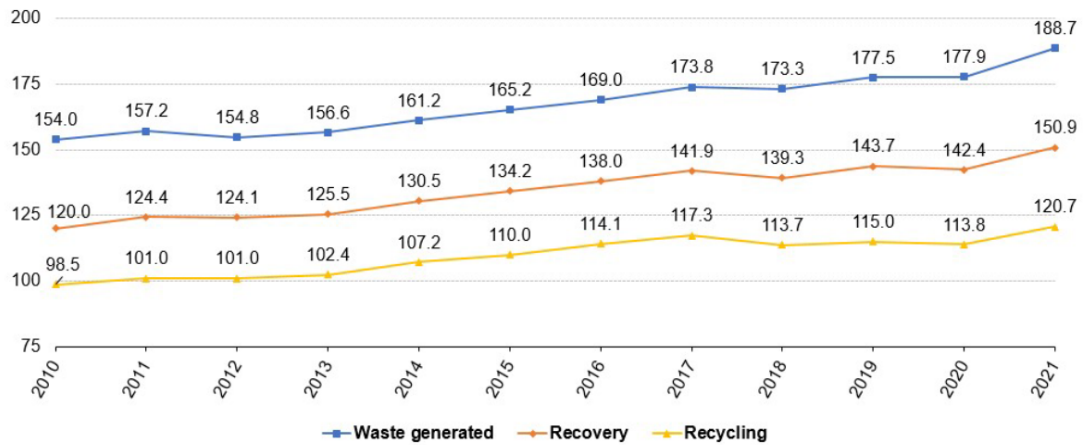


Figure 2: EU packaging waste generated, recovered, and recycled, 2010-2021 (kg/capita). Source: (Eurostat (a), 2023)

Europeans have never generated as much packaging waste (Eurostat (a), 2023). In 2021, the EU generated 188.7 kg of packaging waste per capita, 10.8 kg more per person than in 2011 (Figure 2). This is the largest increase in ten years and nearly 32 kg more than in 2011, as recalled by the European statistical office (Eurostat (b), 2023). The publication of these data comes as the battle rages in the European Parliament ahead of the vote, on October 2024, in the Environment Committee, on the packaging regulation. Projections indicate that if no measures are implemented, this figure could rise by 19% by 2030, and for plastic waste, the increase could reach 46% (Bong, 2024). Therefore, the production, distribution, and management of waste in Europe must be urgently regulated (Ragonnaud, 2024).

Analysis of Recycling and Recovery Rates

1. Recycling Rate Calculation:

$$\frac{120.7 \text{ kg}}{98.5 \text{ kg}} = 1.225 \Rightarrow 22.5\% \text{ growth}$$

2. Waste Generation Rate Calculation:

$$\frac{188.7 \text{ kg}}{154.0 \text{ kg}} = 1.225 \Rightarrow 22.5\% \text{ growth}$$

The Figure 2 illustrates the trends in EU packaging waste generated, recovered, and recycled from 2010 to 2021. During this period, packaging waste generated increased by

22.5%, from 154.0 kg to 188.7 kg per capita. Similarly, the recycling rate also rose by 22.5%, from 98.5 kg to 120.7 kg per capita. However, the rate of recycling has matched the growth rate of waste generation, indicating that despite improvements, the overall volume of waste recycled has not proportionally increased relative to the total waste produced. This trend suggests that current recycling policies are inadequate in reducing the overall waste burden and merely keep pace with the increasing waste.

The absolute intrinsic growth in recycling has paralleled the growth in waste generation, indicating that despite advancements in recycling practices, the overall volume of waste being recycled has not significantly improved relative to the increase in waste generation. Therefore, there is an urgent need for stricter regulation and more effective policies to address the growing waste challenge (Ragonnaud, 2024). Projecting the trends from 2020 to 2060, assuming a consistent 4% annual increase, highlights the urgency for more robust and effective waste management policies. If the growth rate of waste generation continues to mirror that of recycling, the gap between waste produced and recycled will persist, exacerbating environmental and ecological concerns.

The analysis underscores that the current rate of recycling must significantly exceed the rate of waste generation to achieve meaningful reductions in overall waste. The present policies are insufficient as they only accompany the growth in packaging waste rather than reducing it. Thus, Europe must urgently enhance its waste management strategies to not just manage, but to significantly reduce the production and improper disposal of packaging waste.

Linking Waste Trends to Packaging Necessity

As defined by the Packaging and Packaging Waste Directive, packaging serves essential functions in the lifecycle of products, including containment, protection, handling, delivery, and presentation (European Commission (a), 2022). Packaging is critical for ensuring the safe transportation and consumption of goods (Ragonnaud, 2024). However, its environmental impact is significant, contributing to waste production and posing a challenge to waste management systems (Kumari & Raghubanshi, 2022)

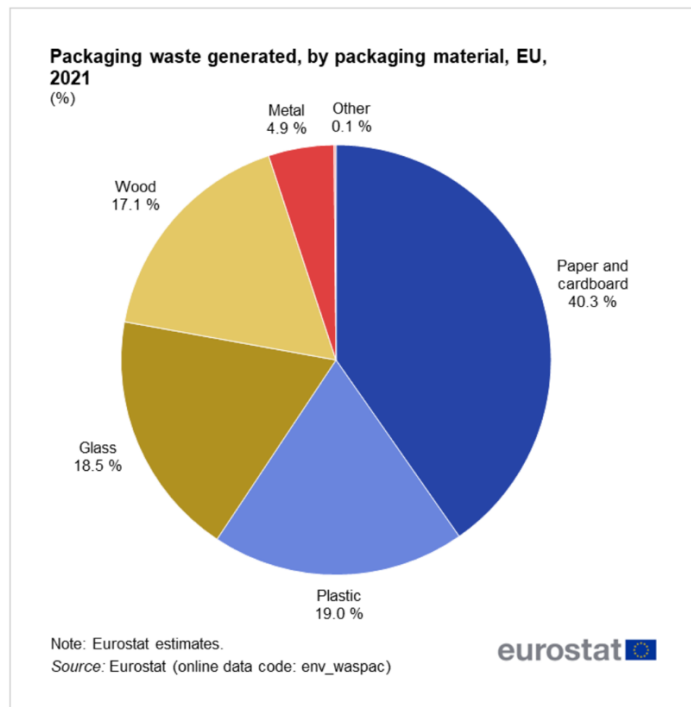


Figure 3: Packaging waste generated, by packaging material, EU, 2021. Source: (Eurostat (c), 2023).

As depicted in the Figure 3, the diversity of packaging materials—ranging from paper and cardboard to plastic, glass, wood, and metal—adds complexity to waste management efforts. Paper and cardboard lead in packaging waste volume, accounting for 40.3% of the total waste, followed by plastic (19%), glass (18.5%), wood (17.1%), and metal (4.9%) (Eurostat (c), 2024). Despite plastic being lightweight, its predominance in single-use applications exacerbates waste management issues, especially in developing countries where plastic waste management infrastructure may be lacking (The French Agency for Ecological Transition, 2022).

Packaging constitutes a substantial portion - representing 36% - of municipal solid waste (European Commission (b), 2022). Furthermore, the production of virgin materials for packaging is significant, with 40% of plastics and 50% of paper in the EU destined for packaging purposes. A crucial issue is that many packaging materials are not designed to facilitate easy recycling or reuse, and the labeling intended to guide consumers in sorting their packaging waste is often unclear (Bong, 2024). This highlights packaging as a major consumer of virgin materials and underscores the necessity of improving recycling and waste reduction strategies. The growing volume of packaging waste, as depicted in the Figure 3, directly correlates with the widespread use of packaging across various sectors. The essential functions of packaging make it indispensable, yet the current waste management policies and recycling efforts are insufficient to counterbalance the increasing waste generation. The need for packaging, particularly single-use plastic, has transformed from a solution into a significant environmental problem (Jemet et al., 2024).

The data analysis highlights the urgent need for enhanced waste management policies that can outpace the growth in packaging waste generation. While recycling rates have improved, they have not kept up with the overall increase in waste production, necessitating more aggressive and effective strategies. Packaging remains crucial for the economy and daily life, but its environmental impacts require urgent attention to develop sustainable practices that can mitigate waste generation and enhance recycling efficiency.

Rise of Plastic Production: An Irreversible Pathway

Plastic constitutes 71% of household packaging materials (The French Agency for Ecological Transition, 2022). Produced from fossil fuels and exacerbating the climate crisis, plastic production has increased significantly since the 1970s and is expected to triple by 2060, potentially generating up to 19% of global greenhouse gas emissions by 2040 (UNEP, 2023). The EU is a significant contributor to the leakage of land-based plastic waste into the seas which receive approximately 9 to 14 million tonnes of plastic waste annually, resulting in single-use plastic (SUP) products and packaging being the most common items found on European beaches (Jemet et al., 2024).

The production of single-use plastics accounts for 50% of total plastic production, with packaging being the most significant contributor, using 146 million metric tons in 2017 alone (Statista (a), 2024). The surge in plastic production has created a seemingly irreversible pathway in plastic packaging. Global annual plastic waste generation is projected to nearly triple from 2019 to 2060, reaching 1,014 million tonnes per year (Hitt et al., 2023). This increase is partly driven by the unsustainable use of single-use plastics, especially in regions lacking safe drinking water, leading to unprecedented levels of plastic pollution (Adam et al., 2020). Public awareness of the negative impacts of plastic production and consumption has grown, spurred by rising global plastic waste (Walker, 2021). Consumer plastics are derived from fossil fuels, and currently, 8% of global annual oil and gas consumption is attributed to plastics production (Plastics Europe, 2022). Plastic production is heavily dependent on fossil fuels, exacerbating environmental degradation. This dependency not only drives climate change but also significantly impacts biodiversity and human health.

Environmental Impact of Plastic Packaging

The life cycle of plastic packaging involves significant carbon emissions, whether it is littered, recycled, landfilled, or incinerated (Somlai et al., 2023). The growing consumption, ubiquity, and longevity of single-use plastic waste pose severe threats to both marine and terrestrial environments (Arijeniwa et al., 2024). These impacts extend beyond biodiversity, affecting human health due to the presence of microplastics and nanoplastics, which are less than 1 µm in size (Molenaar et al., 2021). These particles enter the human body through ingestion, skin contact, and inhalation, leading to adverse

health effects (Ghosh et al., 2023). Human health is also at risk, with microplastics entering the food chain and causing potential health issues (Jin et al., 2021).



Figure 4: Waste treatment in the EU. Source: (European Environmental Bureau, 2023).

With only 47% of waste recycled or composted in 2020, the rest of EU household waste was incinerated or buried (Eurostat (a), 2023). This substantial waste generation is driven by the low cost of virgin materials and versatility, making it cheaper to produce new plastic from virgin feedstocks than to recycle existing plastics (Ellen MacArthur Foundation, 2024). These materials are strong, durable, lightweight, easily modifiable, water-resistant, and bio-inert (Somlai et al., 2023). Additionally, the production of packaging, particularly plastic packaging, incorporates an insufficient quantity of recycled materials, or secondary raw materials (Bong, 2024). The omnipresence of SUP makes recycling and proper disposal challenging. At this critical juncture, it is essential to highlight the pressing issues that the EU is facing, particularly the increasing amount of packaging waste. Despite the significant efforts by policymakers and industry stakeholders, the volume of waste continues to rise (Dimopoulou, 2024). This persistent problem underscores the necessity for continued support from future policymakers to maintain momentum in addressing this challenge. However, waste management alone cannot adequately address the growing global plastic footprint (Borrelle et al., 2020). While waste collection and disposal present significant challenges, they also offer substantial opportunities for improvement. As illustrated in Figure 4, implementing effective and efficient waste management practices—such as recycling, reusing, reducing, utilizing landfills, and incineration—is essential for the sustainable development of any nation (Kumari & Raghubanshi, 2022).

The linear economy model, characterized by a "take, make, use, dispose" approach, perpetuates due to the constant growth of both the global population and the consumption of packaged goods (Arijeniwa et al., 2024). Continuing the "business as usual" scenario will only perpetuate global mismanagement of plastic waste and the production of single-use plastics, discouraging resource conservation (Ellen MacArthur Foundation, 2024). Therefore, it is crucial to phase out current unsustainable practices and adopt a more circular approach to plastic production and management.

2.2 Circular Economy Reusing Packaging Industry

The transition to a circular economy is critical for addressing the packaging waste problem. The traditional linear economy, characterized by the "take-make-dispose" model, involves extracting resources like oil and gas to produce plastic products, which are consumed once and then discarded (Knight, 2023). This model is increasingly unsustainable given the environmental challenges it poses (Ellen MacArthur Foundation, 2024). The inefficiency of existing frameworks in addressing plastic pollution has prompted a re-evaluation of business-as-usual scenarios. This shift towards circular economy principles emphasizes the importance of innovation in product design, policy initiatives, investments, and consumer education (Burke et al., 2023).

