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PROJECT

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2.1 Report from policy frameworks analysis in the SBS Region, stakeholder needs and challenges

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Preface

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List of Abbreviations

Abbreviation	Full term
B2B	Business-to-Business
B2C	Business-to-Consumer
BePacMan	Better Paper Packaging Management
BMUKN	Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (Germany)
CAGR	Compound Annual Growth Rate
CEPI	Confederation of European Paper Industries
DRS	Deposit Return System
EPR	Extended Producer Responsibility
EPA	Environmental Protection Agency
ESPR	Ecodesign for Sustainable Products Regulation
EU	European Union
FSC	Forest Stewardship Council
GS1	GS1 (Global Standards 1)
LUCID	LUCID Packaging Register (Germany)
NGOs	Non-Governmental Organisations
OECD	Organisation for Economic Co-operation and Development
PEFC	Programme for the Endorsement of Forest Certification
PPWR	Packaging and Packaging Waste Regulation
PRO	Producer Responsibility Organisation
QR	Quick Response (code)
REPAID	REPAID (project name: reusable packaging return system pilot)
RFID	Radio-Frequency Identification
SBS	South Baltic Sea (Region)
SMEs	Small and Medium-sized Enterprises
TOMRA	TOMRA (company name; not an acronym)
ZSVR	Zentrale Stelle Verpackungsregister (Central Agency Packaging Register, Germany)

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1. Introduction

1.1 Background and policy context on circular economy in the Baltic Sea Region

The Baltic Sea Region is at the forefront of the European Union's transition towards a circular economy, a model that emphasizes resource efficiency, waste reduction, and the creation of closed-loop systems. This transition is driven by a combination of EU policies and national-level commitments aimed at decoupling economic growth from resource consumption. Key EU directives, such as the Waste Framework Directive (2008/98/EC) and the Directive on Packaging and Packaging Waste (94/62/EC), have established a clear legal framework for waste management and recycling, setting high targets for all member states.In recent years, the focus has shifted from mere recycling to a more holistic approach that prioritizes waste prevention and reuse. The proposed Packaging and Packaging Waste Regulation (PPWR) signals a significant step in this direction, aiming to make all packaging on the EU market reusable or recyclable in an economically viable way by 2030. This evolving policy landscape creates both challenges and opportunities for industries in the Baltic Sea Region, particularly for the paper and packaging sector, which plays a crucial role in the regional economy.

1.2 Objectives

This report, developed within the framework of the BePacMan (Better Paper Packaging Management) project, aims to provide a comprehensive analysis of the policy frameworks and stakeholder needs related to paper packaging in the South Baltic Sea region. The primary purpose is to identify the legal enablers and barriers to the adoption of reusable paper packaging systems and to map the challenges and priorities of key stakeholders across the value chain.

The specific objectives of this study are to:

- Analyze the existing EU and national legal frameworks governing paper packaging and waste in the SBS region (Germany, Poland, Lithuania, and Denmark).
- Provide a market and sector overview of the paper packaging industry in the region.
- Identify and categorize the main stakeholder groups involved in the paper packaging lifecycle.
- Map the needs, priorities, and challenges of these stakeholders in

relation to the adoption of circular packaging solutions.

1.3 Scope of study

The scope of this study is focused on the paper packaging sector within the South Baltic Sea region. It covers the entire lifecycle of paper packaging, from raw material supply and manufacturing to end-use, collection, and recycling. The analysis is centered on the potential for developing and implementing reusable paper packaging systems, in line with the goals of the BePacMan project. The study examines both the policy and market dimensions, as well as the perspectives of a wide range of stakeholders.

1.4 Geographic coverage: SBS partner countries

The geographic coverage of this report includes the four partner countries of the BePacMan project in the South Baltic Sea region: Germany, Poland, Lithuania, and Denmark as shown in Figure 1. The analysis is based on data and information collected from these countries, allowing for a comparative assessment of their respective policy landscapes, market conditions, and stakeholder dynamics.

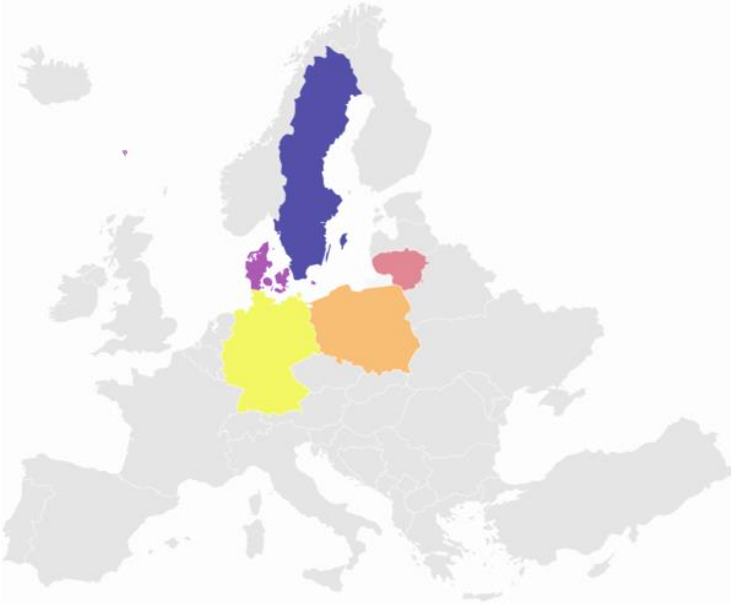

Figure 1 Geographical coverage of the BePacMan project in the South Baltic Sea Region

1.5 Alignment with BePacMan's circular economy goals

This report is directly aligned with the overarching goal of the BePacMan project, which is to extend the lifecycles of paper packaging through cross-sector and cross-border approaches to reuse in the South Baltic region. The project aims to develop practical, market-ready business models and solutions that promote a circular economy for paper packaging. The results of this study will provide an evidence base for the subsequent phases of the BePacMan project, informing the development of pilot projects and policy recommendations.

1.6 Structure of the report

This report is structured as follows:

Section 1 provides a market and sector overview of the paper packaging industry in the SBS region.

Section 2 presents a detailed analysis of the legal and policy landscape at both the EU and national levels.

Section 3 maps the needs, challenges, and priorities of the different stakeholder groups.

2. Methodology

The study employed a mixed-methods approach to ensure a comprehensive analysis of the policy frameworks and stakeholder needs related to paper packaging in the South Baltic Sea region as describe in Figure 2. The methodology was designed to be both descriptive and analytical, combining a thorough review of existing literature and legal documents with the collection and analysis of primary data from key stakeholders. The research was conducted within the framework of Work Packages 2.1 and 2.2 of the BePacMan project and was structured around two main components: a legal and policy analysis, and stakeholder needs and challenge mapping.

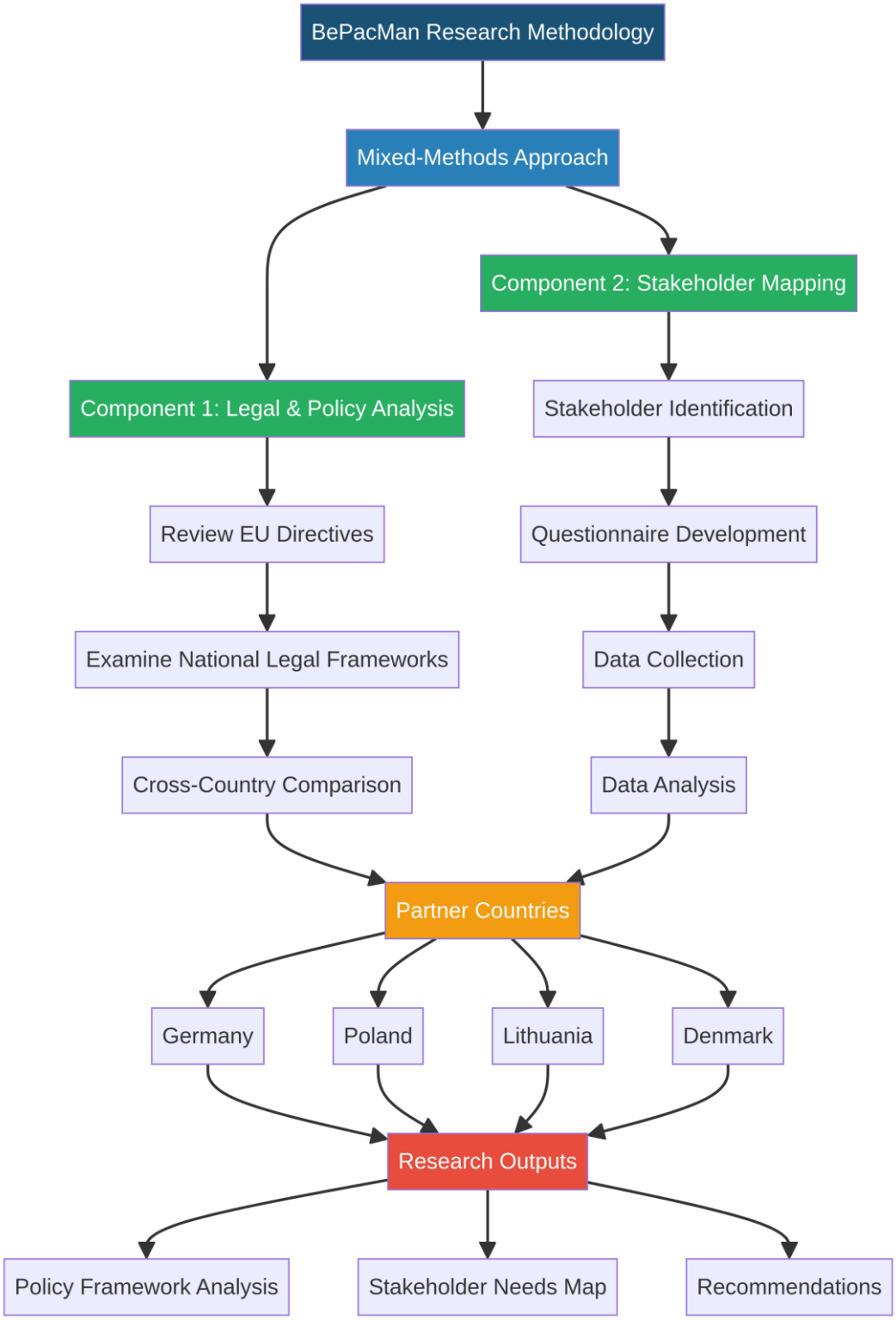

Figure 2 BePacMan Research Methodology - Mixed-Methods Approach

The first component of the methodology involved a detailed analysis of the legal and policy landscape governing paper packaging and waste in the SBS partner region. This included:

- A comprehensive review of relevant EU directives and regulations, such as the Waste Framework Directive, the Packaging and Packaging Waste Directive, and the proposed Packaging and Packaging Waste Regulation.
- An in-depth examination of the national legal frameworks in Germany, Poland, Lithuania, and Denmark, focusing on aspects such as extended producer responsibility schemes, recycling targets, and provisions for reuse.
- A cross-country comparison of the legal frameworks to identify similarities, differences, and potential areas for harmonization.

The second component of the methodology focused on mapping the needs, priorities, and challenges of stakeholders across the paper packaging value chain. This was achieved through a multi-step process:

1. Stakeholder identification and categorization: An initial mapping exercise was conducted to identify and categorize the primary stakeholder groups involved in the paper packaging lifecycle. This resulted in the identification of eleven distinct stakeholder categories, ranging from raw material suppliers to waste management companies.
2. Development of structured questionnaires: Four structured questionnaires were developed, each tailored to a specific stakeholder group:
    - Producer questionnaire: Targeted at raw material suppliers, pulp and paper manufacturers, converters, and packaging designers.
    - Logistics questionnaire: Addressed to stakeholders involved in transportation, distribution, collection, and recycling.
    - E-commerce questionnaire: Focused on retailers, online sellers, and packaging-intensive SMEs.
    - Consumer questionnaire: Designed to gather information on end-user behavior, awareness, and preferences.
3. Data collection: The questionnaires were distributed to a wide range of stakeholders in the four partner countries. The data collection process was managed by the BePacMan project partners in each region, ensuring a high response rate and a representative sample of stakeholders.
4. Data analysis: The data collected from the questionnaires was analyzed to identify key trends, patterns, and insights. The analysis focused on

identifying the specific needs and priorities of each stakeholder group, as well as the main challenges and barriers they face in adopting reusable paper packaging solutions.

By combining these different methodological approaches, this study provides an important and nuanced understanding of the complex issues surrounding the transition to a circular economy for paper packaging in the South Baltic Sea region.

3. Market and sector overview: Paper packaging in the SBS Region

3.1 Value Chain Actors in the Paper Packaging

The paper packaging value chain in the South Baltic Sea region is shaped by a diverse set of actors, each contributing to the production, distribution, reuse, and recycling of packaging materials. Understanding these actors, which are briefly described in the following sections, is crucial for identifying opportunities and challenges in building a cross-border reuse system. Table 1 provides the role of each actor in the value chain.

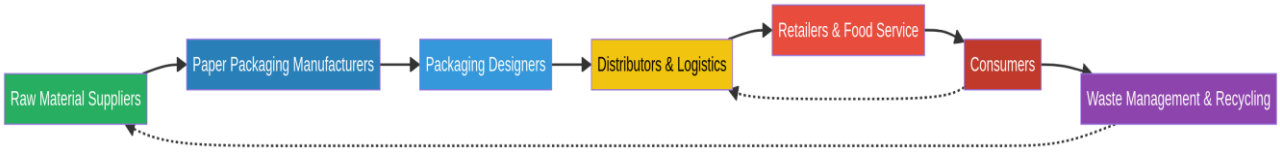

Figure 3 Paper Packaging Value Chain in the SBS Region (with Reuse and Recycling Loops)

Table 1 Value chain actors and their roles in paper packaging

Actor	Role
 Raw material suppliers	They provide wood pulp or recycled fibers, which are the basic ingredients for making paper packaging.
 Paper packaging manufacturers	They turn raw materials into boxes, cartons, and paper bags.
 Packaging designers and technology providers	They create packaging that is reusable, durable, and easy to track or recycle.
 Distributors and logistic companies	They transport packaging to retailers and also assist with the return of used packaging for reuse.
 Retailers and food service operators	They use packaging to sell products or serve food, which affects the potential for reuse.

 Consumers	They decide whether to reuse, return, or throw away packaging - their behaviour shapes the system.
 Waste management and recycling companies	They collect, clean, and recycle packaging or prepare it for reuse.

Raw material suppliers

At the start of the chain, raw material suppliers in Sweden and Poland provide the bulk of wood pulp and recycled fibers used in packaging. Sweden's forestry sector is internationally recognized for sustainable management, with certification schemes such as the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) ensuring that paper packaging has a lower environmental footprint and supports biodiversity protection [1, 2]. Poland's pulp and paper industry has expanded significantly, supplying both domestic and export markets, while Lithuania contributes through smaller but growing recycled fibre operations.

