Nordic Council of Ministers

EXTENDED PRODUCER RESPONSIBILITY

Learnings from the Nordics

Contents

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1. Summary

This report explores the Nordic countries' experience with Extended Producer Responsibility (EPR), an environmental policy approach that extends the responsibility of producers to include the environmental impact of a product. With a particular focus on EPR schemes for plastic products, the report aims to extract practical insights for the development and expansion of EPR schemes globally.

The methodology involves a literature review and semi-structured interviews with authorities in Denmark, Finland, Iceland, Norway, and Sweden. The information is then analyzed and discussed with focus on lessons learned in terms of challenges and success factors.

A theoretical conceptualization and discussion of EPR is also laid out in the text and forms a basis for the analysis.

In summary, the report notes very diverse implementations of EPR across the Nordics, ranging from more comprehensive schemes to more nascent efforts, with varying challenges and success factors. Mandatory EPR legislation/systems in the Nordic countries cover a diverse range of product categories such as packaging, electrical and electronic equipment, batteries, tires, end-of-life vehicles, pharmaceuticals, and single-use plastics, except for Denmark where mandatory EPR Schemes have only recently started to be implemented.

The countries struggle with different issues related to EPR systems. Challenges include administrative burdens, unclear definitions and roles, and limited influence on upstream conditions such as product design and waste generation. Obstacles to EPR implementation also include economic and informative responsibilities. The fee structure and reporting obligations differ between the Nordic countries, making compliance complicated and resource intensive for international producers. Harmonizing design requirements, reporting, and fees within the EU is recommended to streamline administration.

Overall, collaboration between producers, municipalities, and Producer Responsibility Organizations, coupled with transparent systems, all seem to be success factors for effective implementation of EPR schemes, as long as the responsibilities are clarified, and economic models are negotiated and accepted by all parties.

Key learnings also emphasize the efficacy of single waste stream systems, such as the PET bottle return system. This seems to be true regardless of the systems being mandatory or voluntary, connected to less material complexity or their reliance on material quality standards such as rPET. Although it is not feasible to introduce separate systems for each packaging type, more stringent design requirements

could be helpful, in combination with development of material quality standards for more types of recycled plastics. Linking design requirements to differentiation of fees can have positive effect on recyclability. Harmonizing EU-level standards and supporting sorting and recycling capacity is also crucial to reach recycling targets. It is important to measure the actual recycling rate, something that has been corrected in the EPR for plastic packaging.

Better enforcement of the regulation and sanctions for non-compliance is desirable, but often difficult for authorities to manage due to limited resources. Enforcement mechanisms, such as mandatory producer registers, could also be helpful. To combine EPR with other policies, such as weight-differentiated waste fees and landfill bans, could form a more comprehensive approach to promote a circular economy.

The report concludes that EPR should be viewed as a complement to policies directly targeting waste generation sources. That way, EPR could be part of an efficient policy package.

2. Background and scope

Extended Producer Responsibility (EPR) is an environmental policy approach under which the responsibility of producers or in some cases importers or sellers[1], is extended to include the environmental impact of the product with the objective of putting the Polluter Pays Principle into practice.

The EPR schemes can be differently constructed depending on the type of product and market but can include voluntary or mandatory provisions for the producer to bear the costs for collection, waste management, consumer information and sustainable design.

EPR is often described as a policy instrument with good potential to mobilize private funding to improve resource efficiency and waste management of different product types. It is, for instance, often mentioned as a key measure to transform the largely linear global plastics economy towards a more circular one in the ongoing discussions about the envisaged global instrument to end plastic pollution.

The ideas of EPR, and other instruments to mobilize funding, in the new global instrument have been described in two previous Nordic reports: *Possible elements to a global agreement on plastic pollutions* and *Global agreement to prevent plastic pollution - exploring financing needs and opportunities*. The reports conclude on the one hand that EPR is one of the most prominent instruments to mobilize private resources for plastic waste collection and management, and to promote circularity by encouraging sustainable product design. On the other hand, the reports also emphasize that development of EPR schemes comes with many challenges and that it needs to be accompanied by supporting policies.