Circular Economy Principles for Tackling Packaging Waste

The linear model of production, where resources are extracted, used, and then disposed of, remains predominant. However, there is a gradual shift towards a circular economy, which emphasizes preserving resources and maximizing their recovery and regeneration (Burke et al., 2023). The circular economy is built around the principles of reducing, reusing, and recycling (the 3Rs), as well as considering biodegradable alternatives (Jemet et al., 2024). The transition from a linear to a circular economy involves several critical steps, as illustrated in the Figure 5.

Aspect	Linear Model	Circular Model
Reducing	Utilizes a significant amount of material, often with unnecessary packaging.	Minimizes the amount of material used in packaging and eliminates unnecessary packaging through redesign and innovation.
Reusing	Products are typically used once and then discarded.	Designs packaging to be reused multiple times, thereby extending its lifecycle.
Recycling	Limited recycling; many materials are not reprocessed into new products.	Ensures that packaging materials can be effectively recycled and reprocessed into new products.
Challenges	The dominance of the linear model poses significant challenges to implementing circular practices.	Requires systemic changes across industries, policy frameworks, and consumer behavior.

Figure 5: Transition from Linear to Circular Models. Source: Author's own. Adapted from: (Arijeniwa et al., 2024).

While the transition is underway, the linear model's dominance poses significant challenges to fully implementing circular practices. The shift requires systemic changes across industries, policy frameworks, and consumer behaviour.

Strategies for Circular Economy in Plastic Packaging

Embracing a circular economy for plastic packaging can significantly mitigate the waste problem. This approach ensures that plastic is used efficiently, benefiting society, the environment, and the economy (Ellen MacArthur Foundation, 2024). Key strategies include, first eliminating problematic plastics. Reducing unnecessary plastic packaging through redesign, innovation, and new delivery models. This involves banning overpackaging while maintaining the utility of essential packaging. Given the expected tripling of plastic demand by 2060, reducing material use is imperative. Secondly, by developing new packaging designs, materials, reprocessing technologies, and business models to ensure that all plastic packaging is reusable, recyclable, or compostable. Thirdly, one of the key circular economy strategy is to keep plastic within the economic loop and out of the environment (Ellen MacArthur Foundation, n.d.). This requires businesses to rethink product design and usage, and to enhance their contributions to reuse, recycling, and composting within their value chains. Effective material circulation involves collecting, sorting, and reintroducing materials into the production system. The EU's environmental and political framework supports the transition to a circular economy. Key regulations, such as the PPWR, set ambitious targets for recyclability, minimum recycled content, and reusable packaging, driving innovation and compliance across the industry. These regulations are designed to promote sustainability, reduce waste, and foster a circular economy.

Adopting circular economy principles, which emphasize reducing, reusing, and recycling, will help mitigate the environmental impact of packaging waste. This approach requires systemic changes across industries, policy frameworks, and consumer behaviors. By fostering innovation, economic efficiency, and environmental protection, the EU can transform its packaging industry and significantly reduce its ecological footprint (Jensen, 2024). The continued support of policymakers and industry stakeholders is vital to achieving these goals and ensuring a sustainable future for all.

2.3 Overview of Existing EU Policies and the rise of the PPWR

The PPWR is designed to address gaps in existing EU directives and create a cohesive approach to packaging waste management. The PPWR builds on several key directives, each contributing foundational concepts and frameworks that inform its development.

Political Background

The Waste Framework Directive (WFD) establishes core principles related to waste generation and management, such as treatment, recycling, and recovery (European Commission (c), 2023). It introduces the waste hierarchy, which prioritizes waste prevention over reuse and recycling, and recycling over other recovery options and final disposal via landfilling. Although the WFD provides a framework for waste management, it lacks specific, enforceable targets for packaging waste (Katsarova, 2023). The PPWR addresses this by establishing clear and ambitious reuse and recycling targets specifically for packaging materials, ensuring these materials are reused multiple times and effectively recycled. Furthermore, mandated by the WFD, the Extended Producer Responsibility (EPR) schemes ensure that producers are responsible for the waste stage of their products. However, inconsistencies in EPR fees and implementation across Member States create challenges for businesses operating in multiple EU countries. The PPWR aims to harmonize EPR fees, ensuring a fair and predictable cost structure across the EU, thereby promoting investment in innovative and environmentally friendly packaging solutions.

Another EU policy promoting circular economy is the Circular Economy Action Plan (CEAP) committed the Commission to assess the feasibility of harmonizing separate waste collection systems in Member States (Sinkko et al., 2024). While the CEAP provides strategic direction, it lacks binding measures to ensure implementation. The PPWR incorporates circular design principles from the outset and ensures a comprehensive life cycle assessment¹ (LCA) of packaging, promoting a systemic change towards circular economy principles.

¹ LCA is the compilation and evaluation of the inputs, outputs and potential environmental impacts of a product system throughout its life cycle (Sinkko et al., 2024).

The Single-Use Plastic Directive (SUPD) focuses on reducing the environmental impact of certain plastic packaging by setting product bans, mandating separate collection for recycling, and establishing minimum recycled content targets for single-use plastic beverage bottles (Somlai et al., 2023). Despite its effectiveness in targeting specific plastics, the SUPD did not fully integrate the principles of reducing and reusing packaging materials. The PPWR addresses these gaps by eliminating problematic plastics and reducing material use through redesign and innovation, integrating all aspects of the 3Rs (reduce, reuse, recycle).

The 2020 Own Resource Decision (ORD) established an own resource based on plastic packaging waste not recycled in specific Member States, incentivizing high recycling rates (European Commission (b), 2022). While the ORD creates flexibility, it lacks binding measures to ensure high recycling rates across all Member States. The PPWR provides a unified framework for packaging management, setting consistent definitions and standards for reusable and recyclable packaging, thus reducing friction and increasing predictability for businesses.

Several barriers hinder the efficient management of packaging and packaging waste in the internal market, arising from the heterogeneous legal landscape across the 27 member states. Differences in methods for defining reusable or recyclable packaging, inconsistencies in EPR fees, and various marketing restrictions create significant frictions. These challenges make it difficult for businesses to predict the legal environment, threatening new circular business models and leading to low investments in innovative and environmentally friendly packaging (Eur-lex, 2022).

Recently observed differences include labelling requirements for packaging, approaches to defining recyclable or reusable packaging as well as modulating EPR fees and marketing restrictions for certain packaging formats. Such discrepancies create legal uncertainty, leading to lower investment in innovative and environment-friendly packaging and new circular business models. Moreover, economic operators in selected packaging groups must meet mandatory reuse targets by 2030 and 2040, promoting sustainable practices across the EU (Sinkko et al., 2024).

Tuning the Orchestra: PPWR's Role in Harmonizing EU Policies

With an annual average of nearly 190kg of wrappers, boxes, bottles, cartons, and cans discarded per EU citizen, current trends suggest that without urgent policy action, this level of waste generation could rise to 209kg per capita by 2030 (Hodgson, 2024). The varied legal frameworks across the 27 EU Member States pose significant challenges to harmonizing packaging and waste management policies (Interviewee #10). The PPWR aims to create a unified framework that sets consistent definitions and standards for reusable and recyclable packaging, thereby reducing friction and increasing predictability for businesses (Polychroni, 2024). Supported by 476 lawmakers, with 129 voting against

and 24 abstaining, the PPWR is a binding regulation that takes immediate effect upon adoption, ensuring a unified approach across the EU (Interviewee #3).

The PPWR emphasizes the reuse and recycling of packaging and limits the use of disposable packaging, including a ban on disposable paper and plastic containers. This legislative step is crucial for advancing a circular economy (Katsarova, 2023). It aligns with international objectives, particularly Sustainable Development Goal 12.5 of the United Nations 2030 Agenda, which focuses on reducing waste generation through prevention, recycling, and reuse (Sinkko et al., 2024).



Figure 5: The Waste Hierarchy. Source: (European Commission (c), 2023).

Figure 5 illustrates the hierarchical framework, known as the "pyramid of priorities", emphasizing prevention, reuse, and recycling (Interviewee #9). The primary goal of the PPWR is to ban certain packaging formats and minimize packaging usage, prioritizing reuse before recycling to curb packaging waste growth and enhance sustainability. The PPWR exemplifies the EU's commitment to reducing plastic waste, banning harmful chemicals, and setting stringent recycling and reuse targets.

The PPWR's implementation timeline is complex, beginning with the first proposal in 2022 and expected to enter into force by the end of 2024 or early 2025, with full application by 2026. This timeline reflects the need to accommodate the diverse regulatory landscapes of the member states, resulting in some compromises for flexible implementation (Bong, 2024).

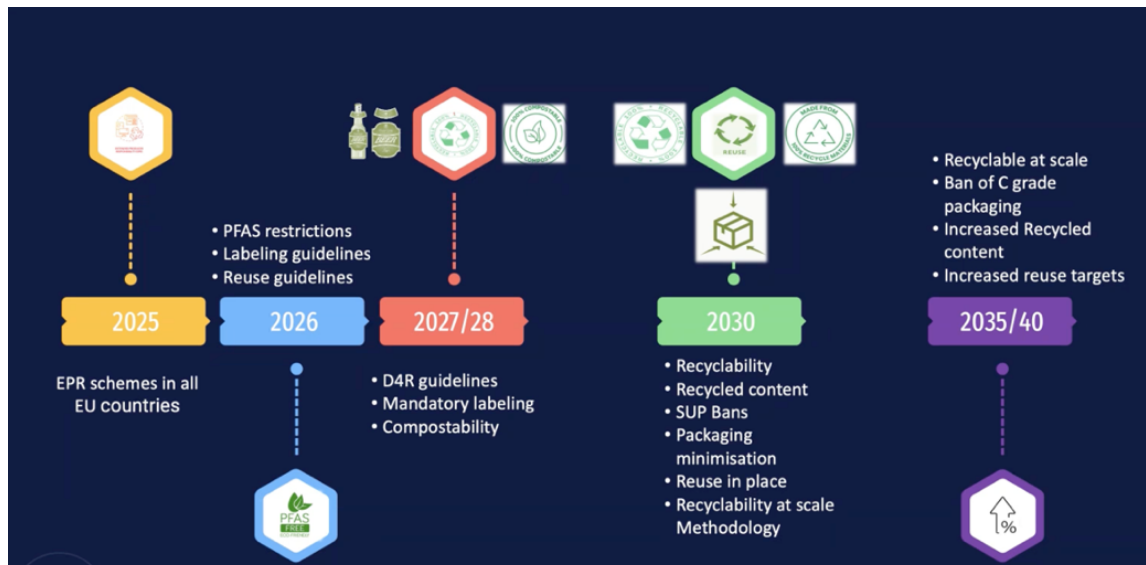


Figure 6: PPWR timeline at each stage, Source: (ViaPackaging et al., 2024).

Figure 6 outlines the timeline for implementing the PPWR, detailing key milestones. Starting January 1, 2026, single-use packaging will be banned in the food service industry, affecting items such as cups, plates, cutlery, straws, and cotton swabs. From 2030, the use of certain single-use plastic packaging formats will be prohibited in the hospitality industry (food and beverages), retail sector (fresh fruits and vegetables), and hotels (toiletries and hygiene products).

The PPWR mandates a 5% reduction in packaging waste by 2030, rising to 10% by 2035 and 15% by 2040, compared to 2018 levels (Popp, 2024). By January 1, 2030, all packaging must be economically recyclable (DG ENVI, 2024). Moreover, member states must ensure the separate collection of at least 90% of single-use plastic bottles and metal beverage containers by 2029, necessitating deposit return systems (DRS) (Dimopoulou, 2024). States with 80% collection rates by 2026 are exempt if they have a plan to exceed 90% by 2029. Moreover, to reduce unnecessary packaging, the empty space ratio inside packaging will be limited to 50% for certain categories. By 2030, at least 10% of alcoholic and non-alcoholic beverages and take-away food and beverages must be in reusable packaging within a reuse system (Chirez & Boddez, 2024). The regulation also enhances EPR, requiring producers to manage their packaging's entire lifecycle. It prohibits specific pollutants in food packaging, including per- and polyfluoroalkyl substances (PFAS), to prevent adverse health effects (Ghosh et al., 2023). Effective stakeholder engagement, including businesses, consumers, and policymakers, is crucial to support and implement the packaging waste reduction targets.

The ambitious nature of the PPWR, including its focus on reducing plastic waste, banning harmful chemicals, and setting stringent recycling and reuse targets, demonstrates the EU's commitment to addressing packaging waste and advancing a circular economy. Is a

5% reduction in packaging waste by 2030, 10% by 2035, and 15% by 2040 sufficient to mitigate the projected environmental impacts, considering the expected tripling of waste production by 2060 and the 22.5% growth in waste between 2010 and 2021? The project promotes reuse and recycling, such as beverage bottles, bans certain lightweight plastic bags, and regulates recycled plastics from sources such as China. How can stakeholders, including businesses, consumers, and policymakers, be effectively engaged to support and implement the 10% of products in a reusable packaging format by 2030?

Thus, which extent these targets can be achieved given the heterogeneous legal landscape of the 27 member states? What criteria and metrics should be used to evaluate the success of the 5% reduction target, and how can progress be measured against the backdrop of increasing waste production trends? The ambitions of the PPWR are indeed high, but they are necessary to drive industry-wide changes towards sustainability.