Paper packaging manufacturers

Large paper mills and converters in Germany, Poland, and Sweden transform these raw materials into corrugated boxes, cartons, and paper bags. Germany hosts some of Europe's most advanced packaging producers, with companies like Mondi and MM Group leading in recyclable and reusable designs [3, 4]. Poland's corrugated industry is rapidly expanding, while Sweden combines industrial scale with innovation in lightweight and eco-designed packaging. Small and medium-sized enterprises (SMEs) in Denmark and Lithuania play a complementary role, focusing on niche packaging formats and reusable paper solutions. Manufacturers across the region are adapting to the European Union's (EU's) new Packaging and Packaging Waste Regulation, which requires all packaging to be reusable or recyclable by 2030 [5].

Packaging designers and technology providers

Specialized packaging designers and technology providers are developing eco-designs that reduce material use and improve durability for multiple reuse cycles. Germany and Sweden lead in digital innovation, introducing tracking systems such as QR codes and RFID tags to monitor the circulation of packaging. Denmark, on the other hand, emphasizes design for reuse

in food service packaging. These innovations align with the EU's Ecodesign for Sustainable Products Regulation (ESPR), which promotes durability and circularity in product design [6].

Distributors and logistics companies

Distributors and logistics companies are essential for moving packaging across SBS countries. Germany and Poland benefit from extensive logistics networks, while Denmark and Sweden are piloting circular logistics models that integrate cleaning and redistribution systems for reusable packaging. Lithuania, though smaller in scale, offers opportunities for regional cooperation through logistics hubs. Cross-border cooperation is vital to ensure harmonized standards and efficient circulation, particularly given the fragmented infrastructure across Member States [7].

Retailers and food service operators

Retailers and food service operators are major users of paper packaging. In Germany, the Packaging Act (Verpackungsgesetz) requires food service outlets to offer reusable packaging alternatives, and Denmark has introduced similar obligations, embedding reuse into everyday consumer practices [8]. Poland and Lithuania are gradually implementing reuse obligations, while Sweden is piloting innovative schemes in retail and food service sectors. Retailers act as intermediaries with consumers, influencing acceptance and adoption of reusable formats.

Consumers

Consumers themselves are critical actors, as their willingness to return and reuse packaging determines the success of reuse systems. Awareness campaigns in Sweden and Denmark have shown strong potential for shifting behaviour toward reusable packaging, with Denmark's city-wide pilot in Aarhus achieving return rates of over 85% [9]. Germany's legal obligations have also increased consumer participation, whereas Poland and Lithuania face more resistance due to concerns over convenience and hygiene.

Waste management and recycling companies

Waste management and recycling companies handle the collection and processing of paper packaging at end-of-life. Germany and Sweden have advanced recycling systems that integrate reuse alongside recycling, while Poland and Lithuania are expanding infrastructure to accommodate reuse. Denmark is piloting cleaning and return systems linked to municipal waste management, ensuring that reusable packaging is not misclassified as waste [9, 10].

3.2 Industry structure and flows

The paper industry in the SBS region is diverse in scale and specialization, yet it plays a central role in supporting the transition toward a circular economy. Germany dominates the sector, with 144 paper mills and a production volume of approximately 22 million tonnes in 2022, making it the largest paper producer in Europe. Its industry employs nearly 39,000 workers and generates a turnover of €21.2 billion in 2022, reflecting both scale and technological leadership [11]. Germany's strength lies in packaging paper, which accounts for more than half of its output, and in advanced recycling and reuse systems that align with the EU's PPWR [5]. This combination of industrial capacity and regulatory alignment positions Germany as the anchor of the SBS paper industry.

Poland is the second-largest player in the region, with a turnover of €16.37 billion and a production volume of approximately 5.2 million tonnes in 2022 [12, 13]. The sector is highly labour-intensive, employing around 70,000 people, and is expanding rapidly, particularly in corrugated and packaging papers [14]. According to a report published by Dun and Bradstreet, the number of paper mills and companies was estimated to be 788, underscoring the fragmented but extensive nature of the industry [15]. Poland's role is critical for regional supply chains, as it strikes a balance between industrial scale and growing exports of packaging products. Its rapid expansion in packaging grades strengthens its position as a supplier to both domestic and international markets, complementing Germany's technological leadership with industrial breadth.

Lithuania's paper industry is smaller in scale but notable for its resilience and vertical integration. In 2024, the sector comprised around 176 companies, with revenues of approximately €829 million in 2023 and employing 5,462 people. The industry encompasses raw material processing, pulp and paper manufacturing, and final distribution and export, creating a vertically integrated structure that supports stability. Over 90% of Lithuanian companies are considered low- or medium-risk, indicating a generally stable economic environment. This structure allows Lithuania to contribute to regional cooperation, offering opportunities for niche innovation and cross-border integration despite its smaller size [16].

Denmark's paper industry is the smallest among the SBS countries but it remains strategically significant. In 2022, the number of enterprises in the paper and paper product manufacturing industry was about 114 [17], while a report published by Dun and Bradstreet, estimated 17 pulp, paper, and paperboard mills with a turnover of

approximately €487 million [18]. The sector employs around 2,500 people [19], reflecting its modest scale compared to Germany and Poland. Despite its size, Denmark's industry is positioned to integrate circular models and municipal reuse pilots into its operations, aligning with broader sustainability goals. Together, these four national industries form a complementary system: Germany provides technological leadership, Poland industrial scale, Lithuania stability and integration, and Denmark innovation potential. This diversity strengthens the SBS region's collective capacity to transition toward circular resource use in the paper packaging sector.

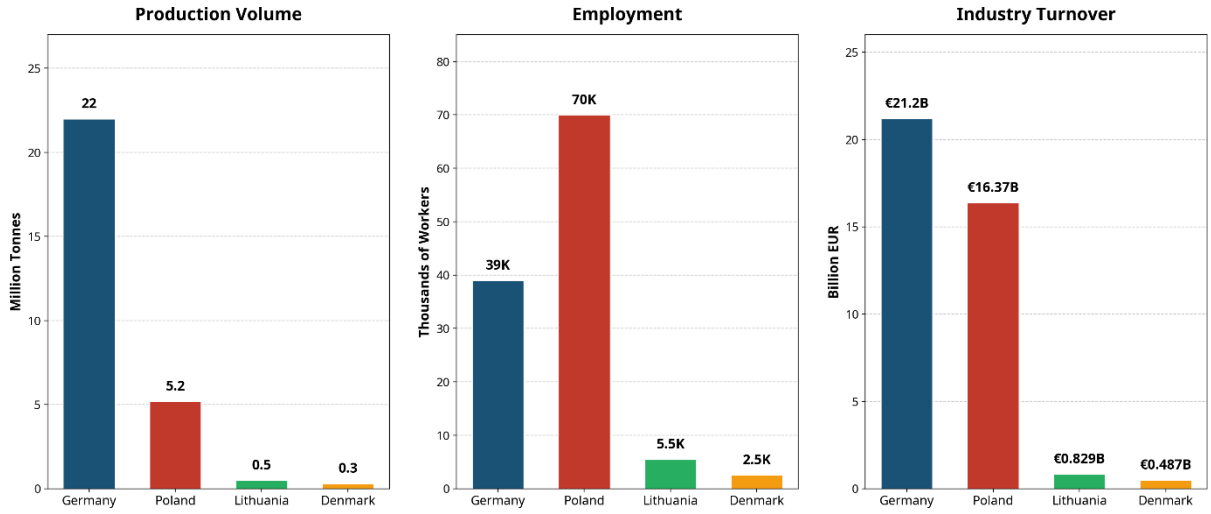

Figure 4 Paper Industry Comparison in SBS Region

3.3 Circularity and environmental profile

Germany is the strongest performer in the SBS region when it comes to recycling paper. Every year, the country collects more than 13 million tonnes of paper for recycling, reaching a recycling rate of about 75%, which is one of the highest in Europe. The German paper industry also has a relatively low carbon footprint, producing only 0.55 tonnes of CO_2 per tonne of paper. This is possible because of efficiency improvements and the use of renewable energy. Germany shows how recycling and reuse can work together to support the EU's Packaging and Packaging Waste Regulation [11]. Poland is also an important player in the region. In 2022, it collected more than 2 million tonnes of paper and cardboard waste, with a recycling rate of around 56% [20]. The pulp and paper sector were responsible for just under 2% of all industrial emissions in the country [21]. Poland's recycling system is still developing, but it is expanding quickly as the packaging industry grows. This means Poland has a big role to play in balancing industrial growth with environmental

responsibility. Lithuania has a smaller paper industry, but it is making steady progress toward EU circular economy goals. In 2022, Lithuania collected about 200,000 tonnes of paper and cardboard waste, with recycling rates between 60-65%. While the infrastructure is not as advanced as in Germany or Poland, most Lithuanian companies are considered stable and low-risk, which helps the sector grow in line with EU targets. The European Environment Agency notes that Lithuania is improving its waste management systems and aligning with EU recycling requirements [22]. Denmark produces around 1 million tonnes of paper and cardboard waste at a recycling rate of about 70% in 2022 [23]. Denmark also benefits from a more favourable energy profile compared to Poland, using more alternative fuels and external heat supply, which lowers emissions.

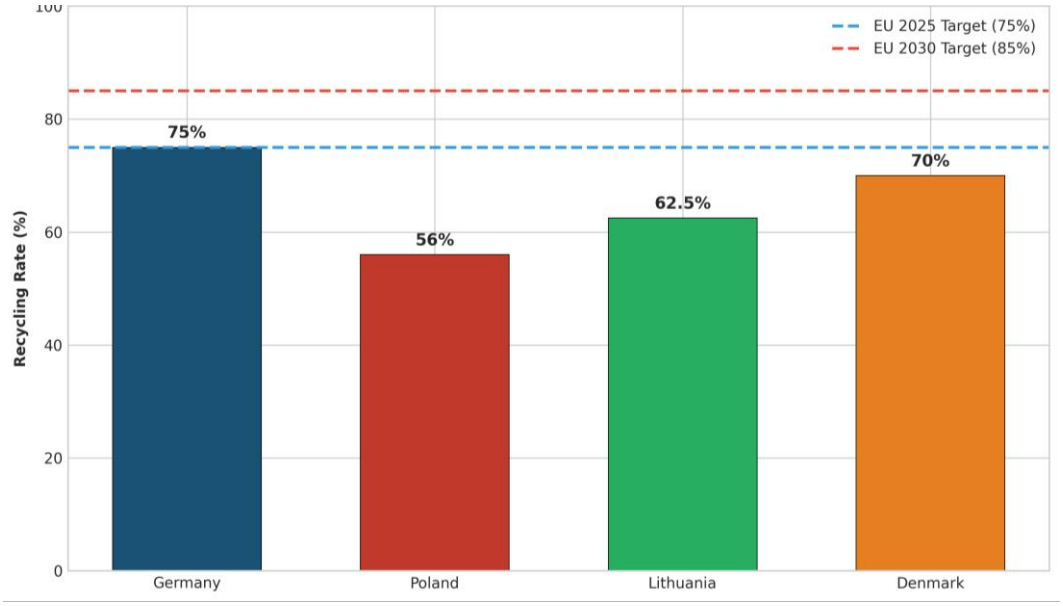

Figure 5 Paper and Cardboard Recycling Rates in SBS Region with EU Targets

3.4 Market challenges and opportunities

The paper packaging industry in the SBS region is undergoing a rapid transformation, shaped by energy market volatility, evolving EU regulations, and changing consumer expectations. Each partner country Poland, Lithuania, Germany, and Denmark faces unique challenges that affect competitiveness and innovation, while also benefiting from opportunities linked to recycling targets, extended producer responsibility, and the growing demand for reusable packaging.

Table 2 summarizes the main challenges and opportunities across the four countries, providing a comparative overview of the sector's current dynamics.

Table 2 Market challenges and opportunities

Country	Market challenges	Market opportunities
Poland	Rising energy and raw material costs reduce competitiveness; margins eroded by weak demand and high costs. Regulatory compliance under EU packaging rules adds an administrative burden [24].	Strong export position in EU markets; packaging industry expected to reach €13 billion by 2025 [24]. Growth in flexible packaging (highest CAGR among pack materials, 2023-2028) [25].
Lithuania	Small domestic industry with limited scale; debt levels rising among some firms; dependence on imports for specialty grades [26].	Sector revenues grew 51% between 2021-2023; resilience despite debt increases [16]. Opportunities in folding cartons, paper cups, and food boxes as demand for sustainable packaging rises [26].
Germany	The paper packaging industry is facing weak demand, pricing instability, and high energy or raw material costs [27]. Strict Packaging Act obligations (registration, reporting, take back) increase compliance costs, with fines up to €200,000 for non-compliance [28].	There is still high demand for sustainable, recyclable solutions, the rapid expansion of e-commerce, and supportive environmental regulations [29].
Denmark	Denmark's paper packaging industry struggles with implementing complex new EPR legislation, facing major data management hurdles, and balancing ambitious sustainability goals with high material costs and essential technical performance requirements [30].	Denmark is a frontrunner in reuse pilots: Aarhus hosts the world's first city-wide reusable takeaway platform. Eco-modulated fees under new EPR system reward reusable or recyclable designs, giving fibre-based solutions a cost advantage [31, 32].

3.5 Emerging market trends and developments

The paper packaging industry in the SBS region is evolving rapidly under the influence of EU regulations, consumer demand for sustainability, and national pilot projects. While Germany and Denmark are leading in reuse obligations and demonstration cases, Poland and Lithuania are gradually adapting through investments, policy reforms, and smaller-scale pilots. Table 3 highlights the main emerging trends

in each partner country, focusing on the shift to reusable packaging, new investments or pilots, and expected policy incentives.

Table 3 Emerging trends in the paper packaging industry in the SBS region

Trend Area	Poland	Lithuania	Germany	Denmark
Shift to reusable packaging	Preparing for EU PPWR. Uptake of reuse is slow, with consumers more familiar with recycling than reuse. Awareness campaigns will be needed [24].	Early-stage exploration of reuse, mainly through small pilots in retail and food service. Deposit-return systems for bottles are established, but reusable paper cups and cartons remain rare [22].	Legal obligation for takeaway food and drinks to be offered in reusable cups and containers. From 2025, food and drinks consumed on site must be served in reusable solutions [33].	Advanced reuse systems already in place. Aarhus hosts TOMRA's city-wide reusable takeaway platform, and Copenhagen pilots reuse in schools and public events. National strategies target a 50% increase in reusable packaging share by 2027 [34, 35].
New investments or pilots	Investments in flexible packaging and corrugated board. Limited reuse pilots, though some firms test reusable transport packaging in logistics [24].	EIT Food supports Researchers in Kaunas University of Technology to develop a takeaway food package made of cardboard [36].	Federal programmes support pilots in gastronomy and delivery services. The REPAID project trials digital return systems, automated take-back points, and cleaning logistics for reusable food containers and cups [33].	Municipal and private partnerships fund reuse pilots. The Change(K)now! project promotes reusable takeaway packaging in schools and catering, while LOOP 2025 develops national return systems for reusable packaging. Industrial investment includes Faller Packaging's Horsens plant (2025), expanding folding carton capacity to 900 million units annually [37, 38, 39].