The Nordic countries have extensive experience of EPR. Sweden, for example, introduced EPR in the nineties and have today established EPR schemes for several product categories including packaging, tires, cars, electronics, batteries, and a number of single use plastic products. These schemes include obligations for producers to design packaging and products that are recyclable, as well as provisions for the producers to bear the costs for information, collection, sorting, recycling and clean up.

2.1 Scope and delimitations

The aim of this report is to gather experiences from the Nordic countries' long history of EPR as a government policy instrument and create learnings for future development and expansion of EPR schemes in the Nordic countries and other

1. A producer is usually defined as the actor putting a product on the market for the first time.

countries in the world. Specific issues of the project include, but are not limited to:

- What does the current landscape of EPR schemes of plastic products look like in the Nordic countries? What products are covered by EPR schemes and how are the schemes implemented?
- What kind of obstacles have the countries met when implementing EPR schemes for plastic products? And what can we learn from them?
- What are the factors for a successful implementation of EPR schemes that have a positive impact on the transition to a circular plastic economy and reduced plastic pollution?

The project builds upon previous Nordic reports and provide more detailed and practical advice on how to create national EPR schemes that works for the industry and have real impact on the transition to a circular plastics economy and reduced plastic pollution. More specifically, the analysis investigates how the EU Waste Framework Directive, specifically the Packaging and Packaging Waste Directive (94/62/EC) and the Single-Use Plastics Directive (2019/904), are implemented in each country with a particular focus on reducing waste and littering. As focus is on plastic packaging and single-use plastic products, other subordinate waste regulations to the EU Waste Framework directive fall outside the scope of this report.

2.2 Method

Literature review and semi- structured interviews were used to collect and map information about ERP schemes for plastic products in the Nordic countries Denmark, Finland, Iceland, Norway, and Sweden. The literature review builds upon previous Nordic reports and includes scientific reports as well as website information and reports from Nordic authorities.

Supplementing the literature review, four interviews were conducted with actors responsible for implementing EPR in each of the Nordic countries. The interviews aimed to collect insights into the implementation of EPR, including challenges and success factors. The interviews followed a semi-structured format, based on an interview guide with guiding questions with room for follow-up questions. A list of the interviewed authorities can be found in References.

An analysis was made based on results from literature and interviews that investigates compliance levels and how different actors in the economy are affected. Commonalities and differences between the different countries are also analyzed with the aim to identify factors of success and barriers to EPR in the Nordic countries.

3. Extended Producer Responsibility

The concept of Extended Producer Responsibility (EPR) was introduced in a seminal work by Lindhqvist in the 1990s. The Nordic countries are often recognized for best practices of implanting EPR (see for instance Roman (2012). Lindhqvist's work also provided the following definition of EPR:

"Extended Producer Responsibility is an environmental protection strategy to reach an environmental objective of a decreased total environmental impact from a product, by making the manufacturer of the product responsible for the entire life cycle of the product and especially for the take-back, recycling and final disposal of the product. Extended Producer Responsibility is implemented through administrative, economic, and informative instruments. The composition of these instruments determines the precise form of the Extended Producer Responsibility." This definition brings up some interesting aspects worth noting:

- Producers[2] are made responsible for products' environmental impact during their whole life cycle, especially the final stages when they generate waste.
- The responsibility of producers in EPR can be of different kinds.
- Which kind of responsibility producers should have in EPR depends on product-specific characteristics and the objectives of the specific EPR legislation.

EPR has become popular and today there is extensive literature, especially among policymakers and authorities involved in implementing producer responsibility in environmental policies around the world, nonetheless in the Nordic countries.

Some useful insights for policy can be found in some studies conducted by the OECD. The OECD has elaborated the definition of EPR and emphasizes that the focus of producer responsibility lies on the final stage of a product's life cycle. The OECD defines EPR as "an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle" (OECD, 2016). The post-consumer stage means that the product in question has already been used and disposed of by a consumer. EPR is further described as a way to shift responsibility (physically and/or economically) upstream toward the producer and away from municipalities, so that producers have incentives to take environmental considerations into account even when designing

2. In this definition the producers and manufacturers have the same meaning. In fact, in Lindqvist conceptual reasoning these two terms are equivalent. However, when EPR is implemented in policy, there are significant differences that discussed later in this report.

their products. The design aspects considered in relation to EPR are often related to recyclability, such as choosing materials and material combinations that do not interfere with current recycling processes, or designing products that can be easily dismantled and repaired or separated for sorting and recycling.