Adopting circular economy principles—emphasizing reducing, reusing, and recycling—is essential to mitigating the environmental impact of packaging waste. This approach requires systemic changes across industries, policy frameworks, and consumer behaviours. By fostering innovation, economic efficiency, and environmental protection, the EU can significantly reduce its ecological footprint. Achieving these goals and ensuring a sustainable future depends on continued support from policymakers and industry stakeholders. The PPWR aims to bridge gaps left by previous directives and promote a cohesive, comprehensive approach to packaging waste management.

3 Industrial Transition and Intense Lobbying of the PPWR

3.1 Unpacking the PPWR: Influences from Unprecedented Lobbying

The Packaging and Packaging Waste Regulation (PPWR) was introduced with the objective of reducing packaging consumption by emphasizing prevention and the implementation of reuse systems. This regulation prompted one of the most significant lobbying efforts in the history of the European Parliament, primarily driven by packaging producers, fast food chains, and trade associations. Investigations revealed extensive misinformation campaigns and opposition from organizations against climate science and action. These lobbyists held over 290 official meetings with Members of the European Parliament (MEPs), compared to just 21 meetings held by NGOs (Strinati, 2023). These entities actively lobbied against the legislation intended to mitigate packaging waste, advocating for delays in its implementation (Carlile, 2023).

Transforming the Value Chain: Societal Changes and Courageous Strategies

The PPWR aims to revolutionize the entire value chain from materials to consumers, necessitating significant societal changes and bold implementation strategies (Interviewee #4). This regulation represents a major advancement in the EU's environmental policy, emphasizing the democratization of reusable packaging and requiring fundamental shifts in societal models. It is one of the most comprehensive texts ever worked on by the European Parliament, demanding intricate and courageous implementation efforts (Chabaud, 2024).

Voices from the Frontline: Industry Interests Versus Environmental Goals

Marco Musso, Senior Policy Officer for Circular Economy at the European Environmental Bureau, criticized MEPs for siding with packaging producers and fast-food giants (Abou-Chleih, 2023). He argued that MEPs deleted provisions which would have simultaneously reduced waste, scaled up reuse, and created new economic opportunities for Europe. This decision, he stated, served the interests of polluters, compromising the EU's leadership in circular economy practices. Musso highlighted specific instances, such as the reluctance to ban unnecessary plastic wrapping for fruit or to promote the use of plates in restaurants (Baffoni, 2024). This critique underscores the tension between regulatory ambitions and industry resistance, necessitating targeted policies and incentives to overcome barriers to circularity.

Balancing Act: Reducing Plastic Waste Versus Preventing Food Waste

Several proposed amendments aimed to phase out single-use plastics, except where their absence could lead to increased food waste. However, these proposals were ultimately rejected, as they were perceived to create significant loopholes that could undermine the overall objective of the ban. Concerns from the plastic industry about the potential for increased food waste if lightweight plastic bags were banned outright influenced the legislative process. This highlights the tension between reducing plastic waste and preventing food waste (Interviewee #1).

Financial Stakes and Lobbying Pressure

The packaging manufacturing industry, with an annual revenue of €355 billion in 2018, underscored its substantial economic stake in the regulation (DG ENVI, 2024). This financial influence was a key factor in the aggressive lobbying efforts aimed at protecting industry interests. Suppliers to the fast-food industry applied significant pressure to preserve their financial interests and operational flexibility, which could be compromised by stringent regulatory measures aimed at waste reduction and sustainability. Based on the interviewees #1, #6, #9 and several articles in the PPWR, initially ambitious, were diluted after intense lobbying. The reuse provisions, currently Article 29 and previously Article 26 in the proposal, and the restrictions on packaging formats, now Article 25 and previously Article 22, were notably weakened. The Deposit Return Schemes (DRS) and bio-based packaging targets also faced significant alterations. Additionally, the PFAS regulations, initially high on the political agenda, were similarly impacted by lobbying pressures, resulting in only partial restrictions.

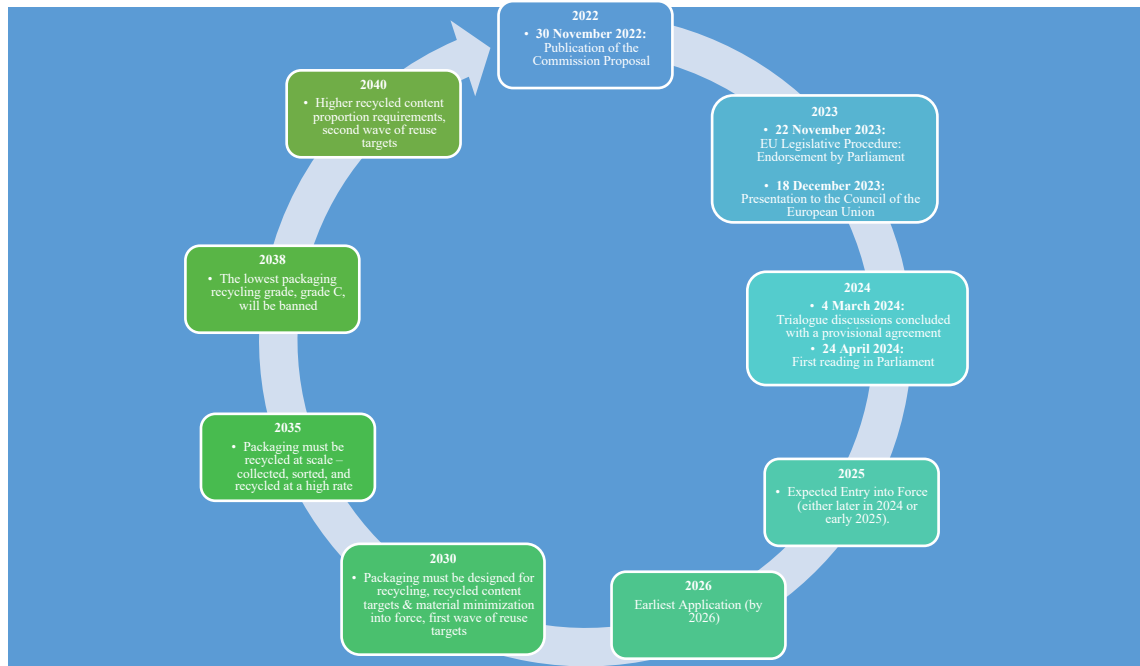


Figure 7: Timeline of PPWR Implementation. *Source: Author's own. Adapted from: (Ragonnaud, 2024).*

This timeline in Figure 7 is pertinent to understanding the interactions between stakeholders before the first reading was adopted by the European Parliament, illustrating the role of lobbying in shaping the regulation.

Governance Challenges: Economic Interests Versus Environmental Priorities

The intense lobbying from the most wasteful industries significantly altered the initial ambitions of the PPWR proposal, undermining efforts to prevent waste through false claims and alarmist statements (Baffoni, 2024). By October 2023, the Environment Committee had already diluted the proposal's ambition, and the November plenary session further weakened the provisions for managing the packaging waste crisis (Rethink Plastic, 2023). Roberta Metsola, the President of the European Parliament, initiated a judicial inquiry into the aggressive lobbying practices of single-use industries, which included extreme measures such as following MEPs into the toilet or entering their offices without permission ahead of crucial votes (Cater, 2024). Pascal Canfin described the industry lobbying as "almost unethical", indicating significant oversteps of boundaries (Cater, 2024). This situation underscores a broader issue of governance, where economic interests often outweigh environmental and public health priorities. Consequently, while the PPWR marks progress in certain areas, it fails to fully align with the ambitious goals of significantly reducing packaging waste and fostering a more sustainable packaging industry within the EU (Palacin, 2023).

Navigating the Complexities of the PPWR

The PPWR represents a significant legislative milestone in the EU's environmental policy. Its comprehensive nature, depicted through 71 articles, requires a detailed examination of specific provisions to fully understand its implementation challenges and opportunities (Interviewee #9). With packaging production consuming 10% of oil and gas in the EU and half of the paper used in the region, the selection of single-use plastics in the food industry and paper will provide a roadmap for navigating the complexities of the regulation, offering insights into the pathways towards achieving its ambitious environmental goals (Jahnz & Stoycheva, 2022).

3.2 Single-Use Plastics in the Food Industry

Challenges and Context

Single-use plastics are ubiquitous in the food industry due to their convenience, leading to significant plastic waste. The challenge is to balance the convenience and economic benefits of single-use plastics with the need to reduce environmental impact. The PPWR mandates a shift from single-use to sustainable packaging solutions, requiring companies to rethink their marketing and distribution strategies (Interviewee #5). This transition can alter product presentation and consumer perception, necessitating effective communication about environmental commitments. It is crucial to note that packaging in direct contact with food is excluded from this regulation for safety and public health reasons.

This comprehensive analysis highlights the delicate balance between regulatory ambitions and the practical realities of implementation within the framework of the PPWR, showcasing the significant influence of lobbying efforts and the subsequent adaptations by the industry.

The PPWR could have had a significant impact on combating single-use plastics, especially in the take-away sector. However, intense lobbying from large corporations, most notably McDonald's, argued vehemently against the regulation, citing that a substantial portion of their revenue is generated through take-away sales, which necessitates the continued use of disposable packaging (Interviewee #10). In November 2023, MEPs faced a pivotal decision: uphold the reuse targets in Article 26 and address unnecessary packaging (Article 25 & Annex V) with sustainable solutions, or yield to intense lobbying from the single-use packaging industry (Popp, 2024). Article 25 of the PPWR stipulates restrictions on certain packaging formats in the HoReCa (hotels, restaurants, and cafes) sector starting January 1, 2030. Annex V of this regulation provides the list of such packaging formats, which includes exemptions for metal packaging and composite materials like plastic-coated paper cups and window bags.

There are exceptions for micro-enterprises and establishments with specific hygiene requirements.

	Packaging format	Restricted use	Illustrative example
1.	Single-use plastic grouped packaging	Plastic packaging used at retail level to group goods sold in cans, tins, pots, tubs, and packets designed as convenience packaging to enable or encourage end users to purchase more than one product. This excludes grouped packaging necessary to facilitate handling in distribution.	Collation films, shrink wrap
2.	Single use plastic packaging, single use composite packaging or other single use packaging for fresh fruit and vegetables	Single use packaging for less than 1.5 kg fresh fruit and vegetables, unless there is a demonstrated need to avoid water loss or turgidity loss, microbiological hazards or physical shocks.	Nets, bags, trays, containers
3.	Single use plastic, single use composite packaging or other single use packaging	Single use packaging for foods and beverages filled and consumed within the premises in the HORECA sector, which include all eating area inside and outside a place of business, covered with tables and stools, standing areas, and eating areas offered to the end users jointly by several economic operators or third party for the purpose of food and drinks consumption	Trays, disposable plates and cups, bags, foil, boxes
4.	Single use packaging for condiments, preserves, sauces, coffee creamer, sugar, and seasoning in HORECA sector	Single use packaging in the HORECA sector, containing individual portions or servings, used for condiments, preserves, sauces, coffee creamer, sugar and seasoning, except such packaging provided together with take-away ready-prepared food intended for immediate consumption without the need of any further preparation	Sachets, tubs, trays, boxes
5.	Single use hotel miniature packaging	For cosmetics, hygiene and toiletry products of less than 50 ml for liquid products or less than 100 g for non-liquid products	Shampoo bottles, hand and body lotion bottles, sachets around miniature bar soap

Figure 8: Annex V of Article 25 on *Restrictions on use of certain packaging formats*. Source: (European Commission (a), 2022).

In the context of single-use plastics in the food industry, there is no comprehensive ban currently in place. Figure 8, representing Annex 5 of Article 25, outlines specific restrictions on the use of certain packaging formats. According to line 3, there is a prohibition on single-use plastic packaging within the HoReCa sector, specifically targeting fast food establishments. This regulation means that any item categorized as single-use plastic packaging cannot be used in fast food restaurants. However, such packaging can still be sold in supermarkets for consumer use (Interviewee #9). It is crucial to understand that the regulation does not impose a blanket ban on single-use plastic packaging but rather restricts its use in specific contexts (Interviewee #9). This distinction highlights the absence of a horizontal ban across all sectors. While certain types of single-use plastic packaging are restricted, non-plastic alternatives remain permissible. The regulatory framework also includes measures such as banning very lightweight plastic bags, except for specific hygiene purposes or when used as primary packaging for loose food items to prevent food waste.

The plastic industry lobbied to weaken the minimum recycled content requirements and delay the implementation of stricter standards (Mehdorn et al., 2024). Proposed amendments to phase out single-use plastics were ultimately rejected, as they were perceived to create significant loopholes that could undermine the overall objective of the

ban. Concerns about increased food waste, if lightweight plastic bags were banned outright, influenced the legislative process, highlighting the tension between reducing plastic waste and preventing food waste (Interviewee #1).