Policy incentives expected	Drafting new EPR law. Fees for packaging placed on the market will rise, but eco-modulated fees could encourage reusable and recyclable designs [40].	EU pressure to raise recycling and reuse rates. Incentives expected through EU funds and national waste strategies, focusing on circular economy pilots [22].	National Circular Economy Strategy aims to create market-based incentives for circular business models, including reuse and secondary raw materials [41].	New EPR system (from October 2025) requires registration and fees. Eco-modulated fees reward packaging that is easy to reuse or recycle, giving fibre-based reusable solutions a cost [42].

4. Legal and policy landscape

4.1 EU legal and policy framework

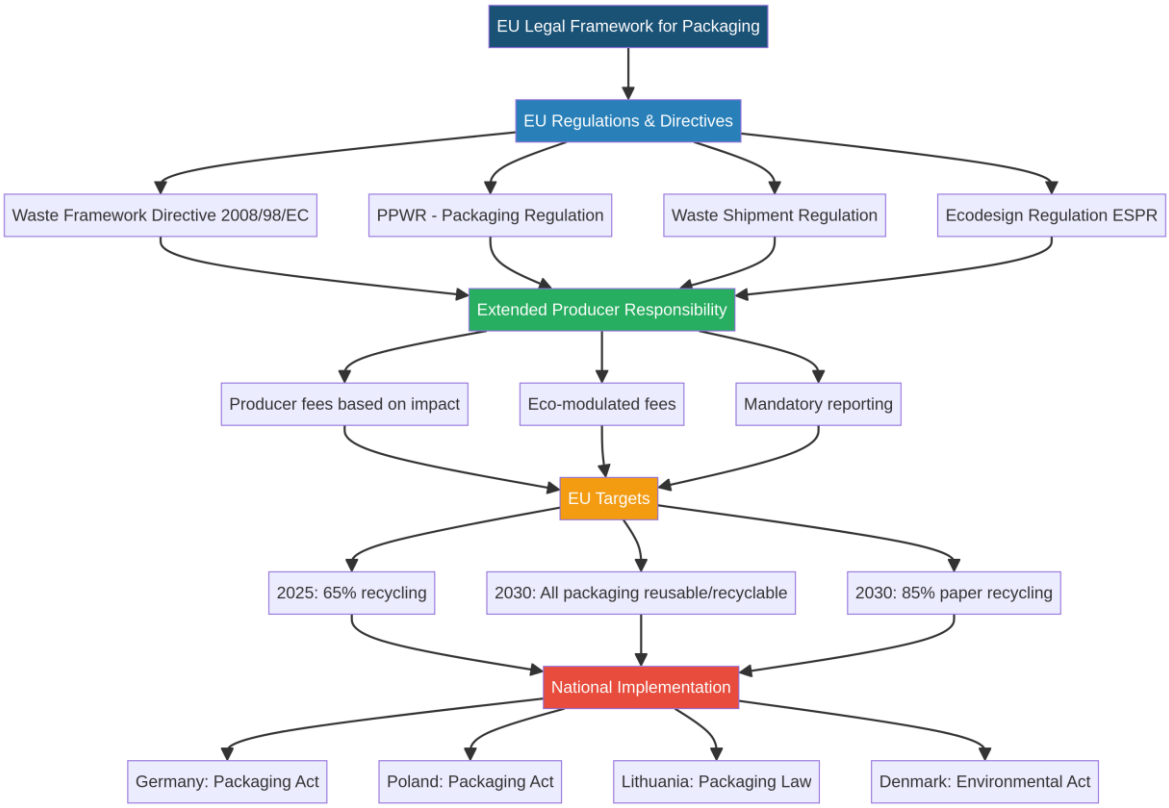

Figure 6 EU Legal Framework for Packaging and Waste Management

4.1.1 Directive 94/62/EC on packaging and packaging waste

Directive 94/62/EC on packaging and packaging waste was adopted by the European Parliament and Council on 20 December 1994. Its main goal was to harmonize the different national rules in EU Member States regarding how packaging and packaging waste are managed, while also ensuring a high level of environmental protection. Over the years, the directive has been revised several times, including Directive (EU) 2015/720, which addresses the use of lightweight plastic carrier bags, and Directive (EU) 2018/852, which places greater emphasis on reusable packaging and the reuse of packaging waste, particularly in Article 5. Most recently, Regulation (EU) 2025/40 has replaced Directive 94/62/EC. This new PPWR aims to unify packaging rules across the EU and speed up the shift toward a circular economy. It requires that by 2030, all packaging placed on the EU market must be either reusable or recyclable. The key difference is that the previous directive set goals and allowed each country to create its own laws to meet them, while the new regulation is directly

binding and applies the same rules across all Member States without needing national laws to implement it [5, 43, 44, 45].

4.1.2 Directive 2008/98/EC (Waste Framework Directive)

Directive 2008/98/EC on waste and the repeal of certain directives (also known as the Waste Framework Directive) came into effect on 12 December 2008 and sets out the basic rules for how waste should be managed across the European Union. It introduces the waste hierarchy, which is a system that ranks different methods of handling waste based on what is best for the environment. At the top of this hierarchy is prevention, followed by reuse, then recycling, recovery, and finally disposal as shown in Figure 7. This means that reusing materials is better than recycling them, and both are better than simply discarding them. The directive aims to protect the environment, human health, and natural resources, and to help the EU become a recycling-oriented society by encouraging more separate collection and recovery of waste. In May 2018, the directive was updated through Directive (EU) 2018/851 to reinforce these goals [46, 47].

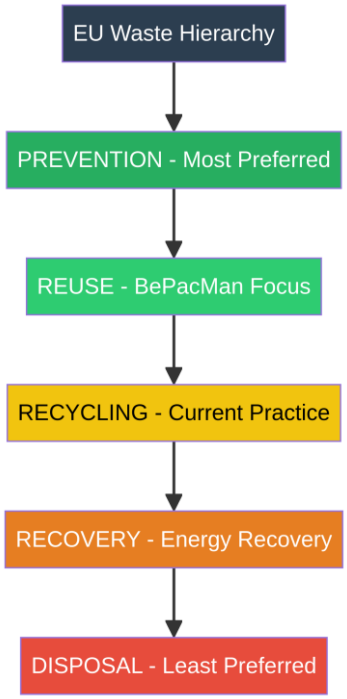

Figure 7 EU Waste Hierarchy (Directive 2008/98/EC)

4.1.3 Waste Shipment Regulation

The Waste Shipment Regulation, first introduced in 2006, sets the rules for how waste is moved between EU countries and beyond. Over time, exports of waste from the EU to non-OECD countries have increased, often to places with weak environmental protections, causing pollution and health risks. In 2020, the EU exported around 33 million tonnes of waste

and imported approximately 16 million tonnes. To fix this, the EU adopted a new version of the regulation on 20 May 2024, though most of its rules will only apply from 21 May 2026, and export rules from 21 May 2027. The updated regulation has three main aims: (i) to stop the EU from sending its waste problems to other countries, (ii) to make it easier to move waste for recycling and reuse within the EU, and (iii) to crack down on illegal waste shipments. It also encourages better product design so that packaging and other materials can be reused or recycled more easily. To prevent waste from being incorrectly classified as reusable products, the EU will introduce clear guidelines to help distinguish between actual used goods and waste, with particular attention to items such as vehicles and batteries [48, 49, 50].

4.1.4 Extended Producer Responsibility (EPR) framework

EPR is a policy in the EU that makes producers responsible for what happens to their packaging after it is used, including collecting, sorting, recycling, or reusing it. The idea is to shift the cost and responsibility from local governments to the companies that put packaging on the market, encouraging them to design packaging that is easier to reuse and recycle. For paper packaging, this means producers are expected to use cleaner designs, avoid mixing materials like plastic and foil with paper, and create stronger paper bags or boxes that can be reused multiple times. Under the new EU PPWR, producers must also pay fees that reflect the environmental impact of their packaging, and these fees help fund recycling systems and encourage sustainable design choices. Globally, EPR schemes such as deposit return systems and printed paper programs demonstrate how producers can fund recycling infrastructure without passing costs to consumers, provided systems are designed for ease of use. While recycling has traditionally dominated EPR policy, there is growing recognition of the importance of reuse, with organizations like Upstream advocating for EPR to actively support reusable packaging systems. By placing responsibility higher up the production chain, EPR encourages producers to minimize environmental harm through better design, and widespread reuse can help offset potential cost increases for consumers, making sustainable packaging both practical and economically viable [51, 52, 53].

4.1.5. EU reuse and recycling targets

Reuse targets are clear goals set to make sure products and packaging are used again without heavy processing. The idea is to keep items in use for longer, which cuts down on waste and saves resources compared to recycling or disposal. Reuse is becoming more important in environmental policy because it goes beyond recycling and

helps prevent waste at the source. To reach these goals, countries and businesses need good collection systems, standard reusable formats, and ways to encourage people to move away from single-use packaging. Meeting reuse targets is a key step toward building a circular economy where resources are not wasted [54]. The EU has introduced specific reuse targets in the new PPWR as shown in Figure 8.

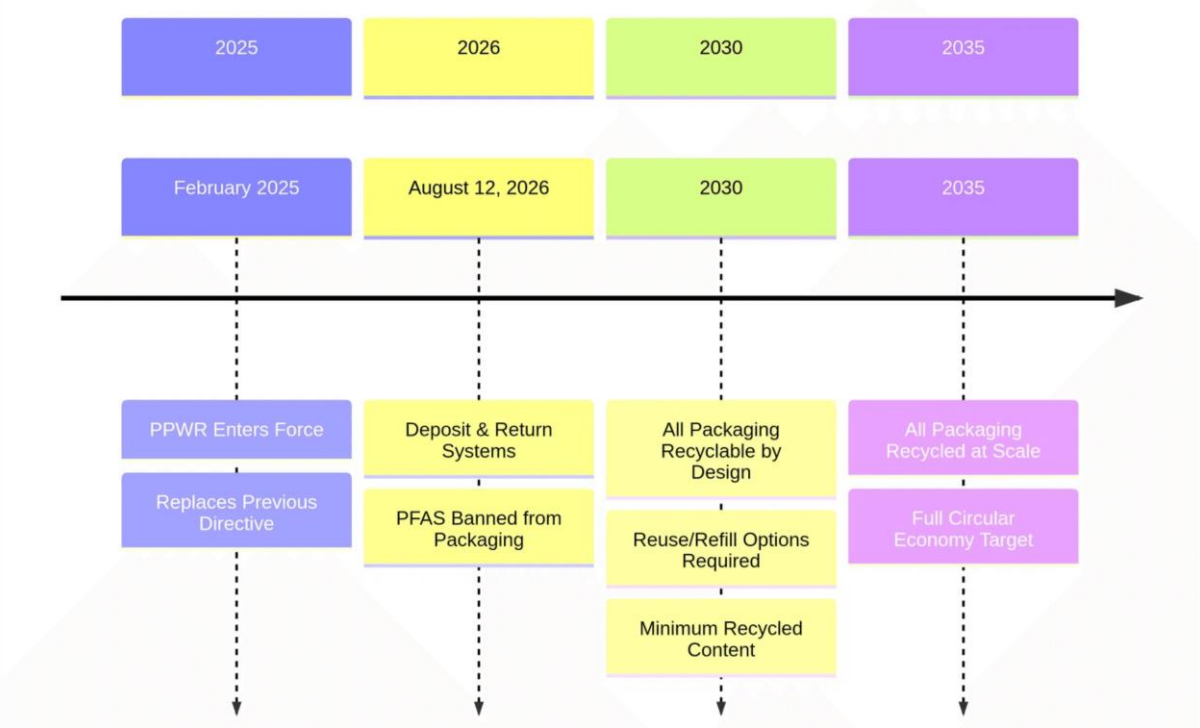

Figure 8 The New PPWR implementation timeline

These rules aim to reduce single-use packaging and promote reusable systems across all Member States [5]. Table 4 summarizes the reuse targets. Article 11 sets overall waste reduction goals, while Articles 28 to 33 focus on reuse in different sectors, such as beverage containers, transport packaging, takeaway food packaging, and retail packaging. Together, these measures are designed to move the EU toward a circular economy by 2030 and beyond.

Table 4 EU reuse targets

Article	Focus Area	Reuse Targets/ Requirements	Timelines
11	General packaging waste prevention	Member States must reduce packaging waste per capita by 5% (2030), 10% (2035), and 15% (2040) compared to 2018 levels.	2030, 2035, 2040
28	Beverage packaging reuse	Obligations for reuse systems for beverage containers (plastic, glass, metal). Targets for refillable beverage packaging placed on the market.	Starting 2030
29	Transport and e-commerce packaging	Economic operators must ensure certain formats (pallets, boxes, crates, plastic transport packaging) are reusable within a reuse system.	From 2030
32	Takeaway food and drink packaging	Reuse targets for takeaway food and drink packaging (cups, boxes, containers). Businesses must offer reusable options and meet minimum reuse quotas.	Phased from 2030
33	Retail and logistics packaging	Large retailers must provide reusable packaging options for transport and grouped packaging. Reporting obligations on reuse performance.	From 2030

To support a sustainable future, the EU has also set recycling targets for packaging waste, shown in Figure 9. These recycling goals work alongside reuse targets to reduce waste and protect resources.