OECD's position is interesting and has implications for the incentives that are created in an economy. In general, markets function well when property rights (defined in more detail in the next section) are well defined. However, when there are problems in asserting property rights, market mechanisms are not enough to deliver the amount of goods desired or damage to commonly owned goods and services (such spread of harmful substances in rivers, lakes, and seas). Overproduction of waste in the economy is one such case. The OECD definition is more precise, and it is an attempt to correct this deficiency in the market, that is, assign responsibility when property rights are difficult to determine in their final stage of life cycle and turn to waste.

3.1 EPR – Towards more efficient environmental policy

EPR and the problem with property rights for waste

Property rights and ownership are fundamental concepts in economics, law, and society that define an individual or entity's legal claim to control, use, and benefit from a particular asset or resource. These concepts play a crucial role in shaping the way societies allocate and manage resources, create wealth, and maintain order.

In most cases, property rights are based on the principle that ownership of a product renders rights as well as liabilities to the owners. However, there are cases when determining ownership of goods can be complicated. One such case is waste. This is the basic problem that needs to be regulated.

The basic problem can be illustrated as in Figure 1. Resources needed to produce and consume goods are continuedly brought from nature and generate a constant rate of waste. If nature's assimilative capacity can take care of the generated waste, there is no problem. However, in modern economies the amount and the environmental effects of waste are large and over time accumulate and lead to high economic damages.

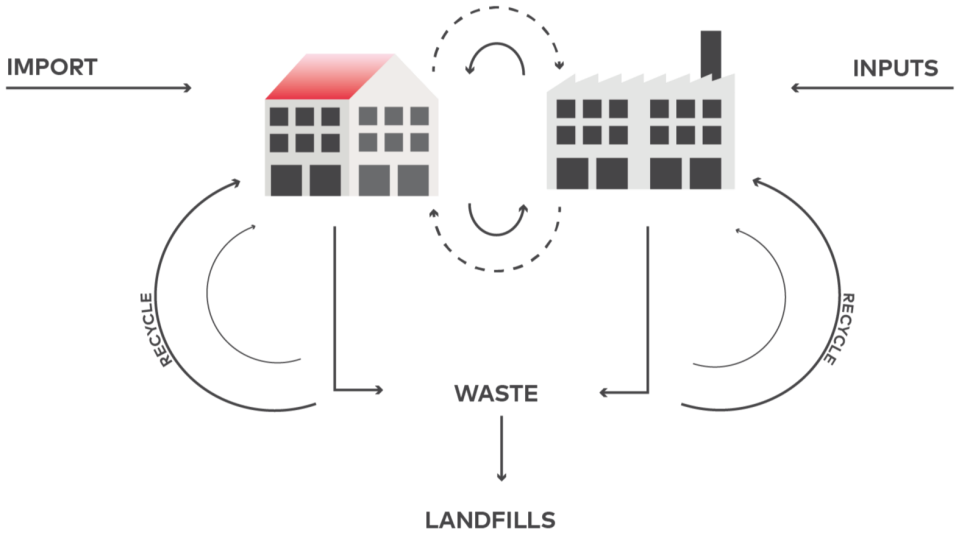

Figure 1. Different streams of material that affect the volume of waste are described.

Extending responsibility is one possible solution to the problem. The main idea from Lindhqvist is that producers are responsible for environmental impacts of goods and products. In the case of waste from household, it is generated from goods that producers no longer own, which is a step away from the basic principle that responsibility is closely related to actors' ownership of goods and products. OECD is more specific in its definition of EPR and makes an important contribution by clearly pointing out that producer responsibility should be extended beyond the consumption stage. As such, OECD emphasizes the gap in environmental regulation that EPR can close. In this sense, EPR has a specific and unique role in regulating environmental impact beyond the consumption stage when it comes to waste from consumers or households.

Determining ownership of waste, when products no longer have a commercial value, in a complex economy with many streams of products, is difficult. Consequently, demanding responsibility for products environmental impact when they are discarded is difficult, which is discussed in the next section.