McDonald's Leads Lobbying Offensive Against Laws to Reduce Packaging Waste in Europe

A message from McDonald's stated: "A switch to reusable packaging as proposed in the Packaging and Packaging Waste Regulation brings hidden costs for the environment" (Hanke Vela, 2023). McDonald's and the packaging industry have sponsored multiple articles to support their stance (Interviewee #6). Notably, McDonald's sponsored an article in Politico EU, a highly influential publication read by nearly six million readers monthly in Brussels. The article claimed that "Reusable packaging will be counterproductive to Green Deal goals." This message appeared in the Brussels Playbook newsletter (Carlile, 2023).

The global management consulting firm Kearney launched a study, funded by McDonald's, employing pessimistic assumptions regarding the environmental impact of switching to reusable packaging systems. It suggested that it would increase greenhouse gas (GHG) emissions by 50% for dine-in and 260% for take-away packaging (Strinati, 2023). The report advocated for implementing some recycling infrastructure for dine-in scenarios but advised against reusable packaging for take-away (Romano, 2023).



Figure 9: Packaging industry flyers distributed ahead of the vote in the European Parliament in November 2023. Source: (Engelmann, 2023).

The Figure 9 depicts the use of this study, stating that it was from an "independent study", used by the industry lobbying to distribute these flyers ahead of the vote in the European Parliament, in November 2023. When it is written on the flyer "This is the opposite of what the EC is trying to achieve", this statement is based on false foundations. In contrast, the European Commission provided science-based evidence predicting that

the PPWR measures could reduce GHG emissions by 23 million tonnes annually by 2030 (Carlile, 2023). This perspective is supported by American researchers who found that global warming could be reduced by over 50% if reusable components were used 20 times instead of single-use alternatives (Hitt et al., 2023). As a result, they are playing with false statement from corrupted studies funded by McDonald's, in order to confuse the audience before voting the PPWR.

McDonald's, a key player in this lobbying offensive, produces over a billion kilos of packaging waste annually—equivalent to the weight of 100 Eiffel Towers (Carlile, 2023). The pressure exerted on this legislation seeks to undermine Europe's net zero ambitions. The proposed legislation would necessitate a significant shift in how these companies produce, brand, and market their products, which are heavily dependent on packaging for delivering fast, fresh, and hot food while promoting safety and reducing food waste, according to a McDonald's spokesperson (Romano, 2023). McDonald's and similar companies are resistant to changing and upgrading their infrastructure due to the substantial investments required (Interviewee #2). Their primary argument, however, is that reusable packaging would negatively impact the environment. "The current system works really well for them because they get to keep using single-use packaging ... it's still very profitable," explained Justine Maillot from the advocacy organization Rethink Plastics Alliance². However, policies encouraging reuse will require "systemic change" (Carlile, 2023).

The aggressive lobbying efforts led by McDonald's against the EU's Packaging and Packaging Waste Regulation (PPWR) underscore the tension between corporate interests and environmental sustainability. By funding studies with pessimistic assumptions about the environmental impacts of reusable packaging, McDonald's and its allies aim to influence public opinion and legislative outcomes. These efforts highlight the broader challenges faced by regulatory bodies in implementing policies that balance economic and environmental goals. Despite industry pushback, the European Commission and independent researchers provide robust evidence supporting the environmental benefits of reusable packaging, which is essential for achieving the EU's ambitious climate targets. This case illustrates the complexities of transitioning to sustainable practices in the face of entrenched industrial interests and emphasizes the need for transparent, science-based policymaking to address the pressing issue of packaging waste.

² Rethink Plastic is an alliance of leading European NGOs, representing thousands of active groups, supporters and citizens in every EU Member State. Rethink Plastic is part of the global Break Free From Plastic movement, consisting of over 11,000 organisations and individuals worldwide demanding an end to plastic pollution.

3.3 Cardboard Exemption and the Paper Industry

Challenges and Context

Under the Article 29 of the PPWR, reusable packaging must be conceived, designed, and placed on the market to ensure it can be reused multiple times. This requirement applies across various sectors, mandating specific reuse targets for transport and sales packaging (Mehdorn et al., 2024). In December 2023, the European Council reviewed the PPWR and updated the re-use and re-fill targets for 2030 and 2040, exempting cardboard packaging from these targets (European Council, 2023). This exemption results from significant lobbying by the paper industry and has profound implications. To illustrate how limited the portion of the market is concerned by the reuse targets, a German NGO NABU³ has found that since 70% of the transport packaging market in Germany is cardboard, the reuse targets effectively apply to only 30% of the market (Reusable Packaging Europe, 2024). Thus, the 40% target by 2040 is actually relevant to a much smaller segment, undermining the overall impact of the regulation. This means that the reuse targets would only influence a reduced portion of the market, given that the majority—comprising 70% of the transport packaging market—is already reusable (Druta, 2024). This discrepancy highlights a critical issue: the current ambitions of the regulation are not as robust as they could be. The existing reuse systems for transport packaging are highly advanced and scaled, making it practical and beneficial from a business perspective to move goods in reusable packaging throughout the EU (Druta, 2024). Despite this, significant challenges remain in advancing these ambitions, which should be a focal point for future efforts. The implications are clear: while the targets appear ambitious on paper, their actual impact is diluted by exemptions. Therefore, strengthening these targets is essential to achieving more substantial progress in the reuse of packaging materials across the EU.

Industry Perspective on Reusable Packaging

"One of the major players was Cefi, representing the paper industry, which argued that paper is recyclable and therefore not problematic." (Interviewee #2). The European association representing the paper industry, Cefi, a non-profit-making organisation together with other paper associations, including ECMA, EPPA, FEFCO conducted a study in March 2023 that provided a critical assessment of the proposed PPWR's reuse targets. This study reveals several key insights. Firstly, the study found that reusable plastic packaging would result in a 160% increase in CO₂ emissions compared to paper and cardboard packaging in the delivery sector, and a 40% increase in the e-commerce sector (CEPI, 2023). Secondly, the implementation of reusable packaging solutions

³ NABU (The Nature And Biodiversity Conservation Union) is Germany's oldest and largest environmental association.

would impose substantial costs on manufacturers and consumers. Thirdly, the logistics involved in transportation, identified as a major source of CO₂ emissions, would further exacerbate these costs. Reusable packaging options predominantly rely on materials derived from fossil fuels, raising significant environmental concerns. Lastly, the introduction of reusable packaging would increase the complexity of the value chain, necessitating substantial investments and leading to higher costs for companies and consumers due to the need for multiple packaging setups. While paper is often considered environmentally friendly due to its biodegradable, recyclable, and renewable properties, its production process involves high consumption of water and energy (Oloyede & Lignou, 2021). Furthermore, certain types of paper-based packaging face biodegradability and recyclability challenges due to the presence of printing inks and chemicals (Deshwal et al., 2019).

Environmental Concerns and Alternatives

Sergio Baffoni, Senior Paper Packaging Campaigner at the Environmental Paper Network, asserts that the Council's support for paper packaging exemptions undermines the regulation's goal to reduce packaging waste. He emphasizes, "The Council's support for paper packaging exemptions undermines the regulation's aim to reduce packaging waste (Baffoni, 2024). Instead, it will increase cardboard packaging, adding to the 3 billion trees cut down annually for packaging. True ambition would not include this exemption. Forests are not packaging factories" (Baffoni, 2024).

Replacing plastic with materials like paper, aluminium, or glass can lead to unintended consequences, such as increased water usage, higher carbon emissions, and greater food waste. This issue necessitates a comprehensive perspective that addresses the entire packaging system, from material sourcing and production to usage and disposal (Ellen MacArthur Foundation, 2024). However, this practice has led to significant consequences, including increased water usage, higher carbon emissions, and greater food waste. Moreover, a surge in eucalyptus forest fires in Portugal, Brazil has been attributed to the extensive use of eucalyptus for paper production, touted as a recyclable miracle solution. It is imperative to avoid simplistic substitutions, such as replacing plastic with paper. Therefore, a systemic approach is required, one that redesigns the relationship between plastic production and usage. Instead, a conservation-based model is required, one that eschews both plastic and paper in favour of more sustainable practices.

Addressing these issues necessitates a comprehensive perspective that considers the entire packaging system, from material sourcing and production to usage and disposal (Turkcu & Tura, 2023). Thus, a systemic approach is required, one that redesigns the relationship between plastic production and usage. Moreover, Pascal Canfin supports the notion that substituting plastic with paper merely shifts the problem, creating a dependency on forests. He argues that "The first step is thus to reduce useless packaging" (Taylor, 2023).

It is crucial to address the root of the issue—reducing waste—rather than merely substituting one form of dependency with another.

3.4 Public Frustration and Criticism

Intense Lobbying Efforts Lead to Dilution of Targets

The PPWR's ambitious reuse and recycling targets, initially proposed by the European Commission, were significantly diluted due to intense lobbying efforts (Parkinson, 2023). Lobbyists employed aggressive and direct tactics, such as confronting MEPs in informal settings and placing promotional materials on office doors, thereby bypassing official channels and transparency rules (Vasques, 2023). These actions violated internal transparency guidelines, which mandate that all interactions between lobbyists and EU legislators should occur in official meetings to ensure transparency and integrity. The established procedures to maintain transparent lobbying activities were systematically undermined. Lobbyists circumvented these rules by directly approaching MEPs, urging them to vote against the legislation or support amendments favourable to their interests (Vasques, 2023). This resulted in a significant influence on legislative votes, bypassing the intended transparent debate and decision-making processes. Pascal Canfin, Chair of the Environment Committee (ENVI), highlighted these issues, noting that the legislation faced "enormous lobbying by several companies, starting with the fast-food sector," and criticized the use of "biased" studies funded by industry to sway votes. Canfin pointed out the ethical concerns with these studies, which relied on proprietary research and confidential data, undermining the legislative process (Canfin, 2024).

NGO Criticism and Legislative Compromises

Rethink Plastic, an alliance of NGOs dedicated to limiting plastic pollution, strongly criticized the European Parliament's actions, stating that the Parliament had "destroyed the EU's hopes of reducing packaging waste by siding with the disposable industry" (Rethink Plastic, 2023). They argued that intense lobbying led to numerous exemptions in the legislative framework, potentially undermining the regulation's effectiveness in achieving its environmental objectives (Palacin, 2023). Frédérique Ries, the rapporteur of the text, expressed frustration over these compromises, noting that while the legislation banned harmful chemicals like PFAS and bisphenol A, the numerous exemptions diluted its overall message on waste prevention and circular economy principles (Palacin, 2023).

In its initial proposal, the European Commission had set out ambitious goals to translate these objectives into actionable measures (Interviewee #6). However, the reduction goals have not been effectively translated into action across other parts of the legislation. As a result, the focus remains heavily on recycling, leaving significant gaps in addressing waste prevention and circular economy principles comprehensively.

Glimmers of Hope Amidst Challenges

Despite the setbacks, there are still significant achievements within the PPWR. For the first time, the Commission established concrete targets for prevention and reuse, marking a departure from previous EU legislation, which lacked specific targets and methodologies for calculation (Interviewee #9). This represents a success story, as these targets are not merely theoretical but address specific economic operators and come with concrete methodologies for implementation. While the ambition of the PPWR was reduced, the main elements of the proposal remain intact in a compromised form that still makes sense. This reflects a synchronized effort among stakeholders to negotiate and find compromises, ensuring the inclusion of meaningful and concrete provisions (Interviewee #4). As a result, history teaches us to appreciate the progress made, even if it seems slow, and underscores the importance of continuing to work towards ensuring that reusable systems deliver their environmental benefits effectively (Chabaud, 2024). It is crucial to maintain momentum in the reuse movement and strive for greater ambition in future mandates (Druta, 2024). The future of circularity hinges on its ability to transcend niche status and become mainstream. This transition requires robust regulatory frameworks, industry collaboration, and significant investments in new technologies and systems. The PPWR marks significant progress, but there is ample room for greater ambition to fully realize the potential of circular economy principles.

The Packaging and Packaging Waste Regulation (PPWR) has highlighted the profound challenges of balancing environmental goals with powerful industrial interests. The intense lobbying efforts from the packaging and fast-food industries, particularly exemplified by McDonald's, have significantly influenced the legislative process, often diluting the ambitious targets initially proposed by the European Commission. These industries have employed aggressive strategies and funded studies to create a narrative that reusable packaging would be detrimental to environmental goals, thus protecting their interests. Despite these efforts, the PPWR represents a critical step forward in the EU's environmental policy. The regulation's emphasis on reusable packaging and waste reduction, although compromised, still marks a significant advancement towards a circular economy. The ongoing tension between regulatory ambitions and industrial resistance underscores the need for robust, science-based policymaking and the implementation of comprehensive strategies that can withstand lobbying pressures.

Looking ahead, the next chapter will explore the broader implications of the PPWR. It will examine whether the regulation's push for circularity will remain a niche concept or serve as a catalyst for business innovation. This analysis will delve into how the PPWR can transform industry practices, foster new economic opportunities, and drive sustainable development within the EU.