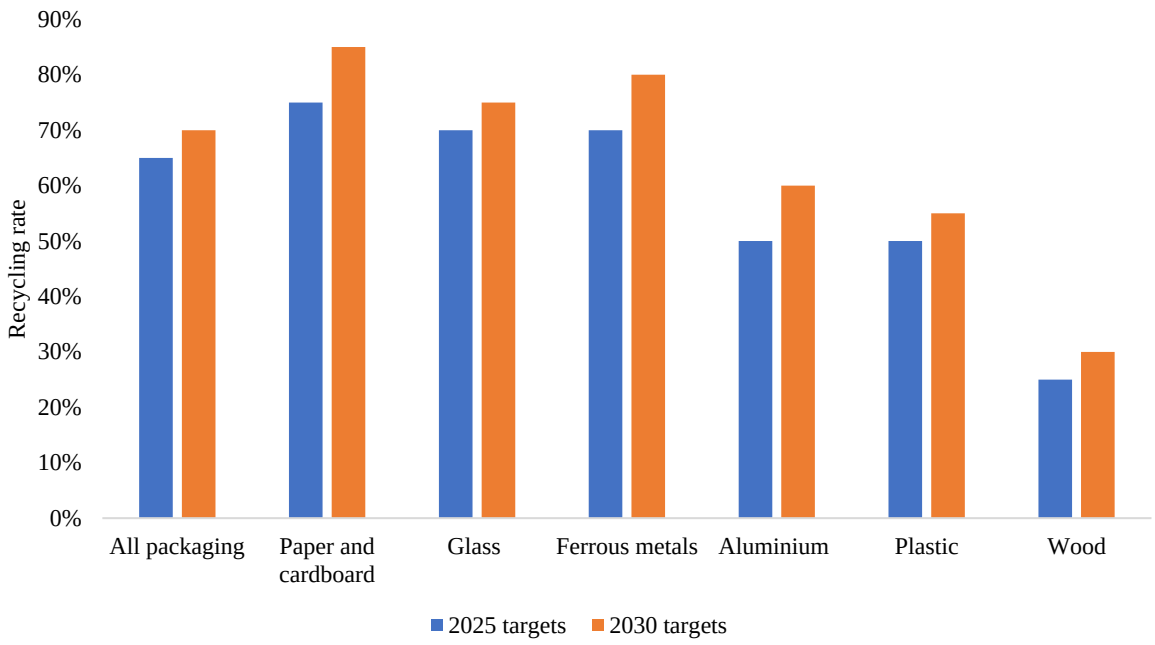

Figure 9 EU recycling targets for packaging waste [55].

4.1.6 Relevance and implications for the SBS region

The EU legal and policy framework on packaging and waste management has direct relevance for the SBS region, where cross-border cooperation is essential to achieve sustainable outcomes. The shift from directives to the new PPWR provides a unified set of rules that apply equally across all Member States, removing inconsistencies that previously existed between national laws. This is particularly important in the SBS region, which includes several countries with close economic and trade ties. A common legal framework ensures that reusable paper packaging can move freely across borders and be treated as a product rather than waste, reducing administrative barriers and supporting regional supply chains.

The Waste Shipment Regulation also plays a critical role in the SBS region, as it prevents waste misclassification and illegal shipments while making it easier to transport reusable packaging across borders. This supports the creation of regional reuse systems that can operate efficiently and sustainably.

An EPR adds another layer of relevance, as producers in the SBS region will be required to design packaging that is easier to reuse and recycle, while also covering the costs of collection and recovery. This creates incentives for innovation in paper packaging design and encourages businesses to adopt reusable formats that can be shared across the region.

The EU's reuse and recycling targets set clear timelines and measurable goals that all Member States must meet. For the SBS

region, this means coordinated action to reduce single-use packaging, expand reuse systems, and align business practices with EU-wide objectives. By working together under a harmonized legal framework, the SBS region can become a model for cross-border cooperation in packaging reuse, contributing to the EU's broader circular economy goals while delivering local environmental and economic benefits.

4.2. National Legal Frameworks in SBS Countries

4.2.1 Germany

Germany's packaging and recycling system is governed by two main federal laws (i.e., the circular economy and packaging acts). The Circular Economy Act provides the overall framework for waste management and the circular economy. Its purpose is to conserve natural resources, protect human health, and establish a waste hierarchy. It also gives the federal government authority to impose producer responsibility [56]. The Packaging Act regulates how packaging is placed on the market, the obligation to take it back after use, and its recycling. It implements EPR and aims to reduce environmental impacts while increasing recycling rates [57].

Under the Packaging Act, any company that first places filled packaging on the German market is considered a producer. Before selling packaged products, companies must register in the national LUCID packaging register, managed by the Central Packaging Register Authority (Zentrale Stelle Verpackungsregister, ZSVR). Registration is mandatory and must be completed before the first product is placed on the market; unregistered packaging cannot be sold [58]. Producers whose packaging ends up as household waste must also join a licensed dual system and pay fees to finance nationwide collection and recycling [57].

Private dual systems are responsible for the separate collection, sorting, and recycling of household packaging waste. They are funded by producers and retailers, not municipalities, and must meet legally defined recycling quotas. Since 1 January 2022, packaging made of paper, cardboard, carton, glass, aluminum, and steel must reach a 90% recycling rate; beverage cartons 80%; composite packaging 70%; and plastic packaging 63% material recycling [57]. Compliance is monitored through the mandatory reporting of packaging volumes, which the ZSVR verifies together with state enforcement authorities [59].

The Packaging Act also includes reuse obligations in the food service and takeaway sector. Since 1 January 2023, businesses selling takeaway food or drinks must offer customers reusable cups and/or food containers as alternatives to single-use

packaging, as set out in § 33 of the Act. Reusable options must not be offered under worse conditions than single-use ones (for example, they cannot be more expensive apart from a refundable deposit) [60]. From 2025, food and drinks consumed on site, such as in fast-food restaurants, should no longer be served in single-use packaging but in reusable containers. Small outlets with limited space and staff can meet this duty by filling customers' own clean containers [61].

Germany applies ambitious recycling targets. Since 1 January 2022, dual systems must achieve 90% recycling for paper, cardboard, carton, glass, and metal, and 63% for plastic packaging. By 31 December 2025, at least 65% of all packaging waste must be recycled overall, including 75% for paper, cardboard, and carton. By 31 December 2030, the overall target rises to 70%, with paper, cardboard, and carton reaching 85% [62]. Monitoring is carried out through mandatory data reporting by producers and dual systems. The ZSVR operates the public LUCID register, compares reported packaging volumes, and works with the German Environment Agency and Länder authorities to enforce compliance and prevent free-riding.

4.2.2 Lithuania

Lithuania's packaging and recycling system is governed by the Law on Packaging and Packaging Waste Management (2003, amended through 2023-2024) and the Waste Management Law (1998, amended 2023). Together, these laws establish the national framework for packaging waste prevention, reuse, and recycling, while transposing EU requirements on EPR. The legislation defines producers as any company that manufactures, imports, or first places packaged goods on the Lithuanian market. Producers must register with the national packaging register and join a PRO, which finances the collection and recycling of household packaging waste [63].

Under the EPR system, producers are required to report annually on the quantities and types of packaging placed on the market, including paper and cardboard. They must pay fees to PROs, which organise nationwide collection and recycling. Eco-modulated fees are being introduced to incentivise packaging that is easier to reuse or recycle. Unregistered producers cannot legally place packaging on the market, and incorrect reporting can lead to administrative penalties [63].

Municipalities are responsible for organising the separate collection of household waste, whereas PROs ensure that packaging waste is sorted and recycled to meet national and EU targets. Lithuania defines reuse in its legislation as the operation in which products or components that are not waste are used again for the

same purpose. While there is no general reuse obligation, reuse is supported through voluntary initiatives, municipal pilots, and EU-funded projects. Businesses may also allow customer-owned containers, provided hygiene standards are met.

Lithuania follows EU recycling targets, requiring at least 75% of paper and cardboard packaging to be recycled by 2025 and 85% by 2030. Monitoring is carried out through mandatory reporting by producers and PROs, with oversight by the Ministry of Environment. Compliance is enforced through audits, inspections, and reporting to the European Commission [64].

4.2.3 Poland

Poland's packaging and recycling system is undergoing major reform through a new Act on Packaging and Packaging Waste (2025 draft), which introduces a strengthened EPR model. The legislation aligns Polish law with EU requirements under the PPWR and places financial and reporting obligations directly on producers and importers of packaging [65].

Under the new framework, companies that first place packaging or packaged goods on the Polish market are considered producers. They must register in the national producer register, report packaging volumes by material type, and join a PRO. Producers will pay fees that finance the collection, sorting, and recycling of packaging waste. The system introduces eco-modulated fees, rewarding packaging that is easier to reuse or recycle. Unregistered producers cannot legally place packaging on the market, and misreporting can result in administrative penalties [66].

Municipalities remain responsible for organising the separate collection of household waste, but the financial burden is shifted to producers under the EPR system. PROs must meet national recycling targets and ensure high-quality processing of collected packaging. Businesses are required to sort their waste according to national rules and deliver it to authorised operators. Compliance is monitored by the Ministry of Climate and Environment and local authorities through reporting controls and inspections.

Poland legally recognises reuse within its packaging legislation, encouraging businesses to design packaging that can circulate multiple times. Pilot projects in the foodservice and retail sectors are supported by government guidance and EU funding. While reuse is not yet mandatory, the new law promotes the uses of reusable packaging as part of Poland's circular economy strategy.

Poland follows EU recycling targets, requiring 75% of paper and cardboard packaging to be recycled by 2025 and 85% by 2030. Monitoring is carried out through mandatory reporting by producers and PROs, with oversight by the Ministry of

Climate and Environment. The new EPR system is expected to significantly reduce waste volumes and promote innovative, environmentally friendly packaging solutions [65].

4.2.4 Denmark

Denmark's packaging and recycling system is governed by a set of national laws that implement EU requirements while introducing instruments to stimulate reuse and high-quality recycling. The Environmental Protection Act (Miljøbeskyttelsesloven) provides the overall framework for waste prevention, reuse, recycling, and municipal responsibilities. It establishes the waste hierarchy, defines producer and distributor obligations, and gives the government authority to introduce EPR schemes [67, 68]. The Waste Ordinance (Affaldsbekendtgørelsen - Act 3) sets operational rules for waste sorting, data reporting, and handling of recyclable materials, while also defining reuse, recycling, and recovery. A new EPR system for packaging will take effect on 31 December 2024, with fees applicable from 1 October 2025. Under this system, companies placing packaging on the Danish market will become financially and organisationally responsible for packaging waste, including reporting, fee payments, and data submission to the central producer register. Eco-modulated fees will apply, incentivising packaging that is easier to reuse or recycle [69].

Under the new EPR framework, companies that first place packaging or packaged goods on the Danish market are considered producers. They must register in the national producer register before entering the market and report the quantities of packaging introduced, including paper and cardboard. Producers are required to join a producer responsibility organisation and pay fees that finance the collection and recycling of household packaging waste. From 2025, eco-modulated fees will ensure that packaging designed for reuse or high recyclability carries lower costs. Unregistered producers may not legally place packaging on the market, and incorrect reporting can result in administrative penalties [70].

Waste collection and recycling obligations are shared between municipalities and producers. Municipalities are responsible for organising the separate collection of household waste across ten mandatory fractions, including paper and cardboard. Producers, through the EPR system, must finance the collection, sorting, and recycling of packaging waste placed on the market, and report annual packaging volumes by material type. Producer responsibility organisations are required to meet national recycling targets and ensure high-quality processing of collected

packaging. Businesses must sort their waste according to national rules and deliver it to authorised operators. Compliance is monitored by the Danish Environmental Protection Agency (EPA) and municipalities through reporting controls, audits, and inspections [71, 72, 73].

Denmark legally defines reuse in the Waste Ordinance as the operation in which products or components that are not waste are used again for the same purpose for which they were designed. While there is no general reuse obligation for foodservice operators, reuse is increasingly supported through municipal pilots, government guidance, and eco-modulated EPR fees that favour reusable or highly recyclable packaging. Under the upcoming EPR system, producers are encouraged to design packaging that can circulate multiple times, and municipalities may require or trial reusable takeaway systems in public spaces, schools, and events. Businesses may also allow customers to bring their own containers, provided hygiene requirements are met. Reuse is therefore legally recognised, not mandatory for most sectors, but actively promoted within Denmark's circular economy strategy [74].

Denmark follows EU recycling targets for packaging, including the requirement that at least 75% of paper and cardboard packaging be recycled by 2025 and 85% by 2030. These targets are implemented nationally through the Waste Ordinance and the new EPR system. Municipalities ensure separate collection, while producer responsibility organisations must secure high-quality recycling of packaging waste. Producers must submit annual data on packaging placed on the market, and producer responsibility organisations must report recycling performance to the Danish EPA. Monitoring is carried out through digital reporting systems, audits, and municipal inspections, with the EPA overseeing national compliance and coordinating reporting to the EU [75].

4.3. Cross-Country Legal Comparison

4.3.1 Definitions and interpretations of reuse and recycling

Across the SBS region, recycling is uniformly understood as the processing of waste materials into new products to meet EU targets, while reuse is defined as using products or components again for their original purpose without generating waste.

Germany explicitly embeds reuse obligations for takeaway food and drinks in the Packaging Act, requiring foodservice operators to offer reusable options under fair conditions. Denmark formally defines reuse in the Waste Ordinance and promotes it through pilots and EPR fee incentives, though it is not generally mandatory. Lithuania and Poland legally recognize

reuse within their packaging laws and circular strategies, supporting voluntary and pilot schemes rather than imposing blanket obligations. These approaches align with EU principles but differ in the extent to which reuse is mandated in foodservice and retail settings [57, 60, 74].

4.3.2 EPR schemes and producer responsibilities

All four countries implement or are implementing EPR for packaging, shifting financial and organizational duties for collection and recycling to producers. Germany's system is established through licensed dual systems funded by producers, with mandatory registration in the LUCID database and reporting to ZSVR. Denmark's new EPR enters into force in late 2024 with fees from October 2025, requiring producer registration, membership in a PRO, and eco-modulated fees. Lithuania requires producers to register and join PROs, report annually, and finance nationwide systems; Poland is reforming its EPR with a strengthened model that introduces eco-modulated fees and direct obligations for producers and importers. While the instruments differ in maturity, the direction is consistent: producers finance and organize packaging waste management and are accountable for data reporting and target compliance [57, 58, 63, 65, 69, 70].

4.3.3 Market placement requirements and compliance

Germany requires producers to register with LUCID before placing packaging on the market,to join a dual system, and prohibits the sell of unregistered packaging. Denmark's new regime similarly mandates pre-market registration in the national producer register and joining a PRO; failure to register or incorrect reporting can lead to penalties. Lithuania also mandates producer registration and annual reporting to PROs, with administrative penalties for non-compliance. Poland's reform introduces national producer register obligations, PRO membership, and reporting by material type, with sanctions for misreporting. In all countries, legal market entry is conditional on registration and accurate data submission, making compliance systems (registers, audits, inspections) the backbone of enforcement and EU reporting [58, 63, 66, 70, 75].