EPR as a complementary policy

The EU defines waste as a substance or object that its holder discards, intends to discard or is required to discard (European Commission, 2023a). In a complex modern economy, owners can discard or leave goods when they are no longer of use. This can cause different kinds of problems and damages to society, such as littering. As discussed in the previous section, this is related to difficulties in establishing property rights and connected responsibilities.

Traditionally, responsibility and costs for waste management have been taken over by society. In Sweden and many other countries, collection of municipal waste from households is the responsibility of the municipalities under a strict monopoly. Although taking over such responsibility often leads to well-functioning waste management, it also comes with high management costs. This is because, in principle, generating waste is costless to households in the economy. Consequently, there is a lack of incentive to reduce waste, as the costs for waste management are passed on to society.

As already noted, EPR assigns responsibility to producers. This way, some problems related to the lack of incentive to reduce waste management are addressed. Because the amount or volume of produced and introduced materials on the market is related to the amount of waste generated, the latter can be used as a "good enough"-indicator of relevant policy instruments. If implementing EPR can make producers reduce the amount of material introduced to the market by presenting higher waste management costs for producers, then it is also a useful tool within environmental policy.

An obvious challenge is that producers are made responsible for environmental problems in the consumption stage. In a well-functioning economy, policy instruments to lower waste will create incentives upstream or downstream the different stages of the economy. However, because determining property rights of waste is difficult, these policy instruments are challenging to design effectively. Complementary policy instruments that can reduce environmental damage related to waste are therefore needed. Assigning responsibility to producers, i.e., implementing EPR systems, is potentially one of these complementary instruments.

It is still worth reflecting on whether EPR meets the criteria for an effective policy instrument when the responsibility of producers is limited to the post-consumer stage. In theory, the two most common criteria for effective design of environmental policies are the polluter pay principle (PPP), and to put regulation as close as possible to the source of the environmental problem. The polluter pays principle ensures that the costs of pollution and environmental degradation are paid by those responsible for causing them. When polluters are required to bear the costs of their actions, they have a financial incentive to reduce pollution which leads to more efficient resource allocation. The second criterion for an effective policy instrument is to place regulations close to the source of environmental issues, which leads to precise and tailored signals in the market to reduce environmental damage. When regulations are further away from the source, the signals are less clear, and actors may adjust to the regulations without even reducing environmental impact.

EPR, even as defined by the OECD, has problems with both these two criteria. A lot of waste is generated by consumers and although the amount of waste is related to the amount of material introduced by producers, a large part is closer related to

consumer behavior rather than that of producers. If there is an overconsumption of households that generates waste, for instance, the overconsumption itself or the consecutive waste generation can hardly be reduced by putting responsibility on producers, even if the producers may increase the recycling of what is consumed. The reason is that the waste-generating behaviors, i.e., the source of the problem, are not targeted through EPR. When the responsibility lies with the producers, which is far away from consumer behaviors it may lead to adjustments by producers that have little to no effect on consumers behavior and in turn, on the amount of waste generated at the consumption stage.

As long as consumers behavior is not targeted, any responsibilities taken on by producers will at best shift the waste generating behaviors from one product to another or create a recycling market, without affecting the market of new goods with virgin inputs. Ultimately, EPR needs to be combined with other policies that target consumer behavior to achieve efficiency as an environmental policy instrument.

4. EU Legislation related to EPR

The EU Action Plan for a circular economy was established in 2015, and recycling and reuse of plastics were deemed a top priority. A European Strategy for Plastic in a Circular Economy was also later approved with the goals of boosting plastic avoidance and recycling, setting a target for making all plastic packaging sold in the EU recyclable by 2030, and reducing the use of single-use plastics. The overall goal of the EU strategy on this subject is to address a variety of measures that span the whole plastics supply chain, from product design and production through usage and end-of-life management. (Filho, ., 2019)

4.1 Waste Framework Directive

The Waste Framework Directive (2008/98/EC), adopted in 2008 and amended in 2018, is a key component of the EU circular economy action plan. It addresses the adverse environmental and health impacts of waste generation and management while promoting resource efficiency. The Directive grants EU Member States the authority to allocate waste management expenses to the producer responsible for generating the waste, which includes implementing measures such as the acceptance of returned products, the management of post-use waste, and financial responsibilities related to this. Additionally, the directive may impose an obligation to disclose publicly accessible information concerning a product's reusability and recyclability (Pouikli, 2020) (European Chemicals Agency, n.d.).