4 Implication of PPWR - Will Circularity Stay a Niche Concept or Catalyse Business Innovation?

The PPWR aims to transition circularity from a niche concept to a catalyst for business innovation. While significant challenges exist, opportunities for improvement and innovation, coupled with strong regulatory frameworks, financial investments, and public education, can foster a sustainable transformation in the packaging sector. By addressing industry resistance and supporting new business models, the PPWR holds the potential to drive long-term environmental benefits and economic sustainability.

4.1 Opportunities for Improvement and Innovation

Long-term Sustainability of New Business Practices in the Packaging Sector

The PPWR seeks to inspire significant changes in business practices within the packaging sector, promoting long-term sustainability. The World Economic Forum emphasizes that CE should be viewed not merely as an alternative business model but as a fundamental blueprint for building a sustainable future (Jensen, 2024). Traditionally, products designed under a linear model follow a pattern of obsolescence, promoting excessive consumption and repeated production for profit maximization (Burke et al., 2023). This linear approach results in continuous waste generation and the depletion of natural resources (Knight, 2023). Conversely, a circular approach to plastic ensures that materials are reused rather than consumed, benefiting society, the environment, and the economy (European Parliament, 2023).

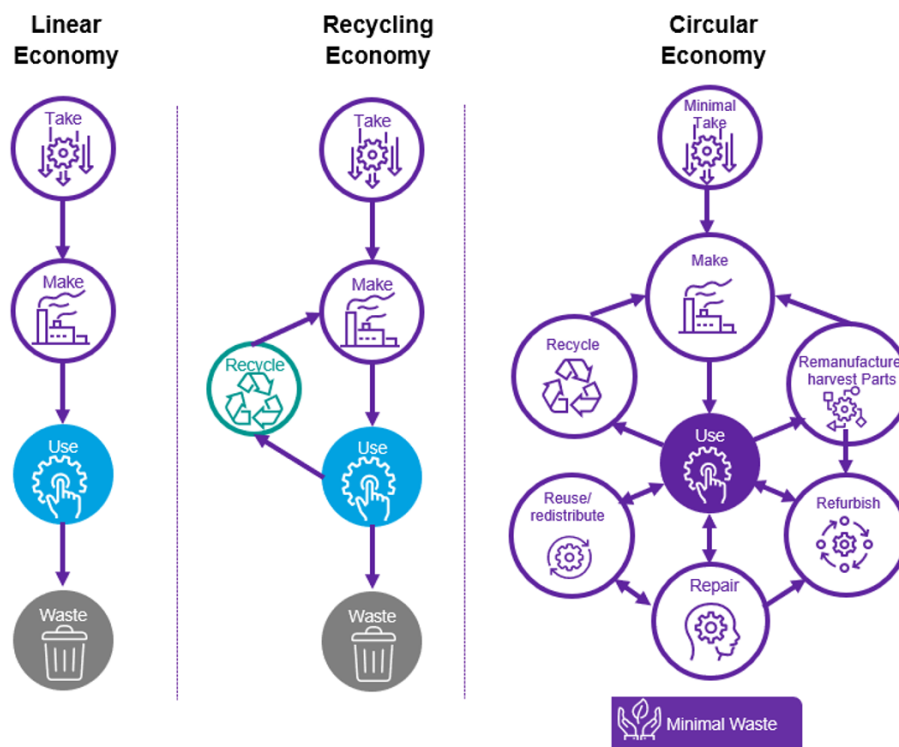


Figure 10: Differences between the linear economy, the recycling economy and the circular economy. Source: (Jensen, 2024).

To keep plastic packaging within the economic loop and out of the environment, businesses must rethink product design and usage, contributing to reuse, recycling, and composting within their value chains, as depicted in Figure 10. Material circulation involves collecting, sorting, and rebuilding materials for reintroduction into the system (Ellen MacArthur Foundation, 2024).

Weighing the Waste: Single-Use vs. Reusable Packaging

In response to industry-prepared studies from proponents of single-use packaging, including major players such as McDonald's and the paper industry, the European Commission's Joint Research Centre (JRC) published a comprehensive report on February 20, 2024, titled "Exploring the Environmental Performance of Alternative Food Packaging Products in the European Union." This report evaluates the environmental impacts of single-use versus reusable packaging through Life Cycle Assessment (LCA) studies in various food service scenarios. Serving as a preparatory study for the decision-making process regarding the PPWR, the report addresses a complex and technical topic under significant time constraints (Rantanen, 2024).

The research incorporated six case studies classified into four scenarios to evaluate the environmental impacts of single-use and reusable (multi-use) packaging products. These scenarios encompassed packaging used in the hospitality, catering, and beverage sectors,

including cups, trays, beverage containers, and glass bottles for both alcoholic and non-alcoholic drinks (Seyring, 2024). Additionally, the study featured a case study on a restaurant with table service. These studies, which addressed 16 different environmental impacts—including greenhouse gas emissions, toxicity, and ozone depletion—consistently showed that reusable packaging tends to perform better environmentally compared to single-use alternatives. A significant finding of the report was the impact of washing practices on the environmental performance of multiple-use packaging products. The use of hot water for rinsing and rewashing can notably affect outcomes, though it was found that water use for cleaning reusable packaging was minor compared to the high water consumption in producing cardboard for single-use options (CORDIS, 2024).

Urban Efficiency: The Advantages of Reusable Packaging in Cities

The environmental benefits of reusable packaging improve significantly in dense urban areas where the return of reusable items involves less transportation, suggesting that reusable packaging solutions are particularly advantageous in urban settings where logistical efficiencies can be optimized. The effectiveness of reusable packaging is also heavily dependent on consumer participation in return and reuse schemes and the availability of infrastructure to support these activities effectively (Parkinson, 2024). While the JRC report generally favours reusable packaging due to its lower environmental impacts in most scenarios, it also acknowledges that the choice between reusable and single-use can be context-dependent. Factors such as local recycling facilities, urban density, consumer behaviour, and specific environmental impact categories all play crucial roles in determining the more sustainable option (European Commission, 2024).

Circular Design: Balancing Environmental Targets with Practical Realities

Circular product design, aiming to improve environmental performance while reducing waste, creating jobs, and enhancing the decomposition of materials, is a nuanced approach that ensures the PPWR can effectively reconcile ambitious environmental targets with practical stakeholder realities (Burke et al., 2023).

The impact assessment of the PPWR proposal highlights both economic and social benefits. Economically, the shift to reusable packaging is expected to reduce costs for businesses, particularly in the fast food and restaurant sectors. These businesses will purchase less packaging and incur lower CSR (Corporate Social Responsibility) costs. Although there are initial costs associated with the installation of necessary equipment, such as washing machines, exemptions exist for micro-companies and regions facing water scarcity, ensuring that the most vulnerable businesses are not unduly burdened.

Job Boost: The Employment Impact of Reusable Packaging

Socially, the job market will experience a transformation. While there might be a reduction in jobs related to single-use packaging manufacturing, the rise of new

opportunities in the reuse sector will offset these losses. The economic modelling associated with the transition from single-use to reusable packaging projects a significant shift in employment and economic benefits within the EU. By 2030, it is estimated that approximately 600,000 new jobs will be created as a direct result of this transition (Willeghems & Bachus, 2018). This job creation stems from the new demands in the reuse sector, including manufacturing and service-oriented roles. For instance, the bottling industry, which currently has limited facilities for reusable bottles in the EU, is expected to expand significantly. This expansion will necessitate the production of new equipment and machinery, creating additional manufacturing jobs. Moreover, the implementation of reuse systems will require new logistics and service models, further contributing to job creation across various stages, from manufacturing to operational services (Interviewee #9). Additionally, financial savings of about €47.2 billion are anticipated across the EU, translating to an average saving of €100 per EU citizen if these savings are transferred to consumers (European Commission (c), 2023)

Finding Middle Ground: Compromise Between EC and Industry

The PPWR has undergone significant lobbying, resulting in a compromise between the EC and industry stakeholders. Companies like McDonald's have taken proactive measures to align with the regulation, investing in research and innovation to develop non-plastic, fiber-based packaging solutions. This effort highlights the industry's acknowledgment of the challenges and limitations associated with packaging waste and their commitment to improving waste management practices (Interviewee #9). Industries have also made strides in enhancing collection systems and reducing littering. For example, fast-food chains are improving their waste collection practices beyond their immediate premises. The regulation reflects this compromise by mandating certain actions, such as ensuring the collection of all packaging waste, while allowing flexibility in reaching reuse targets. Although these targets are not mandatory, they serve as guidelines for companies to aspire to more sustainable practices (Interviewee #5).

Regulating Business Models: A Shift Towards Sustainability

Therefore, PPWR aims to restructure business models rather than solely focusing on consumer behavior. By targeting producers and encouraging the adoption of recyclable and reusable packaging, the regulation indirectly influences consumer behaviour, driving systemic change within the industry (Interviewee #3).

In summary, the PPWR represents a significant step towards sustainable packaging practices in the EU. The JRC study underscores the environmental advantages of reusable packaging, while the economic impact assessment highlights job creation and cost savings. The compromise between the EC and industries exemplifies the collaborative effort required to achieve these ambitious environmental targets. Businesses and civil society play a crucial role in this transition, driving innovation and supporting the

systemic changes needed to reduce packaging waste and promote circular economy principles.

4.2 Recommendations for collaborative innovation: Business and Civil Society in Transition

A Sustainable Shift: Driving Innovation for a Circular Economy

The transition to sustainable packaging solutions necessitates active participation from both businesses and civil society. Innovative projects across the EU are developing and scaling up reuse systems, mobile cleaning and washing systems, and improved logistics. This collaborative effort is driven by the clear regulatory push towards reuse, fostering innovation and enhancing the performance of reusable packaging solutions (Interviewee #7). Given that the food and beverage (F&B) sectors are major producers of sustainable packaging waste, they should actively collaborate with recyclers, technology providers, and environmentalists to develop and implement sustainable packaging solutions (Arijeniwa et al., 2024).

Promoting Industry Collaboration in Achieving Scaling Reuse

Reuse systems must reach scale to be truly effective, much like how recycling systems evolved. In the 1960s, the establishment of recycling systems was driven by the need to manage the increasing volume of plastic waste. This involved public services and producers focusing on waste management. For reuse to succeed, a similar concerted effort and long-term vision are required, by “Waiting for reuse to scale” (Interviewee #2). Waiting for reuse to reach scale is essential for its effectiveness. The initial investments in systems for collection, reverse vending machines, and traceability are high but necessary for creating a functional reuse system. Long-term economic advantages will emerge once these systems are established and harmonized.

It's important to note that while there is a long-term economic advantage to reuse, substantial investment is required upfront. Implementing comprehensive collection structures and reverse logistics systems involves creating an entirely new infrastructure. Currently, our consumption system is linear—extract, transform, market, consume, and dispose—where producers bear most of the costs (Knight, 2023). To shift to a reuse model, both public and private investments are needed to develop scalable and efficient systems. For instance, the German model and its pooling systems for beverage containers have been successfully managed. It highlights the need for a harmonized and mutualized approach to develop effective reuse systems (Bielenstein, 2022). Therefore, standardizing reusable packaging designs is a critical strategy for enhancing the efficiency of reuse systems. By creating uniform packaging dimensions, businesses can facilitate easier stacking, storage, and transport of reusable containers. This uniformity reduces logistical complexities and allows for more streamlined operations across various stages of the supply chain (Larkin et al., 2024). Standardization not only simplifies handling

procedures but also supports the integration of automated systems, further boosting operational efficiency (Rejeb et al., 2022).

The Role of Pooling Systems in Cost Reduction

Pooling structures, wherein multiple businesses share a common inventory of reusable packaging, offer significant economic and environmental benefits. By participating in pooling systems, companies can reduce their individual costs associated with purchasing and maintaining reusable containers (Interviewee #7). The shared use of a centralized inventory increases the utilization rates of each packaging unit, thus distributing the costs and extending the lifecycle of the packaging materials. This approach also minimizes the environmental impact by reducing the total number of containers required in circulation, thereby lowering resource consumption and waste generation (Larkin et al., 2024).

Long-term Objectives for Circularity

The future of circularity hinges on minimizing waste and maximizing the recyclability and reusability of packaging. The implementation of harmonized recycling standards, as mandated by recent regulations, ensures that all packaging materials are designed to be recyclable (Interviewee #2). This harmonization addresses previous inconsistencies in recycling processes and is expected to significantly increase recycling rates while improving the quality of recycled materials. The optimization of recycling operations will likely lead to reduced costs and enhanced efficiency within the recycling industry. The economic impacts of the PPWR have been carefully assessed to avoid imposing undue burdens on small and vulnerable businesses. Measures include:

- Exemptions for micro-companies and regions with water scarcity from the obligation to implement reuse systems.
- Shifting obligations from beverage manufacturers to retailers, who must meet quotas by sourcing products in reusable packaging. This ensures that the responsibility for implementing reuse practices does not disproportionately fall on producers.

By considering these factors, the PPWR aims to balance ambitious environmental targets with practical stakeholder realities, promoting a sustainable and inclusive transition to a circular economy.