4.3.4 Incentives and penalties for reuse practices

Germany combines mandatory reuse offerings in foodservice with fair-conditions rules (e.g., deposit-based parity), creating a compliance obligation that directly supports reuse uptake. Denmark introduces eco-modulated EPR fees that lower costs for packaging designed for reuse or high recyclability and supports municipal pilots, offering economic and

practical incentives without a general mandate. Lithuania and Poland encourage reuse through voluntary schemes, pilots, guidance, and (in Poland's case) upcoming eco-modulated fees, but primarily rely on market incentives rather than statutory obligations. Penalties across countries focus on registration and reporting failures; Germany adds sector-specific compliance exposure for foodservice operators that do not offer reusable options under the Packaging Act [60, 69, 74].

4.3.5 Legal barriers and administrative bottlenecks

Common bottlenecks include fragmented responsibilities between municipalities (collection) and producer-funded systems (sorting and recycling), which can complicate coordination and data quality. Germany's dual system demands precise reporting and verification, raising administrative effort for producers and enforcement agencies. Denmark's transition to EPR introduces implementation challenges (new registers, eco-modulation design, municipal coordination across ten waste fractions). Lithuania and Poland face capacity constraints in PRO administration, data standardization, and scaling reuse pilots into consistent national practice. Cross-border differences in registration platforms, reporting formats, and reuse mandates can create friction for producers operating across multiple SBS countries, increasing compliance costs and the risks of misclassification for reusable packaging [57, 59, 71, 72, 73, 75].

4.3.6 Enforcement mechanisms and competent authorities

Germany's enforcement is led by the ZSVR (public register, data checks) in cooperation with the German Environment Agency and the Länder authorities, ensuring verification and action against free-riding. Denmark's Danish Environmental Protection Agency (EPA) and municipalities oversee registration, reporting, and municipal collection performance, supported by digital reporting, audits, and inspections. Lithuania's Ministry of Environment supervises producer reporting and PRO performance, enforcing compliance via audits and inspections and coordinating EU reporting. Poland's Ministry of Climate and Environment and local authorities conduct controls and inspections, with the reformed EPR expected to strengthen oversight. In all countries, enforcement combines mandatory data reporting, registry checks, audits, and administrative penalties to secure target achievement and EU compliance [59, 63, 65, 71, 75].

4.4. Legal Enablers and Barriers to Multiple Reuse

4.4.1 Enabling provisions at EU and national levels

The EU has introduced several legal provisions that enable and encourage multiple reuses of packaging, particularly under the new PPWR. This regulation, which replaced Directive 94/62/EC, sets binding rules across all Member States and requires that by 2030, all packaging placed on the EU market must be either reusable or recyclable. Importantly, it establishes reuse targets for specific sectors, including beverage containers, takeaway food packaging, transport packaging, and retail packaging. These targets create a harmonized framework that supports the development of reuse systems across borders, ensuring consistency and reducing administrative barriers.

The Waste Framework Directive (2008/98/EC) also plays a central role by placing reuse at the top of the waste hierarchy, above recycling. This prioritization provides a strong legal foundation for Member States to design policies that favor reuse over single-use packaging. It encourages investment in collection systems, infrastructure, and consumer engagement strategies that make reuse practical and accessible.

At the national level, countries such as Germany have introduced enabling provisions through the Packaging Act (Verpackungsgesetz). Since January 2023, food service and takeaway businesses are legally required to offer reusable cups and containers as alternatives to single-use packaging. From 2025, food and drinks consumed on site must be served in reusable packaging rather than disposables, with small outlets allowed to meet the requirement by filling customers' own clean containers. These measures directly support multiple reuses by embedding reuse obligations into everyday business practices.

EPR schemes further enable reuse by shifting responsibility for packaging waste management to producers. Under the PPWR, producers must pay fees based on the environmental impact of their packaging, incentivizing them to design packaging that is durable, recyclable, and reusable. Deposit return schemes for beverage containers and eco-modulated fees are examples of how EPR can be used to strengthen reuse systems.

Together, these EU and national provisions create a supportive legal environment for multiple reuses. They establish clear obligations, harmonized targets, and financial incentives that encourage businesses to adopt reusable packaging, while also empowering consumers to participate in reuse systems. For the South Baltic Sea region, these enabling provisions are particularly relevant as they provide a consistent framework across Member

States, making it easier to build cross-border reuse initiatives and advance the transition toward a circular economy.

4.4.2 Barriers to multiple reuse

Despite strong enabling provisions at the EU and national levels, several barriers continue to limit the widespread adoption of multiple reuse systems. One major challenge is the lack of harmonized infrastructure across Member States. While the PPWR sets common rules, the availability of collection points, cleaning facilities, and logistics for reusable packaging varies greatly, making cross-border reuse in regions such as the South Baltic Sea difficult to implement consistently.

Another barrier is consumer behavior and acceptance. Many consumers remain accustomed to single-use packaging due to convenience, hygiene concerns, or lack of awareness about reuse options. Changing these habits requires significant investment in communication campaigns and incentives, which are not yet uniformly supported across the EU.

Economic costs and market readiness also pose obstacles. Businesses often face higher upfront costs to introduce reusable packaging systems, including redesigning packaging, investing in cleaning and return logistics, and training staff. Smaller companies, particularly in the food service sector, may struggle to meet reuse obligations without financial or technical support.

Legal and regulatory issues can also create barriers. The Waste Shipment Regulation aims to distinguish between reusable products and waste, but in practice, classification challenges remain. This can lead to administrative burdens and uncertainty when moving reusable packaging across borders. Similarly, differences in enforcement between Member States can result in uneven compliance and discourage investment in reuse systems.

EPR schemes have historically focused more on recycling than reuse. Although the PPWR introduces reuse targets, many PROs are still structured around recycling systems and adapting them to support reuse requires significant institutional change.

Together, these barriers highlight the need for coordinated action at the EU and national levels to ensure that reuse systems are not only legally mandated but also practically achievable. For the South Baltic Sea region, overcoming these obstacles will be critical to building effective cross-border reuse networks and achieving the EU's circular economy goals.

4.4.3 Best practices and innovative policy instruments

The transition to multiple reuse systems in packaging requires not only strong legal frameworks but also the adoption of best

practices and innovative policy instruments. Across the EU, several approaches have proven effective in enabling reuse, many of which are directly relevant to the BePacMan project.

One best practice is the implementation of deposit return schemes for beverage containers. These systems incentivize consumers to return packaging by offering a refundable deposit, ensuring high collection rates and enabling multiple reuse cycles. For BePacMan, adapting DRS principles to paper packaging could support the creation of cross-border reuse systems that are simple and attractive to consumers [76].

Another important instrument is eco-modulated fees under EPR. By linking producer fees to the environmental performance of packaging, these schemes reward reusable and recyclable designs while penalizing single-use formats. This creates a financial incentive for producers in the SBS region to invest in durable paper packaging that can withstand multiple reuse cycles [77].

Public procurement policies also serve as powerful enablers. When governments and municipalities require reusable packaging in catering, events, or public services, they create stable demand and set an example for businesses and consumers. BePacMan can leverage such policies by working with local authorities in the SBS region to integrate reusable paper packaging into public contracts [78].

Standardization of reusable formats is another best practice. By harmonizing the design of reusable packaging across borders, businesses can reduce costs, and consumers can use packaging interchangeably in different countries. For BePacMan, promoting standardized paper packaging formats would facilitate cross-border logistics and strengthen regional cooperation [79].

Innovative instruments such as digital tracking systems are emerging to support reuse. QR codes or RFID tags can be used to monitor packaging circulation, track return rates, and provide transparency for both businesses and consumers. Integrating digital tools into BePacMan's reuse model would enhance efficiency and accountability across the SBS region [80].

Consumer engagement campaigns are essential to shift behavior away from single-use packaging. Best practices include clear labeling, awareness programs, and incentives for choosing reusable options. BePacMan can tailor these campaigns to the cultural and social context of the SBS region, ensuring that consumers understand the environmental and economic benefits of reusable paper packaging [81].

4.4.4 Risk areas and compliance uncertainty

While EU and national legislation increasingly support reuse, several risk areas and compliance uncertainties remain that could affect the successful implementation of paper packaging reuse systems. In this project, these risks must be carefully considered to ensure that cross-border cooperation in the SBS region is both legally compliant and practically feasible.

One major risk area is regulatory interpretation and enforcement differences. Although the PPWR sets harmonized rules across the EU, Member States may interpret certain provisions differently, particularly regarding what qualifies as reusable packaging. This creates uncertainty for businesses operating across borders in the SBS region, as paper packaging formats accepted in one country may face stricter requirements in another [82].

Another area of uncertainty is classification between reuse and waste. The Waste Shipment Regulation seeks to distinguish between reusable products and waste, but in practice, paper packaging that has been used multiple times may be misclassified as waste during transport. This could lead to administrative delays, additional costs, or even restrictions on the cross-border movement of reusable packaging [83].

Economic and operational risks also exist. Businesses may face higher costs to meet reuse obligations, including investment in cleaning systems, logistics, and standardized packaging formats. Smaller outlets in the SBS region may struggle to comply with reuse requirements without financial support or exemptions. Compliance uncertainty around fee structures under EPR, such as how eco-modulated fees will be applied to reusable paper packaging, adds further complexity [84].

Consumer acceptance and liability risks must also be considered. If reusable paper packaging is not perceived as hygienic or durable enough, consumers may resist adoption. Businesses could face liability concerns if reused packaging fails to meet food safety standards. Clear EU-wide guidance on safety and hygiene requirements for reusable paper packaging is therefore essential [85].

Monitoring and reporting obligations present compliance challenges. Producers and dual systems must report packaging volumes and recycling or reuse rates to authorities such as the ZSVR in Germany. For cross-border projects like BePacMan, aligning reporting systems across multiple Member States is complex and may lead to inconsistencies or penalties if data is incomplete or misreported [86].

4.4.5 Opportunities for harmonisation and strategic alignment

Despite the risks and uncertainties, there are significant opportunities to harmonise legal frameworks and align strategies that can strengthen multiple reuse systems across the EU and particularly in the SBS region. The new PPWR already provides a harmonised baseline by setting EU-wide reuse and recycling targets. Building on this, Member States can work together to develop common definitions of reusable packaging shared standards for paper packaging formats, and coordinated enforcement practices. Such harmonisation would reduce regulatory fragmentation and give businesses greater confidence to invest in cross-border reuse systems.

Strategic alignment can also be achieved through regional cooperation platforms. In the SBS region, countries could jointly establish infrastructure for cleaning, logistics, and tracking of reusable paper packaging, ensuring that systems are interoperable across borders. This would lower costs, improve efficiency, and make reuse more practical for both large and small businesses. Aligning EPR schemes across Member States is another opportunity. By agreeing on consistent eco-modulated fee structures that reward reusable paper packaging, producers would face clearer obligations and stronger incentives to design durable, reusable formats.

Public authorities can further drive harmonisation by adopting common procurement policies that require reusable packaging in public services and events. This creates stable demand and sets a unified example for businesses and consumers. Coordinated consumer engagement campaigns across the SBS region would help build trust in reusable paper packaging, addressing hygiene and durability concerns while promoting the environmental and economic benefits of reuse.

5. Stakeholders' needs and challenge mapping

This section reports on the stakeholder mapping conducted within Work Package 2.2 of the BePacMan project. This mapping highlights the main stakeholder groups engaged in the paper packaging lifecycle across the South Baltic Sea region, outlining their stated needs and priorities, the barriers they encounter in adopting circular packaging practices, and a comparative synthesis across countries. In total, 126 stakeholders contributed to the study, representing four groups: Producers (n=7), Logistics providers (n=7), E-commerce businesses (n=6), and Consumers (n=106). The results were analyzed using descriptive statistics to reveal key patterns, challenges, and opportunities for advancing circular paper packaging systems.

5.1 Stakeholder groups mapped

In order to assess the potential for reusable paper packaging systems within the South Baltic Sea region, stakeholders were identified and categorized based on their position in the packaging value chain, their functional role, and their potential impact on circular economy outcomes. The following stakeholder categories and subcategories have been mapped across the partner countries (Germany, Poland, Denmark, and Lithuania) as shown in Figure 10.

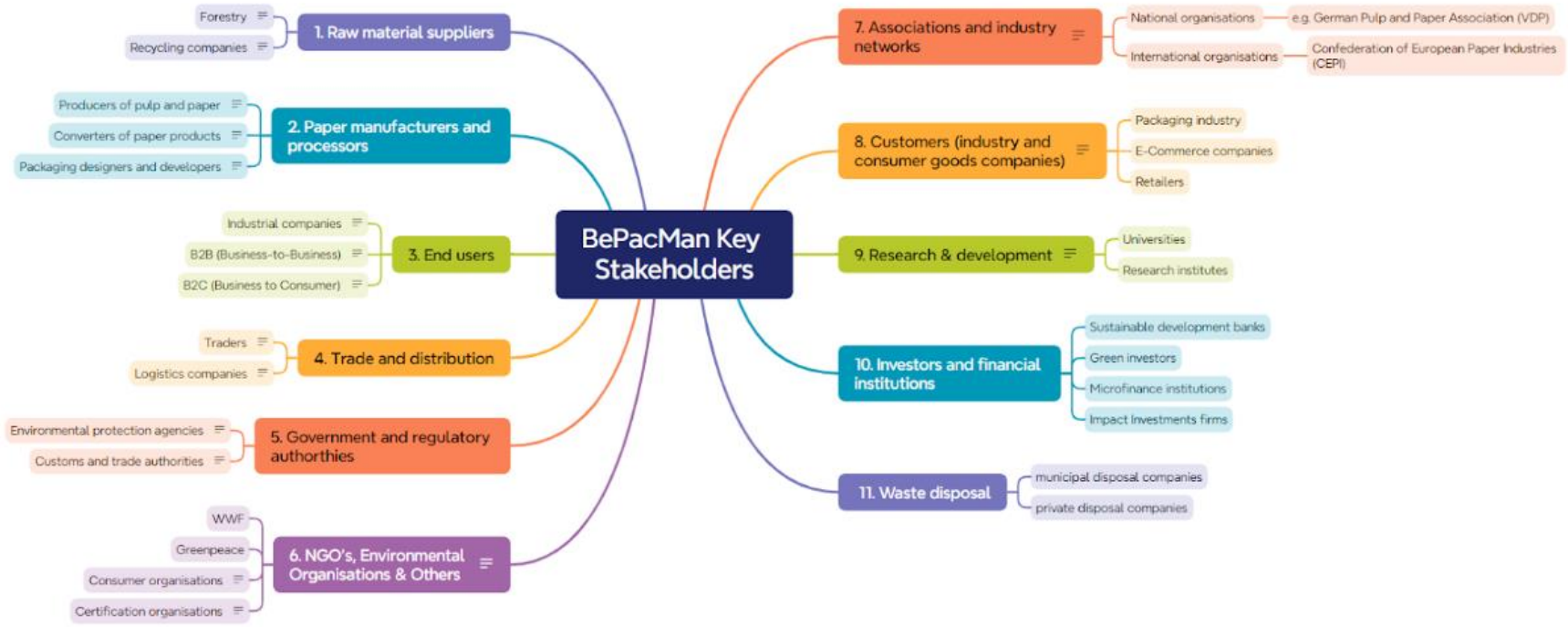

Figure 10 Overview of stakeholder categories across the packaging value chain

a. **Raw material suppliers:** This group includes forestry operations and recycling companies that provide virgin or recovered materials used in paper packaging production. They influence material availability, quality, and environmental footprint at the very beginning of the value chain.
b. **Paper manufacturers and processors:** Comprising pulp and paper producers, paper product converters, and packaging designers and developers, this group determines the physical characteristics of packaging, including its durability, reusability, and recyclability.
c. **End users :** Industrial companies, business-to-business (B2B), and business-to-consumer (B2C) actors represent the end users of paper packaging. Their purchasing preferences, operational models, and waste management behavior shape demand for circular packaging solutions.
d. **Trade and distributions of actors:** This group includes traders and logistics companies responsible for transporting packaged goods. Their systems and infrastructure play a key role in the feasibility of reverse logistics required for reusable packaging.
e. **Government and regulatory authorities:** These stakeholders, such as environmental protection agencies and customs or trade authorities, are responsible for setting, enforcing, and harmonizing legal frameworks. They influence incentives, obligations, and market access for circular packaging models.
f. **Non-Governmental and Environmental Organisations:** NGOs, consumer advocacy groups, and certification bodies raise awareness, promote sustainability standards, and provide oversight or independent validation of packaging claims.
g. **Associations and Industry Networks:** National and international organisations in the paper, packaging, and waste management sectors serve as platforms for knowledge sharing, lobbying, and coordination. They are instrumental in aligning cross-sector efforts.
h. **Customers (Industry and Consumer Goods Companies):** This group includes packaging-intensive sectors like the e-commerce industry, retailers, and consumer goods companies. Their demand for sustainable packaging and willingness to invest in reuse models are critical to mainstream adoption.
i. **Research and Development Institutions:** Universities and research institutes provide data, pilot testing, and innovation support. Their role is essential in evaluating the

environmental and economic impacts of reuse models and designing scalable solutions.