Investment for Scaling Reuse to be as Optimized as Recycling

To achieve parity between reuse and recycling systems, substantial investment is essential. Both public and private sectors must contribute to developing comprehensive collection and logistics systems. Currently, the lack of significant investment hampers the economic viability of reuse initiatives, particularly for early adopters who must bear the high costs of establishing these systems. Effective reuse systems require expensive

infrastructure, including reverse vending machines and traceability mechanisms. Without adequate funding, pilot projects remain small-scale, leading to poor economic and ecological outcomes (Interviewee #7). The economic advantage of these investments becomes apparent in the long term. Although the initial setup for reuse systems requires significant financial input to establish a comprehensive collection structure and reverse logistics, the benefits are substantial. Creating this inverted logistics system involves extracting, transforming, marketing, consuming, and then disposing of products in a manner that shares costs among producers (Interviewee #2). For instance, the development and implementation of waste prevention systems, including zero-waste and reusable packaging initiatives, need increased funding.

Deposit Return Schemes (DRS)

DRS play a crucial role in ensuring high return rates of reusable packaging. By incentivizing consumers to return packaging through monetary deposits, DRS can drastically reduce littering and increase recycling rates (Martinho et al., 2024). A report published by Zero Waste Europe indicates that countries with well-established DRS, such as Germany and the Netherlands, have achieved impressive return rates, contributing to the overall success of their reusable packaging systems (Coelho et al., 2020). Despite the initial high costs, reuse systems offer long-term economic advantages (Interviewee #2). Reuse can become economically viable by properly implementing reuse criteria and employing effective methods. This requires substantial funding to scale up operations and ensure efficient systems, similar to successful models observed in countries like Germany with its GDB⁴ pooling system for beverages (Bielenstein, 2022). A well-funded and harmonized approach can lead to optimized systems that offer economic benefits through mutualization and shared infrastructure (Pike, 2024).

Case Study: Zero Packaging Innovations

The PPWR exemplifies advances in managing packaging and food waste within the EU. One emerging solution is the rise of Zero Waste Shops, where consumers bring their containers to purchase products. While effectively reducing packaging waste, these shops face challenges, including higher costs and hygiene concerns. Financial support or incentives could make these shops more accessible, while strict sanitary standards are essential to maintain safety.

⁴ With around 180 member companies, the Genossenschaft Deutscher Brunnen (GDB) manages the reusable and recycling systems of German mineral springs. The most famous trademark of these pool systems is the pearl bottle for mineral water. There are around 1 billion returnable bottles and around 100 million associated crates in the returnable systems. This makes it the largest managed reusable system in Europe.

Public-Private Collaboration and Funding Sources

Currently, many pilot projects are underfunded and small-scale, leading to suboptimal economic and ecological outcomes. Long-term economic benefits will materialize if adequate funding is provided to develop comprehensive collection and logistics systems for reuse. Significant investment is needed to scale reuse systems to the level of recycling, with both public and private investments being crucial. Without sufficient investment, reuse initiatives struggle to achieve economic and ecological benefits (Interviewee #2). Investment is essential for scaling reuse to be as optimized as recycling. To achieve this, substantial funding must ensure the establishment of robust infrastructure, including reverse vending machines and traceability systems. This initial investment can be particularly challenging for the initial players who must bear the high costs of setting up these systems. Currently, many pilot projects are launched tentatively, resulting in poor economic and sometimes ecological outcomes due to their limited scale (Interviewee #2).

The STOPP initiative

The STOPP (Sustainable Food Packaging and Processing) initiative exemplifies how collaborative projects can drive investment in reuse systems. Funded by SIRE and the European Union's Horizon Program, STOPP aims to promote sustainable food packaging and reduce plastic waste through a circular economy approach. Recently, the EU allocated almost €4 billion for the STOPP initiative under the Horizon Europe program. This research project, running until 2026, focuses on creating circular strategies for plastic usage and processing. Moreover, it will implement awareness campaigns involving a multi-actor network that includes participants from every stage of the food packaging value chain (Parkinson, 2024; Food Packaging Forum).

The STOPP project involves 14 partners from seven countries collaborating over 36 months to facilitate Europe's transition towards sustainable food packaging while maintaining food safety standards. The project aims to:

- **Analyze the impact of plastic waste:** Investigating the effects of plastic waste on various ecosystems to understand its environmental impact comprehensively.
- **Monitor plastic usage:** Evaluating the current use of plastics within the food packaging industry to identify areas for improvement and reduction.
- **Create a sustainable business model:** Developing a replicable business model that promotes sustainable practices in food packaging and processing.
- **Enhance recycling efforts:** Implementing actions to improve recycling rates and the efficiency of recycling processes.
- **Conduct a customer voice study:** Gathering consumer feedback to understand their preferences and behaviors related to sustainable packaging, ensuring that solutions align with market demands (Hermann et al., 2022; Parkinson, 2024; Cordis, 2024).

Promoting these systems and better integrating Short Food Supply Chains (SFSCs) between rural and urban areas, with a focus on retail and SMEs, can enhance sustainability. Successful reuse systems depend on meeting specific reuse criteria and employing best practices. Properly implemented, reuse can be economically viable, necessitating financial support to scale operations effectively and allow for mutualization. Harmonizing and pooling resources is critical for creating efficient systems. The German GDB pooling system for beverages is a prime example of how centralized management can optimize resource use and economic returns (Pike, 2024).

This collaboration can lead to innovative practices and technologies that benefit the entire industry. There is a growing intention within the business community to actively reduce single-use plastic packaging (Interviewee #5). The consumer's role is crucial in mitigating the plastic crisis, as their willingness to pay more for environmentally friendly packaging influences market trends. However, a financial burden may arise from transitioning to more sustainable packaging options (Popp, 2024). Therefore, companies and policymakers must understand consumer preferences to develop effective strategies for reducing single-use packaging (Wikström et al., 2014). By addressing these objectives, STOPP aims to foster a transition to sustainable food packaging practices, thereby reducing plastic waste, and minimizing its environmental footprint.

Economic Incentives for Businesses

Providing economic incentives for businesses to adopt reusable packaging can accelerate the transition from single-use systems. These incentives could include tax breaks, subsidies for the initial setup of reuse systems, and lower tariffs on reusable packaging materials. Additionally, incorporating cost analyses in life cycle assessments (LCAs) can help businesses understand the long-term financial benefits of switching to reusable packaging (Coelho et al., 2020). The economic impacts of the PPWR have been carefully assessed to avoid imposing undue burdens on small and vulnerable businesses. Measures include:

- Exemptions for micro-companies and regions with water scarcity from the obligation to implement reuse systems.
- Shifting obligations from beverage manufacturers to retailers, who must meet quotas by sourcing products in reusable packaging. This ensures that the responsibility for implementing reuse practices does not disproportionately fall on producers.

By considering these factors, the PPWR aims to balance ambitious environmental targets with practical stakeholder realities, promoting a sustainable and inclusive transition to a circular economy.

Economic Factors and Food Waste

The low cost of food relative to household incomes contributes to a throwaway culture. Consumers often undervalue food due to its affordability, leading to higher waste levels (Stroosnijder, 2024). Addressing this requires a multi-faceted approach, including raising awareness about the true cost of food waste and implementing policies that promote responsible consumption. Efforts to reduce plastic packaging and food waste must include promoting short food supply chains (SFSCs), which connect consumers directly with local farmers. Solutions include:

- **Zero-Waste Retailers and Restaurants:** Encouraging zero-waste establishments can foster reuse habits among consumers, significantly reducing waste (Pike, 2024).
- **Food Cooperatives:** These cooperatives utilize collective action to bring sustainability into the supply chain while maintaining individual preferences.

Consumer Education and Behavioural Change in Sustainable Packaging

The role of consumer education is paramount in the transition towards sustainable packaging practices. A significant aspect not previously mentioned is the need for extensive public awareness and education, as seen with recycling initiatives. As noted in an interview “consumers want to be part of the solution, not part of the problem” (Interviewee #9). Educating consumers about new sustainable practices is crucial for fostering these changes. Raising consumer awareness about the environmental benefits of reusable packaging is vital. Public awareness campaigns should focus on educating consumers about the importance of reuse, the proper ways to handle and return reusable packaging, and the environmental impacts of single-use alternatives (Miao et al., 2023). Effective campaigns can shift consumer behaviour towards more sustainable practices, similar to successful recycling awareness initiatives in the past.

Consumer Influence on Market Trends

Consumers play a vital role in mitigating the plastic crisis through their purchasing decisions. Their willingness to pay a premium for environmentally friendly packaging significantly influences market trends (Oloyede & Lignou, 2021). However, transitioning to sustainable packaging often involves financial burdens. Understanding consumer preferences is therefore essential for companies and policymakers to develop effective strategies to reduce single-use packaging (Fogt Jacobsen et al., 2022). Adopting sustainable packaging practices requires significant changes in consumer behaviour. Given that consumers interact with packaging an average of 12 times per day, the transition to more sustainable habits is both challenging and costly (Interviewee #1). On the one hand, recyclable packaging plays a key role for businesses which prefer recycled content over virgin materials, thus an economically viable model is essential. Consumers also face challenges due to inadequate recycling infrastructure, which needs significant

improvements to handle increased recycling demands effectively. On the other hand, reusable packaging's efficiency is limited, with return rates at only 50%. Despite the availability of reusable e-Commerce packaging in the EU for over a decade, the PPWR's goal of achieving 10% of shipments in reusable packaging by 2030 highlights the need for improved systems and consumer compliance. Therefore, this transition demands considerable investment and effort from all stakeholders, emphasizing the need for supportive policies, infrastructure development, and consumer education.

Addressing Hygiene and Safety Concerns

Ensuring the hygiene and safety of reusable packaging is critical for consumer acceptance. Reusable packaging systems must adhere to strict sanitary standards to prevent contamination and health risks. Developing robust cleaning protocols and using materials that are easy to sanitize can address these concerns (Deshwal et al., 2019; DG ENVI, 2024). Public health guidelines should be integrated into the design and operation of reusable packaging systems.

Labelling from Article 12

To ensure that both consumers and businesses clearly understand the regulations, goals, and requirements outlined in the PPWR, several initiatives are being planned or considered. A significant measure highlighted in Article 12 is the provision for reusable containers to carry specific labels, such as logos or digital formats like QR codes. This labelling is crucial for distinguishing between reusable and single-use items (Druta, 2024). Every piece of packaging will feature a label indicating the appropriate disposal method once it becomes waste. This label will also appear on packaging containers, ensuring consistency and clarity for consumers. This dual labelling system allows consumers to easily identify and dispose of packaging correctly, reinforcing proper waste sorting practices. This initiative, developed by the JRC aims to enhance consumer awareness and education on waste sorting (Interviewee #9). Public authorities will also need to conduct training sessions to raise awareness about these labelling schemes, benefiting from a harmonized labelling system for both packaging and waste containers. The objective is to improve consumer behaviour regarding waste disposal through a standardized approach, ultimately increasing acceptability and compliance with the regulations. These QR codes can be scanned by users to access detailed information about the container's lifecycle, including the number of rotations, its current status (e.g., reconditioning, washing, or cleaning), and other relevant details. This digital labelling initiative aims to educate citizens on the benefits of reusable containers and promote their use (Interviewee #9). While the QR code is not mandatory, it is a voluntary practice already being implemented in some countries, such as Germany. The push from legislation is expected to scale up this practice, leading to increased use and awareness of reusable containers. By 2030, it is anticipated that the adoption of QR codes and other digital tracking methods will significantly improve, driven by legislative targets and the

overall framework of reuse (Interviewee #9). By incorporating QR codes and other digital labels, consumers are encouraged to engage with packaging in new ways. Scanning a QR code to access information about the packaging and its background introduces a new behaviour in their consumption habits. This practice can significantly increase consumer awareness and sensitivity to sustainable packaging, ultimately fostering more environmentally conscious behaviour.

Public Awareness and Incentives

Public awareness campaigns are essential for shifting consumer choices towards eco-friendly options. Educating consumers about the benefits of reuse can mirror the success seen with recycling awareness campaigns (Interviewee #2). Concrete incentives, such as financial rewards or penalties, can also motivate consumers to adopt sustainable practices. Price is a significant determinant of consumer behaviour. To shift preferences away from single-use plastics, the EU could implement taxes on plastics and incentivize bulk purchases. Promoting local and seasonal products through short supply chains can also reduce packaging waste, supporting local agriculture and minimizing environmental impact.

Therefore, the PPWR is a landmark initiative by the European Union that aims to foster a circular economy by significantly reducing packaging waste. However, the regulation's journey has been marked by intense lobbying from various industry sectors, particularly those heavily invested in single-use packaging, such as the fast food and packaging industries. This discussion delves into the dual nature of industry influence—both as a formidable barrier and as a potential ally in achieving the regulation's ambitious targets.

Conclusion

The PPWR is a landmark initiative by the European Union that aims to foster a circular economy by significantly reducing packaging waste. However, the regulation's journey has been marked by intense lobbying from various industry sectors, particularly those heavily invested in single-use packaging, such as the fast food and packaging industries. This discussion delves into the dual nature of industry influence—both as a formidable barrier and as a potential ally in achieving the regulation's ambitious targets. Indeed, the PPWR has faced unprecedented lobbying efforts that have diluted some of its most ambitious provisions. Industries, particularly those related to fast food and packaging, have argued against stringent regulations, citing economic burdens and practical challenges. For instance, McDonald's and other major corporations have raised concerns about the increased costs and logistical complexities associated with transitioning to reusable packaging systems. Their lobbying efforts have led to compromises that may undermine the regulation's effectiveness in some areas. The case of McDonald's sponsoring articles and studies to sway public opinion and legislative votes highlights the significant influence these industries wield. Their argument that reusable packaging could counterintuitively increase greenhouse gas emissions and operational costs has resonated with some policymakers, leading to the softening of certain PPWR targets. Similarly, the paper industry successfully lobbied for exemptions, arguing that paper is recyclable and thus less problematic, despite the environmental costs associated with its production.

The Need for Industry Collaboration

Despite the challenges posed by industry lobbying, it is crucial to recognize that these stakeholders also hold the key to a successful transition to sustainable packaging solutions. Industries possess the resources, expertise, and infrastructure necessary to implement scalable and effective reuse and recycling systems. Therefore, bringing these actors on board is essential for achieving the PPWR's objectives.

The EU can foster collaboration by providing economic incentives for industries to innovate in sustainable packaging solutions. Tax breaks, subsidies, and grants for research and development in reusable packaging technologies can motivate industries to invest in more sustainable practices. Establishing standardized designs for reusable packaging can enhance the efficiency of reuse systems. Pooling systems, where multiple businesses share common reusable packaging inventories, can reduce costs and improve utilization rates. Such collaborative efforts can lead to significant reductions in both environmental impact and operational expenses. Developing public-private partnerships can leverage the strengths of both sectors. The STOPP initiative, which focuses on sustainable food packaging and processing, is a prime example of how collaborative projects can drive investment in reuse systems (Brunn, 2024). By working together, public authorities and

private companies can create robust infrastructure for collection, sorting, and recycling, ensuring the successful implementation of the PPWR. Industries can play a pivotal role in educating consumers about the benefits of reusable packaging and promoting sustainable consumption practices. Effective labelling, digital tracking systems, and public awareness campaigns can enhance consumer participation in reuse initiatives, fostering a culture of sustainability.

Balancing Ambition with Practicality

While it is essential to set ambitious environmental targets, the PPWR must also consider the practical realities faced by industries. This balance can be achieved by setting phased targets that allow businesses time to adapt and innovate. Additionally, providing flexibility in meeting these targets, such as through voluntary guidelines and best practice sharing, can encourage industries to transition at a manageable pace.

The intense lobbying efforts by various industries have undoubtedly impacted the PPWR's initial ambitions. However, these stakeholders are also integral to achieving the regulation's long-term goals. By fostering collaboration, incentivizing innovation, and engaging consumers, the EU can navigate the complexities of industry influence and drive a successful transition to a circular economy. The PPWR has the potential to significantly reduce packaging waste and promote sustainable practices, but this success hinges on the active participation and commitment of all stakeholders involved. Through a balanced and inclusive approach, the EU can ensure that the PPWR not only sets ambitious targets but also achieves scalable and practical solutions for a sustainable future.

Bibliography

- Abou-Chleih, S. A. (2023, October 24). *A weakened packaging regulation survives attempt to decimate its environmental ambition—EEB - The European Environmental Bureau*. <https://eeb.org/a-weakened-packaging-regulation-survives-attempt-to-decimate-its-environmental-ambition/>
- Adam, I., Walker, T. R., Bezerra, J. C., & Clayton, A. (2020). Policies to reduce single-use plastic marine pollution in West Africa. *Marine Policy*, *116*, 103928. <https://doi.org/10.1016/j.marpol.2020.103928>
- Arijenwa, V. F., Akinsemolu, A. A., Chukwugozie, D. C., Onawo, U. G., Ochulor, C. E., Nwauzoma, U. M., Kawino, D. A., & Onyeaka, H. (2024). Closing the loop: A framework for tackling single-use plastic waste in the food and beverage industry through circular economy- a review. *Journal of Environmental Management*, *359*, 120816. <https://doi.org/10.1016/j.jenvman.2024.120816>
- Baffoni, S. (2024, June 10). *Packaging: The EU Parliament in the hands of McDonalds? | Environmental Paper Network*. <https://environmentalpaper.org/2023/11/packaging-the-eu-parliament-in-the-hands-of-mcdonalds/>
- Bielenstein, T. (2022). *Refillable bottle systems in Germany – a Model for Well-Designed Pool Systems in Europe?* https://zerowastecities.eu/wp-content/uploads/2022/05/220510_Presentation_Zero_Waste_Europe.pdf
- Blot, D., Tramoy, R., Gasperi, J., & Tassin, B. (2021). Le continent oublié. Lumières et zones d'ombre des recherches sur la dissémination des plastiques. *Natures Sciences Sociétés*, *29*(4), Article 4. <https://doi.org/10.1051/nss/2022002>

- Bong. (2024, February 4). *PPWR - Top 10 measures of the Packaging Regulation* | Bong. <https://www.bongretail.com/en/10-measures-packaging-regulation-ppwr/>
- Bonneau, C. (2020). Les limites planétaires. *Regards croisés sur l'économie*, 26(1), 41–46. <https://doi.org/10.3917/rce.026.0041>
- Borrelle, S. B., Ringma, J., Law, K. L., Monnahan, C. C., Lebreton, L., McGivern, A., Murphy, E., Jambeck, J., Leonard, G. H., Hilleary, M. A., Eriksen, M., Possingham, H. P., De Frond, H., Gerber, L. R., Polidoro, B., Tahir, A., Bernard, M., Mallos, N., Barnes, M., & Rochman, C. M. (2020). Predicted growth in plastic waste exceeds efforts to mitigate plastic pollution. *Science*, 369(6510), 1515–1518. <https://doi.org/10.1126/science.aba3656>
- Brunn, M. (2024, February 7). STOPP: Strategies for food plastic packaging circularity. *RECYCLING Magazine*. <https://www.recycling-magazine.com/2024/02/07/stopp-strategies-for-food-plastic-packaging-circularity/>
- Burke, H., Zhang, A., & Wang, J. X. (2023). Integrating product design and supply chain management for a circular economy. *Production Planning & Control*, 34(11), 1097–1113. <https://doi.org/10.1080/09537287.2021.1983063>
- Cairns-Lee, H., Lawley, J., & Tosey, P. (2022). Enhancing Researcher Reflexivity About the Influence of Leading Questions in Interviews. *The Journal of Applied Behavioral Science*, 58(1), 164–188. <https://doi.org/10.1177/00218863211037446>
- Carlile, C. (2023, May 9). McDonald's Leads Lobbying Offensive Against Laws to Reduce Packaging Waste in Europe. *DeSmog*. <https://www.desmog.com/2023/05/08/mcdonalds-leads-lobbying-offensive-against-laws-to-reduce-packaging-waste-in-europe/>

- Cater, L. (2024, January 26). *Parliament probing lobbyists who fought sustainable packaging rules*. POLITICO. <https://www.politico.eu/article/eu-parliament-qatargate-climate-lobbyists-sustainable-packaging-rules/>
- CEPI. (2023). *Impact Assessment of reuse targets in proposed PPWR*. https://www.cepi.org/wp-content/uploads/2023/04/202303-Impact-Assessment-of-reuse-targets-in-proposed-PPWR_FINAL.pdf
- Chabaud, C. (Director). (2024, April 6). *Webinar: “Glass half full or half empty: Will the PPWR be the game changer the reuse industry expected ?”* [Webinar].
- Chirez, & Boddez. (2024, May). *How will the Packaging and Packaging Waste Regulation impact companies?* https://www.ey.com/en_be/climate-change-sustainability-services/how-will-the-packaging-and-packaging-waste-regulation-impact-companies
- Coelho, P. M., Worrell, E., & Corona, B. (2020). *Zero Waste Europe Reloop REUSABLE VS SINGLE-USE PACKAGING*. https://zerowasteurope.eu/wp-content/uploads/2020/12/zwe_reloop_report_reusable-vs-single-use-packaging-a-review-of-environmental-impact_en.pdf.pdf_v2.pdf
- CORDIS. (2024). *Strategies to prevent and reduce plastic packaging pollution from the food system | STOPP Project | Fact Sheet | HORIZON*. CORDIS | European Commission. <https://cordis.europa.eu/project/id/101134958>
- Deshwal, G. K., Panjagari, N. R., & Alam, T. (2019). An overview of paper and paper based food packaging materials: Health safety and environmental concerns. *Journal of Food Science and Technology*, 56(10), 4391–4403. <https://doi.org/10.1007/s13197-019-03950-z>

- DG ENVI. (2024, April 24). *New EU rules to reduce, reuse and recycle packaging* | News | European Parliament. <https://www.europarl.europa.eu/news/en/press-room/20240419IPR20589/new-eu-rules-to-reduce-reuse-and-recycle-packaging>
- Dimopoulou, P. (2024, April). *Packaging: Council and Parliament strike a deal to make packaging more sustainable and reduce packaging waste in the EU*. Consilium. <https://www.consilium.europa.eu/en/press/press-releases/2024/03/04/packaging-council-and-parliament-strike-a-deal-to-make-packaging-more-sustainable-and-reduce-packaging-waste-in-the-eu/>
- Druta, E. (Director). (2024, April 6). *Webinar: “Glass half full or half empty: Will the PPWR be the game changer the reuse industry expected?”* [Webinar].
- Earth Overshoot Day. (2023). Past Earth Overshoot Days—#MoveTheDate of Earth Overshoot Day. *Earth Overshoot Day*. <https://overshoot.footprintnetwork.org/newsroom/past-earth-overshoot-days/>
- Ellen MacArthur Foundation. (n.d.). *Plastics and the circular economy*. Retrieved May 27, 2024, from <https://www.ellenmacarthurfoundation.org/plastics-and-the-circular-economy-deep-dive>
- Ellen MacArthur Foundation. (2024). *Design and the circular economy*. <https://www.ellenmacarthurfoundation.org/topics/circular-design/overview>
- Engelmann, M. (2023, November 23). *PPWR unpacked Part 14: Parliament decides*. <https://www.linkedin.com/pulse/ppwr-unpacked-part-14-parliament-decides-negotiating-martin-engelmann-dga3e/?trackingId=guTEmFwpSLOWkr3A6e5IOQ%3D%3D>
- European Commission (a). (2022). *Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU)*

2019/904, and repealing Directive 94/62/EC. <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52022PC0677>

European Commission (b). (2022). *Impact Assessment Report of PPWR Proposal*.

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2022:384:FIN>

European Commission (c). (2023). *Waste Framework Directive—European*

Commission. https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en

European Council. (2023). *Packaging and packaging waste: Council adopts its*

negotiating position on new rules for more sustainable packaging in the EU.

<https://www.consilium.europa.eu/en/press/press-releases/2023/12/18/packaging-and-packaging-waste-council-adopts-its-negotiating-position-on-new-rules-for-more-sustainable-packaging-in-the-eu/>

European Environmental Bureau. (2023). Waste prevention. *EEB - The European*

Environmental Bureau. <https://eeb.org/work-areas/circular-economy/waste-recycling/>

Eurostat (a). (2023). *Packaging waste statistics*. [https://ec.europa.eu/eurostat/statistics-](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Packaging_waste_statistics)

[explained/index.php?title=Packaging_waste_statistics](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Packaging_waste_statistics)

Eurostat (b). (2023, October 19). *EU packaging waste generation with record increase*.

<https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20231019-1>

Eurostat (c). (2024). *Packaging waste statistics Statistics Explained*.

<https://ec.europa.eu/eurostat/statisticsexplained/>

Fogt Jacobsen, L., Pedersen, S., & Thøgersen, J. (2022). Drivers of and barriers to

consumers' plastic packaging waste avoidance and recycling – A systematic literature review. *Waste Management*, 141, 63–78.