j. **Financial Institutions and Impact Investors:** Banks, green investment funds, microfinance institutions, and impact-oriented investors influence the financial viability of circular packaging systems through capital allocation, grants, and risk-sharing mechanisms.

k. **Waste Disposal and Management Companies:** Including both municipal and private actors, these stakeholders handle the end-of-life stage of packaging. Their ability to separate, collect, and manage reusable items versus waste is a key factor in the effectiveness of reuse systems.

Following the stakeholder mapping, data collection was conducted through four structured questionnaires, each tailored to a specific group within the paper packaging value chain as shown in Figure 11. The producer questionnaire targeted a range of actors including raw material suppliers, pulp and paper manufacturers, converters, and packaging designers. The logistics questionnaire addressed stakeholders involved in transportation, distribution, collection, and recycling, capturing insights from companies managing both forward and reverse logistics as well as waste handling and material recovery. The e-commerce questionnaire focused on retailers, online sellers, and packaging-intensive SMEs, exploring their operational needs, customer interaction points, and potential roles in reuse systems. The consumer questionnaire gathered information on end-user behaviour, awareness, and preferences related to reusable paper packaging. These four questionnaires provided a comprehensive foundation for identifying stakeholder-specific needs, barriers, and opportunities in the transition toward reusable packaging models across the South Baltic region.

The survey was conducted to better understand the needs, motivations, and barriers faced by producers, logistics operators, e-commerce stakeholders, and consumers in the South Baltic region when considering or adopting reusable paper packaging. In total, interviews were carried out with two producers from Germany, two from Poland, two from Lithuania, and one from Denmark. Among logistics stakeholders, two were interviewed in Germany, four in Poland, one in Lithuania, and none information was obtained in Denmark. For e-commerce stakeholders, no data were obtained in Germany, while two were completed in Poland, three in Lithuania, and one in Denmark. Regarding consumers, twenty-seven were interviewed in Germany, thirty in Poland, twenty-seven in Lithuania, and twenty-one in Denmark.

The questionnaires were completed through online forms, paper-based responses and direct phone interviews. This process provided valuable insights into the factors influencing stakeholder decisions, the main challenges encountered, and the specific needs identified. The following section presents an in-depth analysis of the survey results gathered from producers, logistics stakeholders, e-commerce stakeholders, and consumers across the South Baltic region, with particular attention to Poland, Lithuania, Denmark, and Germany.

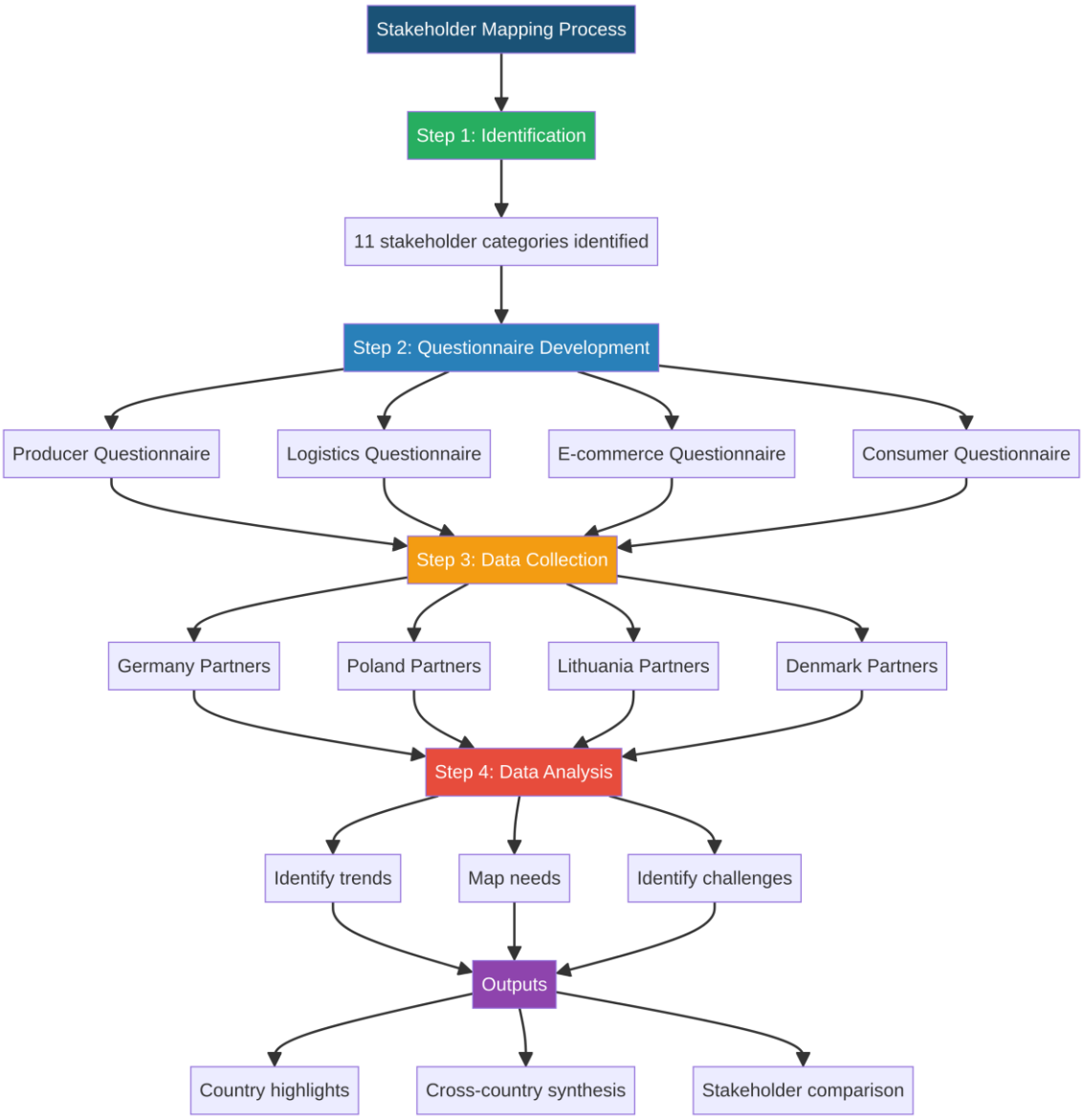

Figure 11 Stakeholder Needs and Challenge Mapping Process

5.2 Identified Needs and Priorities

This section outlines the specific needs and priorities of the four key stakeholder groups as identified through the survey analysis. The results reveal both shared requirements and group-specific priorities that are essential for designing effective and acceptable reuse systems. The Figure 12 provides a comparative overview of the business stakeholders' readiness and willingness to engage in reuse systems.

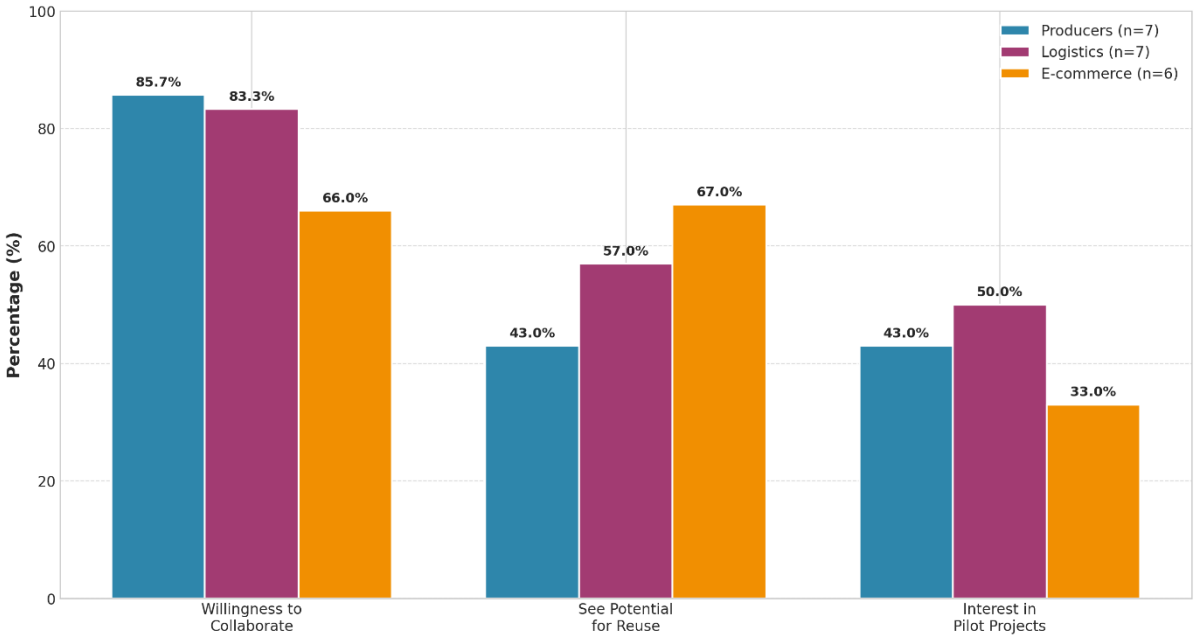

Figure 12 A comparison of the willingness to collaborate, perceived potential for reuse, and interest in pilot projects among Producers, Logistics providers, and E-commerce businesses.

5.2.1. Producers

Producers of paper packaging are cautiously optimistic about reuse systems but require practical and economically solutions to transition from a linear to a circular model. Their needs are primarily focused on de-risking the investment and operational shifts required. The foremost need is for business models that are cost-effective, as a significant majority (85.7%) of producers are open to collaboration on a returning system, but this willingness is contingent on economic viability. This is underscored by the fact that 71.4% agree or strongly agree that taking back products involves high logistical costs. Consequently, producers need efficient and low-cost reverse logistics, as 71.4% view return transport as uneconomical or harmful to the environment. Furthermore, there is a clear demand for well-defined collaboration models that outline roles, responsibilities, and cost-sharing mechanisms to reduce

uncertainty. While immediate interest is moderate, 43% of producers expressed some level of interest in participating in pilot projects, indicating a need for platforms and funding opportunities to test and validate new reuse concepts before large-scale implementation.

5.2.2. Logistic

Logistics providers are central to any reuse system, with needs focused on efficiency, standardization, and the integration of new services. Like producers, they prioritize cost-effectiveness, as 85.7% of survey respondents identified high costs or effort as a major obstacle. Their main requirement is return systems that fit seamlessly into existing delivery networks while remaining economically viable. To support collection, sorting, and redistribution, they also call for standardized, durable packaging formats, with 43% highlighting durability as a key concern. Since 71.4% lack systems to collect used packaging, there is a clear demand for guidance on how to establish and operate such mechanisms, including technical support and best practices. Practical solutions such as stronger boxes, simplified cartons, and designs that are easy to transfer and redeploy are seen as essential. Some stakeholders already reuse cartons as shipping containers or filler material and recognize opportunities to expand these practices through collaboration with waste and recycling service providers. A deposit-and-return mechanism is also mentioned as a way to improve return rates. Overall, many stakeholders are open, sometimes conditionally, to collaboration, provided the concept is clearly defined and adequately supported.

5.2.3. E-commerce

The e-commerce sector, as a major user of paper packaging, plays a critical role in the success of B2C reuse models. Its needs are driven by customer experience, cost pressures, and the unique challenges of last-mile delivery. The most pressing requirement is a functional return system, since currently none of the surveyed e-commerce businesses (100%) have a mechanism for collecting used packaging from customers. This issue is compounded by the unanimous belief that customers are unlikely to return packaging, a perception that sharply contrasts with consumer-reported willingness (73.3%). High costs also pose a significant barrier, with 83.4% of businesses identifying this as an obstacle. To make reuse economically viable, reduced shipping rates for returned packaging are essential. Equally important is bridging the gap between the sector's perception of consumer behavior and actual consumer willingness by providing data

that demonstrates strong consumer interest in reuse.

5.2.4. Consumers

Consumers are the ultimate drivers of B2C reuse systems, with their priorities centered on convenience, simplicity, and tangible benefits. Convenience stands out as the most important factor: the preferred return options are collection stations near supermarkets or shopping centers (37%) and reverse vending machines (31%) as shown in Figure 13. Financial incentives are also a strong motivator, with 66.0% of consumers supporting deposit-style systems. Participation in such schemes scored an impressive average of 7.9 out of 10. While 84.0% of consumers believe reuse is important, 10% identify a lack of information as a barrier, underscoring the need for stronger awareness campaigns. The most frequently cited obstacle, however, is limited storage space (38%), highlighting the importance of return systems that minimize the need to keep bulky packaging at home for extended periods.

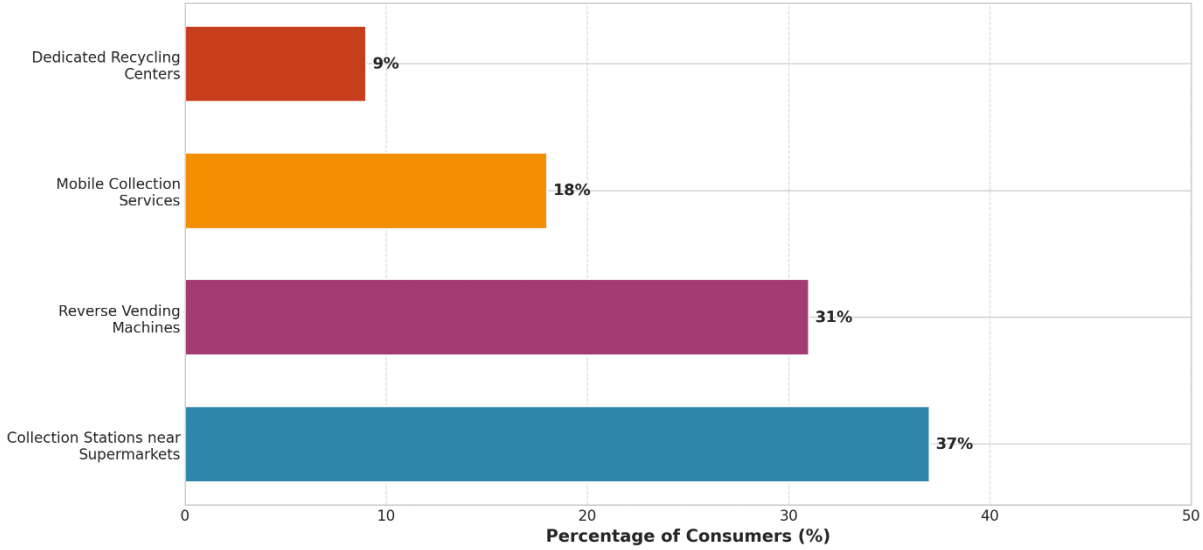

Figure 13 A bar chart showing the percentage of consumers who prefer different types of collection systems for returning paper packaging.

5.3 Main challenges and barriers reported

The transition to a circular economy for paper packaging is constrained by a range of challenges that differ across stakeholder groups. This section highlights the main obstacles reported by producers, logistics providers, e-commerce businesses, and consumers, drawing on quantitative survey data. Figure 14 offers a comparative overview of the barriers identified by business stakeholders.

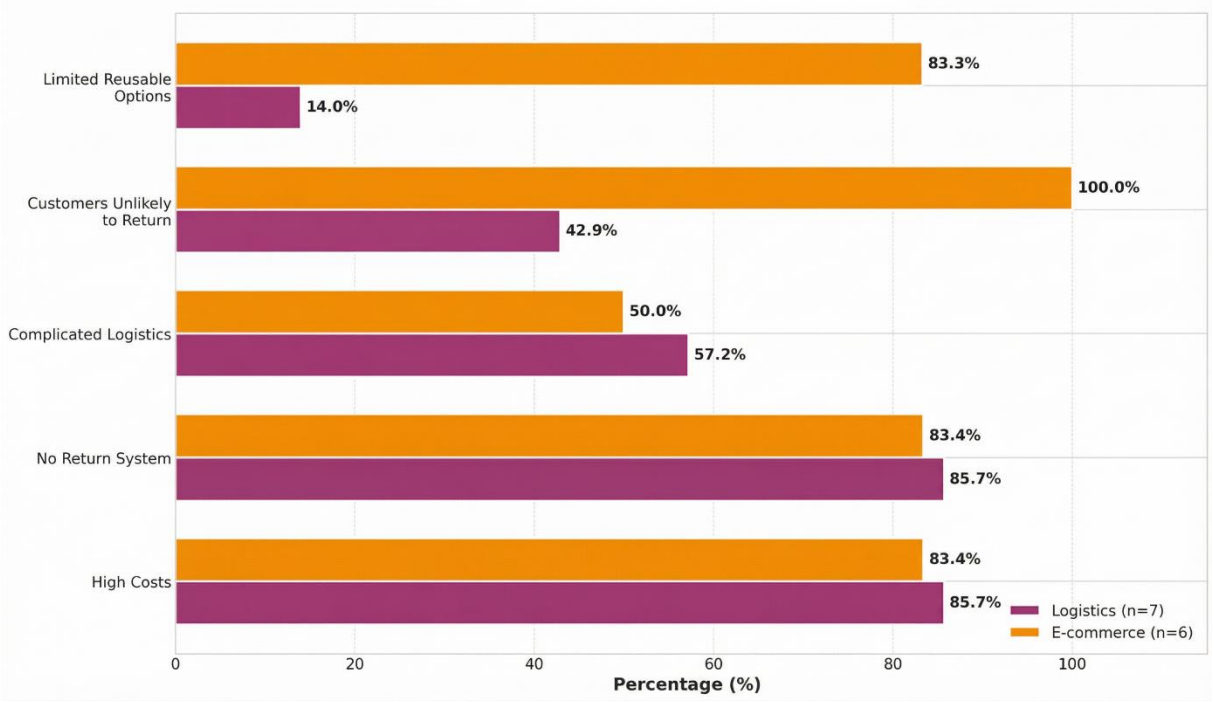

Figure 14 *A horizontal bar chart comparing the main barriers to paper packaging reuse as reported by Producers, Logistics providers, and E-commerce businesses*

- Producers face primarily economic and logistical barriers. A significant majority (71.4%) agree that taking back products involves high logistical costs, while the same proportion believe that return transport is uneconomical or environmentally harmful. The convenience of existing practices also plays a role, with 57.1% stating that recycling is easier than reuse.
- Logistics providers encounter substantial infrastructural hurdles. Most respondents (85.7%) point to the absence of return systems or infrastructure, as well as the high costs and effort involved, as major obstacles. Beyond infrastructure, 57.1% also identify complicated logistics as a barrier.
- E-commerce businesses report some of the strongest barriers, rooted in cost, infrastructure, and perceptions of consumer behavior. The most striking finding is the unanimous belief (100%) that customers are unlikely to return packaging. In addition, 83.4% agree that the lack of return systems or infrastructure, along with high costs and effort, are critical hurdles.
- Consumers, by contrast, face barriers that are more practical than attitudinal. The most significant issue is a lack of space to store packaging (38%), as shown in Figure 15. The second-largest barrier is the condition of the packaging itself, with 33% noting that it is often unsuitable for reuse (e.g., damaged or poor quality). Other notable challenges

include lack of time or convenience (13%) and insufficient information (10%).

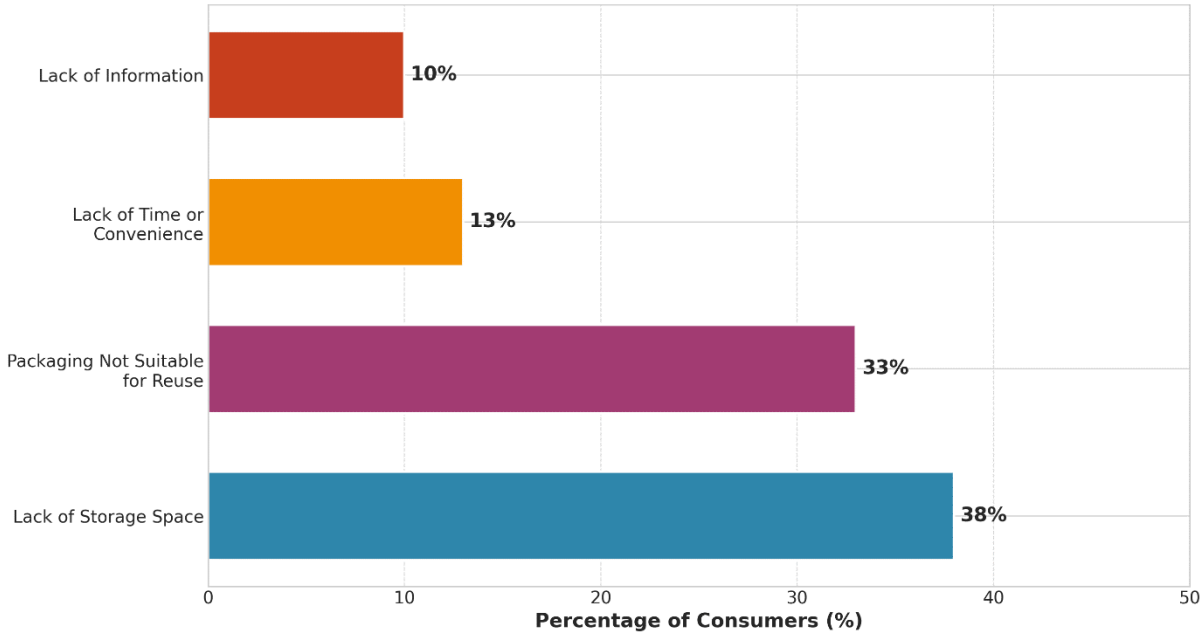

Figure 15 *A horizontal bar chart illustrating the main practical barriers that prevent consumers from reusing paper packaging more often*

5.4 Country-specific highlights

While many needs and challenges are shared across the South Baltic Sea (SBS) region, the survey data reveals distinct country-specific priorities and states of readiness. This section provides highlights from Germany, Poland, Lithuania, and Denmark, drawing on responses from consumers. Figure 16 compares consumer readiness across the four countries.

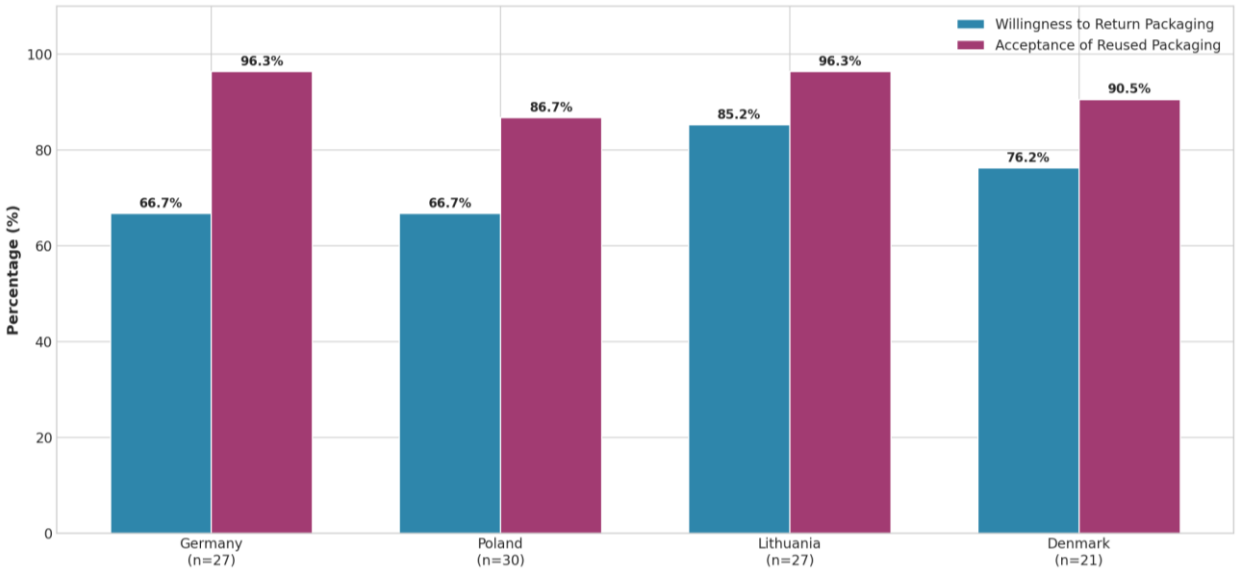

Figure 16 A bar chart comparing consumer willingness to return packaging and their acceptance of reused packaging across the four partner countries.

Germany emerges as a frontrunner in readiness, characterized by high consumer awareness. German consumers demonstrate strong engagement, with 96.3% willing to accept reused packaging. However, their willingness to return packaging is more moderate at 66.7%. There is a strong sentiment for shared responsibility, with German consumers rating the responsibility of businesses at an average of 8.6 out of 10. Poland shows high consumer motivation, presenting a key opportunity for incentive-based systems. Willingness to return packaging is 66.7%, while acceptance of reused packaging is 86.7%. The concept of a deposit-return system is popular, receiving an average participation score of 7.2 out of 10.

Lithuania demonstrates the highest consumer readiness in the survey. Lithuanian consumers are exceptionally open to reuse, with 96.3% willing to accept reused packaging and a remarkable 85.2% willing to return it. This signals a strong social license for implementing circular models. Lithuania also shows the highest enthusiasm for deposit systems, with an average score of 8.9 out of 10, and the highest business responsibility rating at 9.4 out of 10.

Denmark, with its strong focus on sustainability, shows a high degree of consumer awareness. Danish consumers report a satisfaction rate of 71.4% with current recycling options (combining Satisfied and Very satisfied responses). They are highly willing to accept reused packaging (90.5%) and return it (76.2%). They also hold businesses to a high standard, giving an average score of 8.9 out of 10 for business responsibility.

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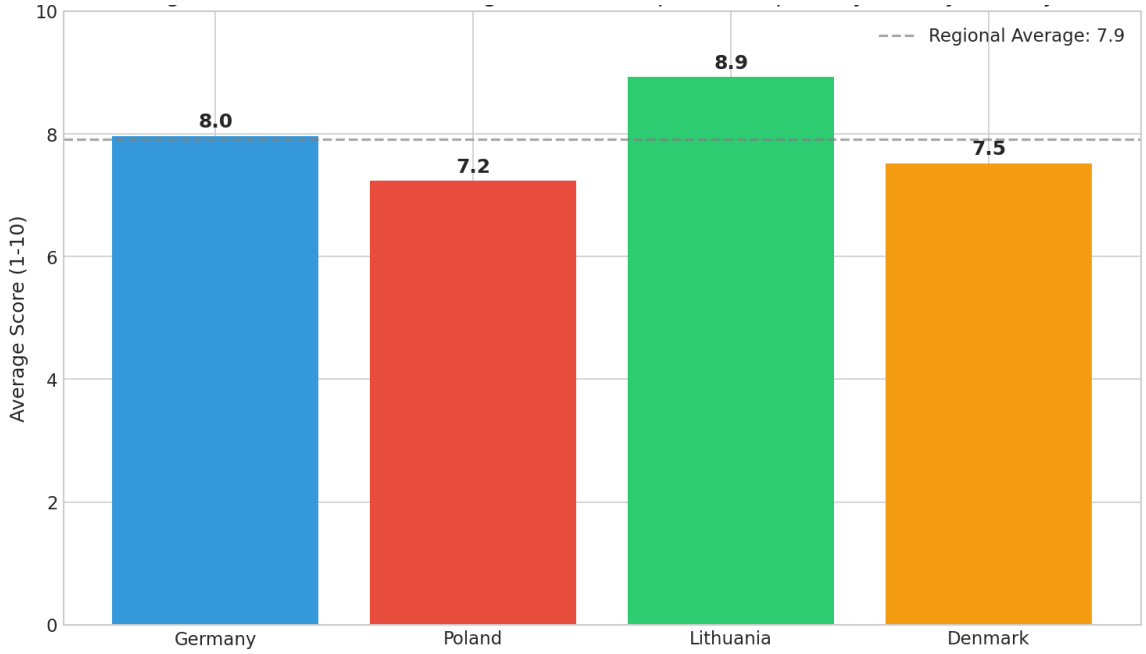

Figure 17 A bar chart comparing the average consumer willingness to participate in a deposit system (on a scale of 1-10) by country.