<https://doi.org/10.1016/j.wasman.2022.01.021>

- Fournier, E., Etienne-Mesmin, L., Grootaert, C., Jelsbak, L., Syberg, K., Blanquet-Diot, S., & Mercier-Bonin, M. (2021). Microplastics in the human digestive environment: A focus on the potential and challenges facing *in vitro* gut model development. *Journal of Hazardous Materials*, *415*, 125632.
<https://doi.org/10.1016/j.jhazmat.2021.125632>
- Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. *Science Advances*, *3*(7), e1700782.
<https://doi.org/10.1126/sciadv.1700782>
- Ghosh, S., Sinha, J. K., Ghosh, S., Vashisth, K., Han, S., & Bhaskar, R. (2023). Microplastics as an Emerging Threat to the Global Environment and Human Health. *Sustainability*, *15*(14), Article 14. <https://doi.org/10.3390/su151410821>
- Hanke Vela, J. (2023, February 28). *Brussels Playbook: Electric tensions — Be brave on Ukraine's EU bid, Weber says — Brexit done*. POLITICO.
<https://www.politico.eu/newsletter/brussels-playbook/electric-tensions-be-brave-on-ukraines-eu-bid-weber-says-brexit-done/>
- Hitt, C., Douglas, J., & Keoleian, G. (2023). Parametric life cycle assessment modeling of reusable and single-use restaurant food container systems. *Resources, Conservation and Recycling*, *190*, 106862.
<https://doi.org/10.1016/j.resconrec.2022.106862>
- Hodgson, R. (2024, April 24). *MEPs approve law to reduce growing stream of packaging waste*. Euronews.
<https://www.euronews.com/green/2024/04/24/meps-approve-law-to-reduce-growing-stream-of-packaging-waste>

- IPBES. (2019, May 5). *Media Release: Nature's Dangerous Decline 'Unprecedented'; Species Extinction Rates 'Accelerating'* | IPBES secretariat.
<https://www.ipbes.net/node/35234>
- Jahnz, A., & Stoycheva, D. (2022, November 30). *European Green Deal: Putting an end to wasteful packaging* [Text]. European Commission - European Commission. https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7155
- Jemet, E., Guiot, E., Parisot, F., & Cosson, J. (2024). *Bilan 3R en 2023 pour les emballages en plastique à usage unique. Réduction, réemploi, recyclage. Rapport.*
- Jensen, H. H. (2024, February 1). *Firms must embrace the circular economy for sustainable success.* World Economic Forum.
<https://www.weforum.org/agenda/2024/02/why-businesses-must-embrace-the-circular-economy-for-a-more-sustainable-future/>
- Jin, M., Wang, X., Ren, T., Wang, J., & Shan, J. (2021). Microplastics contamination in food and beverages: Direct exposure to humans. *Journal of Food Science*, 86(7), 2816–2837. <https://doi.org/10.1111/1750-3841.15802>
- Katsarova, I. (2023). Waste framework directive: A more sustainable use of natural resources. *EPRS | European Parliamentary Research Service, PE 757.572.*
- Knight, C. (2023). *What is the linear economy?* European Investment Bank.
<https://www.eib.org/en/stories/linear-economy-recycling>
- Kumari, T., & Raghubanshi, A. (2022). *Waste management practices in the developing nations: Challenges and opportunities.* <https://doi.org/10.1016/B978-0-323-90463-6.00017-8>

- Larkin, A., Juska, C., Hines, M., & Parmentier, R. (2024). *PR3 Reuse Done Right. — INC-4 Recommendations*. PR3 Reuse Done Right.
<https://www.pr3standards.org/global-plastic-treaty-inc-4>
- Martinho, G., Alves, A., Santos, P., & Ramos, M. (2024). Social evaluation of a Deposit and Refund System pilot project for polyethylene terephthalate packaging. *Environmental Challenges*, 15, 100894.
<https://doi.org/10.1016/j.envc.2024.100894>
- Mehdorn, I., Hölzel, N., & Belaschki, M. (2024). *European Packaging and Packaging Waste Regulation (PPWR): The best things come in small packages... or do they?* <https://www.dentons.com/en/insights/articles/2024/april/30/european-packaging-and-packaging-waste-regulation>
- Miao, X., Magnier, L., & Mugge, R. (2023). Switching to reuse? An exploration of consumers' perceptions and behaviour towards reusable packaging systems. *Resources, Conservation and Recycling*, 193, 106972.
<https://doi.org/10.1016/j.resconrec.2023.106972>
- Molenaar, R., Chatterjee, S., Kamphuis, B., Segers-Nolten, I. M. J., Claessens, M. M. A. E., & Blum, C. (2021). Nanoplastic sizes and numbers: Quantification by single particle tracking. *Environmental Science: Nano*, 8(3), 723–730.
<https://doi.org/10.1039/D0EN00951B>
- OECD. (2022). *Global plastic waste set to almost triple by 2060, says OECD*.
<https://www.oecd.org/newsroom/global-plastic-waste-set-to-almost-triple-by-2060.htm>
- Oloyede, O. O., & Lignou, S. (2021). Sustainable Paper-Based Packaging: A Consumer's Perspective. *Foods*, 10(5), Article 5.
<https://doi.org/10.3390/foods10051035>

- Palacin, H. (2023, November 23). *Le Parlement européen adopte de nouvelles règles pour réduire et recycler les emballages... et sauve les boîtes à camembert*.
Touteleurope.eu. <https://www.touteleurope.eu/environnement/le-parlement-europeen-adopte-de-nouvelles-regles-pour-reduire-et-recycler-les-emballages-et-sauve-les-boites-a-camembert/>
- Parkinson, L. (2024, March 4). *JRC publishes case studies on single-use versus reusable packaging* | *Food Packaging Forum*.
<https://www.foodpackagingforum.org/news/jrc-publishes-case-studies-on-single-use-versus-multiple-use-packaging>
- Peeters, W., Wuite, R., & Henke, A.-L. (2023). *The economics of reuse systems A study into what makes a financially viable reusable packaging system*.
<https://zerowasteurope.eu/wp-content/uploads/2023/06/SB-ZWE-CBA-reuse-executive-summary.pdf>
- Pike, S. (2024, May 15). *The global food waste failure: Examining the role of throwaway plastic packaging*. The Scarab Trust.
<https://www.scarabtrust.org.uk/post/the-global-food-waste-failure-examining-the-role-of-throwaway-plastic-packaging>
- Plastics Europe. (2022). *Plastics – the Facts 2022*. https://plasticseurope.org/wp-content/uploads/2022/10/PE-PLASTICS-THE-FACTS_V7-Tue_19-10-1.pdf
- Polychroni, E. (2024, June 11). *Navigating the Future of Packaging: An Overview of the PPWR*. *Indevco Paper Containers*.
<https://indevcopapercontainers.com/blog/navigating-the-future-of-packaging-an-overview-of-the-ppwr/>
- Popp, D. (2024, March 4). *Deal on new rules for more sustainable packaging in the EU* | *News* | *European Parliament*. <https://www.europarl.europa.eu/news/en/press->

room/20240301IPR18595/deal-on-new-rules-for-more-sustainable-packaging-in-the-eu

Ragonnaud, G. (2024). Revision of the Packaging and Packaging Waste Directive.

EPRS | European Parliamentary Research Service.

Rantanen, M. (2024, March 1). Unwrapping reality: Independent research shows that

paper food packaging outperforms plastic reusables. *EPPA*. [https://eppa-](https://eppa-eu.org/paper-food-packaging-outperforms-plastic-reusables/)

[eu.org/paper-food-packaging-outperforms-plastic-reusables/](https://eppa-eu.org/paper-food-packaging-outperforms-plastic-reusables/)

Rejeb, A., Suhaiza, Z., Rejeb, K., Seuring, S., & Treiblmaier, H. (2022). The Internet of

Things and the circular economy: A systematic literature review and research

agenda. *Journal of Cleaner Production*, 350, 131439.

<https://doi.org/10.1016/j.jclepro.2022.131439>

Rethink Plastic. (2023, November 22). *Parliament trashes EU hopes to reduce*

packaging waste, siding with throwaway industry. Rethink Plastic.

[https://rethinkplasticalliance.eu/news/parliament-trashes-eu-hopes-to-reduce-](https://rethinkplasticalliance.eu/news/parliament-trashes-eu-hopes-to-reduce-packaging-waste-siding-with-throwaway-industry/)

[packaging-waste-siding-with-throwaway-industry/](https://rethinkplasticalliance.eu/news/parliament-trashes-eu-hopes-to-reduce-packaging-waste-siding-with-throwaway-industry/)

Reusable Packaging Europe. (2024, January 17). Reusable Transport Packaging in the

PPWR – the key to a greener EU. *Reusable Packaging Europe*.

[https://rpeurope.eu/2024/01/17/reusable-transport-packaging-in-the-ppwr-the-](https://rpeurope.eu/2024/01/17/reusable-transport-packaging-in-the-ppwr-the-key-to-a-greener-eu/)

[key-to-a-greener-eu/](https://rpeurope.eu/2024/01/17/reusable-transport-packaging-in-the-ppwr-the-key-to-a-greener-eu/)

Romano, V. (2023, March 4). *McDonald's warns EU packaging law will cause plastic*

surge. *Www.Euractiv.Com*. [https://www.euractiv.com/section/energy-](https://www.euractiv.com/section/energy-environment/news/mcdonalds-warns-eu-packaging-law-will-cause-plastic-surge/)

[environment/news/mcdonalds-warns-eu-packaging-law-will-cause-plastic-surge/](https://www.euractiv.com/section/energy-environment/news/mcdonalds-warns-eu-packaging-law-will-cause-plastic-surge/)

Seyed, S. reza, Kowsari, E., Ramakrishna, S., Gheibi, M., & Chinnappan, A. (2023).

Marine plastics, circular economy, and artificial intelligence: A comprehensive

- review of challenges, solutions, and policies. *Journal of Environmental Management*, 345, 118591. <https://doi.org/10.1016/j.jenvman.2023.118591>
- Seyring. (2024, March). *Étude: CCR Analyse du cycle de vie (ACV) pour les emballages réutilisables par rapport aux emballages à usage unique*. | Planet Reuse. <https://platform.planetreuse.eu/news/study-jrc-life-cycle-analysis-lca-for-reusable-in-comparison-to-single-use-packaging/p62JKXzPk5>
- Sinkko, T., Amadei, A., Venturelli, S., & Ardente, F. (2024, February 5). *Exploring the environmental performance of alternative food packaging products in the European Union*. JRC Publications Repository. <https://doi.org/10.2760/971274>
- Somlai, C., Bullock, C., & Gallagher, J. (2023). Plastic packaging waste in Europe: Addressing methodological challenges in recording and reporting. *Waste Management & Research*, 41(6), 1134–1143. <https://doi.org/10.1177/0734242X221142192>
- Statista (a). (2024). *Plastic production by industrial sector globally*. Statista. <https://www.statista.com/statistics/1134796/plastic-production-by-industrial-sector-worldwide/>
- Strinati, M. (2023, May 19). McDonald's & CO. lobbying against packaging regulation. DeSmog Inquiry. *FoodTimes*. <https://www.foodtimes.eu/food-system-en/mcdonalds-co-lobbying-against-packaging-regulation-desmog-inquiry/>
- Stroosnijder, S. (2024, May 14). *Call for partners | Combining sustainable packaging design & natural preservatives to increase shelf life and reduce food waste*. WUR. <https://www.wur.nl/en/research-results/research-institutes/food-biobased-research/show-fbr/call-for-partners-combining-sustainable-packaging-design-natural-preservatives-to-increase-shelf-life-and-reduce-food-waste.htm>

- Taylor, K. (2023, May 8). *Parliament split over how to tackle EU's packaging waste problem*. Www.Euractiv.Com. <https://www.euractiv.com/section/energy-environment/news/parliament-split-over-how-to-tackle-eus-packaging-waste-problem/>
- The French Agency for Ecological Transition. (2022). *Executive Summary of the "3R Strategy" for reducing, reuse and recycling of single-use plastic packaging*. <https://www.ecologie.gouv.fr/sites/default/files/documents/Download%20the%20summary%20of%20the%20report.pdf>
- Turkcu, D., & Tura, N. (2023). The dark side of sustainable packaging: Battling with sustainability tensions. *Sustainable Production and Consumption*, 40, 412–421. <https://doi.org/10.1016/j.spc.2023.07.007>
- UNEP. (2023, April 25). *Everything you need to know about plastic pollution*. UNEP. <http://www.unep.org/news-and-stories/story/everything-you-need-know-about-plastic-pollution>
- ViaPackaging, InspireCo, & Bluenote Pack (Directors). (2024, April 6). *Webinar on "Packaging and Packaging Waste Regulation"*. <https://www.linkedin.com/events/ppwrwebinarforeastcountries7201186120733184000/about/>
- Voukkali, I., Papamichael, I., Loizia, P., & Zorpas, A. (2023). Urbanization and solid waste production: Prospects and challenges. *Environmental Science and Pollution Research*, 31, 1–12. <https://doi.org/10.1007/s11356-023-27670-2>
- Walker, T. (2021). The Ambivalence of Disposable Time: The Source and Remedy of the National Difficulties At Two Hundred. *Contributions to Political Economy*, 40(1), 80–90. <https://doi.org/10.1093/cpe/bzab005>

Wikström, F., Williams, H., Verghese, K., & Clune, S. (2014). The influence of packaging attributes on consumer behaviour in food-packaging life cycle assessment studies—A neglected topic. *Journal of Cleaner Production*, 73, 100–108. <https://doi.org/10.1016/j.jclepro.2013.10.042>

Willeghems, G., & Bachus, K. (2018). *Employment impact of the transition to a circular economy*.

<https://circulareconomy.europa.eu/platform/sites/default/files/3->

[Employment-Impact-of-the-Transition-to-a-Circular-Economy-Literature-Study-](#)

[NL.Pdf. https://ec.europa.eu/eurostat/statistics-](#)

[explained/index.php?title=Packaging_waste_statistics](#)