5.5 Cross-country synthesis and stakeholder group comparison

This section synthesizes the findings to provide a comparative analysis across the four SBS partner countries and the key stakeholder groups. The analysis reveals both common patterns and significant variations, highlighting the complex interplay of factors that will shape the transition to a circular economy for paper packaging.

5.5.1 Cross country synthesis

Across the region, a consistent narrative emerges: there is universal recognition of the need for circularity, but the path forward is fraught with shared challenges. At the same time, each country's unique context creates different levels of readiness. Table 5 summarizes key consumer metrics by country, indicating that while Germany may be the most structurally ready, the highest levels of consumer motivation are currently found in Lithuania, presenting a unique opportunity to pilot reuse systems in that market.

Table 5 Summary of key consumer metrics by country

Country	Willingness to Return	Acceptance of Reused Packaging	Deposit System Score	Business Readiness
Germany	66.7%	96.3%	8.0/10	High, but cost-sensitive
Poland	66.7%	86.7%	7.2/10	Moderate, infrastructure-focused
Lithuania	85.2%	96.3%	8.9/10	Highest consumer motivation
Denmark	76.2%	90.5%	7.5/10	Seeking policy guidance

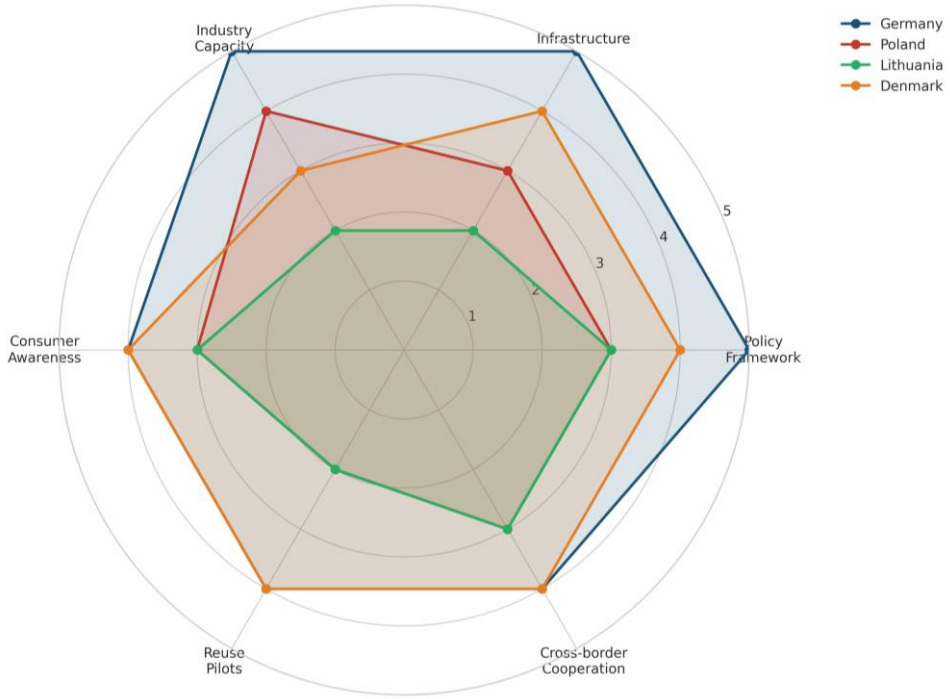

Figure 18 Country Readiness for Reusable Packaging Systems (Comparative assessment of Germany, Poland, Lithuania, and Denmark across six dimensions relevant to implementing reusable packaging systems under the PPWR. The assessment is based on industry capacity (Section 3.2), recycling infrastructure (Section 3.3), and policy frameworks (Section 4). Scale: 1 (lowest) to 5 (highest readiness))

Figure 18 provides a multi-dimensional comparison of the four BePacMan partner countries's readiness to implement reusable packaging systems. Germany demonstrates the highest overall readiness, particularly in terms of infrastructure and industrial capacity. Denmark shows strong policy frameworks and consumer awareness. Poland has significant industry capacity but requires further development in consumer awareness and reuse pilots. Lithuania, while smaller in scale, shows potential for cross-border cooperation within the Baltic Sea region.

5.5.2. Stakeholder group comparison

A comparison of the four stakeholder groups reveals critical differences in perspective, priorities, and perceived barriers. The most significant result is the dramatic gap between business perception and consumer reality, as illustrated in Figure 19.

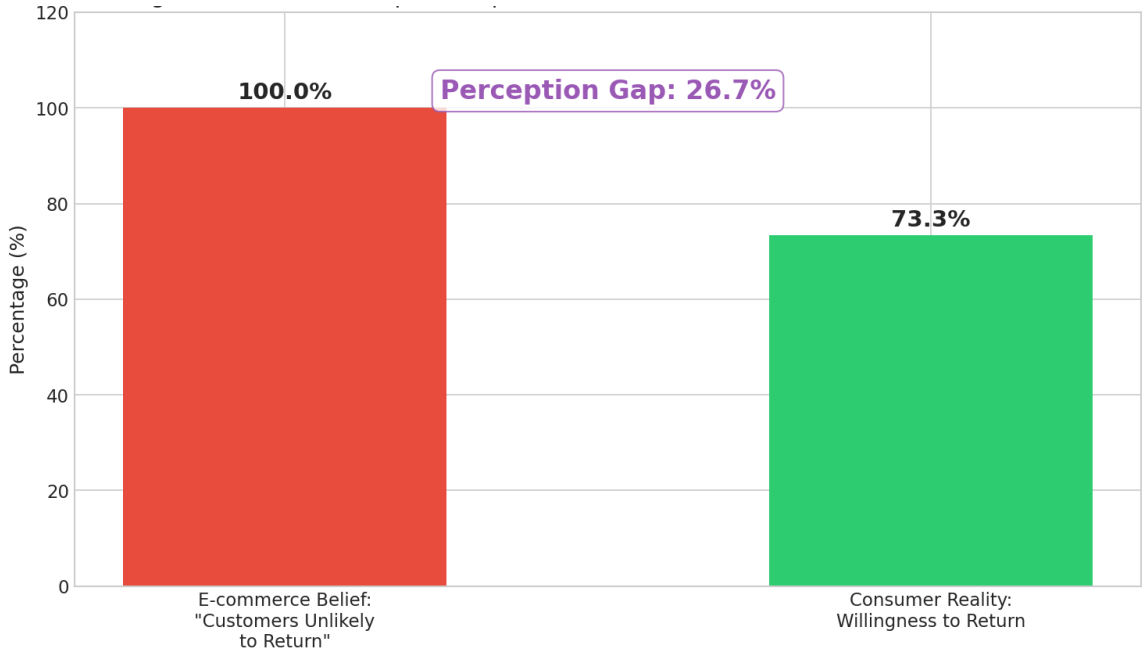

Figure 19 A bar chart illustrating the critical perception gap between e-commerce businesses belief that customers are unlikely to return packaging and the reality of consumer willingness.

There is a fundamental disconnect between the e-commerce sectors view of consumers and the data consumers provided. While 100% of e-commerce respondents believe that Customers are unlikely to return packaging, the reality is that 73.3% of consumers state they would definitely or probably return packaging if convenient options were available. Furthermore, 92.4% of consumers would accept receiving their orders in a reused box. This perception gap is a critical barrier, as it discourages e-commerce businesses from investing in or piloting return models. Bridging this gap by

disseminating accurate consumer data is a primary strategic priority.

Across all business groups, cost remains the dominant concern. In contrast, consumers are driven by practicalities. Their willingness is high, but it is conditional on systems being easy to use and, ideally, rewarding. They emerge from this analysis not as a barrier, but as a key, untapped enabler for the transition to a circular economy. The challenge lies in designing systems that are convenient enough for consumers while being cost-effective enough for businesses a task made more difficult by the significant perception gap held by customer-facing companies.

6. Conclusions and recommendations

This report, developed within the BePacMan project, provides a comprehensive analysis of the policy frameworks, market dynamics, and stakeholder needs shaping the transition to a circular economy for paper packaging in the South Baltic Sea region. The findings underscore a pivotal moment for the industry, driven by the ambitious targets of the new EU Packaging and Packaging Waste Regulation , which mandates a significant shift from recycling to reuse. The analysis of Germany, Poland, Lithuania, and Denmark reveals a region with diverse capabilities but a shared set of challenges and opportunities.

6.1 Findings

The report yields findings that are critical for understanding the current landscape and charting a path forward:

- A Harmonized but challenging policy environment: The PPWR creates a unified legal framework across the EU, eliminating regulatory inconsistencies and facilitating cross-border trade in reusable packaging. However, the reuse targets for 2030 and 2040 present a significant implementation challenge for all member states. While the regulation provides the what, stakeholders across the SBS region lack clear guidance on the how, particularly concerning the development of practical and economically viable reuse systems.
- Diverse but complementary industry structures: The SBS region is home to a varied paper packaging industry. Germany stands out as a technological leader with advanced recycling infrastructure and a strong policy framework. Poland offers significant industrial scale and production capacity. Denmark is a leader in innovation and consumer-facing reuse pilots, while Lithuania provides a stable, vertically integrated industry with potential for niche contributions and regional cooperation. This diversity represents a strategic strength if leveraged through cross-border collaboration.
- Universal need for practical and standardized systems: Across all four countries and stakeholder groups from producers to consumers a consistent set of needs emerged. Stakeholders universally prioritize the development of economically viable reuse models, supported by standardized packaging formats and efficient, low-cost reverse logistics. There is a clear demand for collaboration frameworks that define roles, responsibilities, and cost-sharing mechanisms to de-risk investment.
- Shared barriers to adoption: The primary obstacles to adopting reusable

paper packaging are consistent across the region. These include the high cost and logistical complexity of reverse logistics, the lack of harmonized infrastructure for collection and cleaning, production processes currently optimized for single-use formats, and consumer habits tied to convenience. Uncertainty regarding regulatory interpretation and the allocation of responsibilities further hinders progress.

- Consumers as key enablers: Despite concerns about convenience, consumers in all four countries demonstrated a high willingness to participate in reuse systems, provided they are simple and accessible. Preferred return options include collection stations at supermarkets and reverse-vending machines. This indicates that consumer acceptance is not a primary barrier; rather, the lack of user-friendly infrastructure is the main bottleneck.

6.2 Recommendations

Based on these results, the following recommendations are proposed to accelerate the transition to reusable paper packaging systems in the South Baltic Sea region. These recommendations are directed at policymakers, industry stakeholders, and the BePacMan project consortium.

Recommendation 1: Establish a cross-border task force for harmonized infrastructure

Action: The BePacMan project should facilitate the creation of a regional task force comprising representatives from national authorities, producer responsibility organizations (PROs), and logistics companies from Germany, Poland, Lithuania, and Denmark. The task force's primary mandate would be to develop a blueprint for a shared, interoperable infrastructure for the collection, sorting, and cleaning of reusable paper packaging.

Justification: This directly addresses the most significant barrier identified by stakeholders the lack of harmonized and cost-effective reverse logistics. A collaborative approach will prevent the development of fragmented national systems, reduce investment costs through shared facilities, and leverage the strengths of each country.

Recommendation 2: Co-develop and pilot standardized reusable packaging formats

Action: The BePacMan project should launch a multi-stakeholder working group, including paper manufacturers, converters, and major end-users (especially from the e-commerce sector), to design and pilot a limited portfolio of standardized reusable paper packaging. The focus should be on

creating durable, easy-to-clean formats for transport and e-commerce applications.

Justification: Standardization is a critical prerequisite for efficient reverse logistics and was a key need identified by producers and logistics providers. Piloting these formats will generate practical data on durability, cost-per-use, and consumer acceptance, building the business case for wider adoption.

Recommendation 3: Advocate for supportive and aligned economic incentives

Action: National governments in the SBS region should be encouraged to reform their Extended Producer Responsibility (EPR) schemes to create strong financial incentives for reuse. This should include implementing eco-modulated fees that significantly lower the financial contribution for certified reusable packaging compared to single-use alternatives. Furthermore, governments should explore subsidies or tax credits for investments in reuse infrastructure.

Justification: Economic viability is a primary concern for all stakeholders. While the PPWR sets targets, it does not guarantee a favorable market environment. Strong financial incentives are necessary to shift the economic balance from single-use to reuse and to stimulate the required private sector investment.

Recommendation 4: Launch a coordinated regional consumer engagement campaign

Action: The BePacMan project, in partnership with national environmental agencies and consumer organizations, should develop and launch a unified public awareness and education campaign across the SBS region. The campaign should focus on communicating the environmental benefits of reuse, providing clear instructions on how to participate in new systems, and addressing common concerns such as hygiene and convenience.

Justification: The findings show that consumers are willing but need clear guidance and convenient options. A coordinated campaign will build trust, ensure consistent messaging across borders, and accelerate the behavioral shift required to achieve high return rates for reusable packaging.

6.3 Outlook and Future Trends

The coming decade will bring significant changes to the paper packaging landscape in the SBS region. Regulatory pressure will intensify as PPWR targets for 2030 and 2040 come into effect, with waste reduction requirements of 5%, 10%, and 15% by 2030, 2035, and 2040, respectively. Digital technologies such as, QR codes, RFID tags, and blockchain, will enable the real-time tracking of reusable packaging across borders. New business models will emerge,

including Packaging-as-a-Service and specialized cleaning and redistribution providers. The SBS region, through effective cross-border cooperation, can become a model for other European regions. Rising consumer expectations for sustainable packaging will create additional market pull. Early movers who invest in collection, cleaning, and redistribution infrastructure will be best positioned to capture market share. In summary, the outlook for reusable paper packaging in the SBS region is positive. The regulatory framework is in place, consumer demand is growing, and technological solutions are maturing. The BePacMan project is well-positioned to lead this transformation.

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