In the amended Waste Framework Directive of 2018, an extended producer responsibility scheme is explicitly defined as "a set of measures taken by Member States to ensure that producers of products bear financial responsibility or financial and organizational responsibility for the management of the waste stage of a product's life cycle." (Article 14) General minimum operating requirements for EPR schemes were also introduced in the amendment (Article 8a) and become effective in January 2023. These requirements may include organizational accountability and obligations to support waste prevention, potentially improving product reusability and recyclability. The directive also allows for differentiated fees, that may incur lower costs for easily recyclable products.

A new revision of the Directive is currently in progress, specifically targeting textile waste and food waste. The proposal was published on July 5th, 2023. (European Commission, 2023b)

4.2 Specific Product related directives

The EU has introduced extended producer responsibility through several specific waste legislations that are subordinate to the general waste regulations, of which the Packaging and Packaging Waste Directive (PPWD 94/62/EC) and recent Single-Use Plastics Directive (2019/904) are most relevant to this report as the focus is on plastic waste. As mentioned in the limitations, this report will not examine the other waste regulations under the EU Waste Framework Directive, such as End-of-Life Vehicles (ELV) Directive (2000/53/EC) and Waste from Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU).

It's worth noting the Packaging and Packaging Waste Directive doesn't make EPR mandatory, but it is required in the legislation governing plastic waste. However, none of these directives specify specific recycling targets for plastics. (Hennlock, 2014)

4.2.1 Packaging and Packaging Waste Directive (PPWD)

EU rules on packaging and packaging waste cover both packaging design and packaging waste management. They aim to deal with the increasing quantities of packaging waste, which cause environmental problems. Member states are granted some flexibility in meeting the requirements outlined in the Packaging and Packaging Waste Directive (PPWD). (Hennlock, 2014) However, the directive requires systems for return and collection to be set up for consumers to drop off their used packaging so that it can be recycled and reused once again. The producer is also responsible for what happens to a product's packaging after a consumer has discarded it, including collection and recycling.

The PPWD (94/62/EC) establishes guidelines for reducing packaging waste generation, promoting packaging reuse, recycling, and other methods of recovering packaging waste. Additionally, it puts forth standards that all packaging sold in the EU must adhere to. These rules are intended to reduce the amount of packaging waste disposed of and to encourage a more circular economy. (EPRS, 2023) EU members have time until the end of 2024 to comply with the EPR requirements set by the Packaging and Packaging Waste Directive. This means that, in some countries EPR obligations are yet to be implemented.

In 2022, there was a new initiative proposed by the EU Commission with the aim of turning the Directive into regulation, which would imply less flexibility for member states and consequently more harmonization between them. The initiative's objective is for all packaging to achieve economically viable recyclability or reusability by 2030. To encourage reuse and recycling, boost the use of recycled materials, and improve the efficacy of these requirements, it also strives to reinforce the essential requirements for packaging and includes measures to deal

with excessive packaging and reduce packaging waste. As of 2023, EU legislators are still reviewing the proposal. (EPRS, 2023)

4.2.2 Single-Use Plastics (SUP) Directive

The EU 2019/904 Directive applies to certain single use plastic products (SUPs), i.e., products wholly or partially made of plastic and are intended to be used just once or for a short period of time before being discarded. It also applies to products made from oxo-degradable plastic and fishing gear containing plastic. The overall aim of the SUP Directive is to prevent and reduce the drastic impact of these plastic products on the environment as well as on human health. For example, the SUPs are more likely to end up in the sea than reusable options and the ten most commonly found single-use plastic items on European beaches, alongside fishing gear, represent 70% of all marine litter in the EU.

A combination of measures tailored to the products covered by the directive are to be introduced in line with the goal of reduction and prevention of littering. In addition to packaging, article 8 in the 2019/904 Directive (EUR-Lex, 2019) states that extended producer responsibility schemes must be established for balloons, wet wipes, fishing gear that contains plastic, and tobacco products with filters. The extended producer responsibility means that producers must bear the cost of awareness-raising measures, and the cost for these products that are discarded in public collection system, collection in public systems, and cleaning up of their products.

5. Implementation of EPR in the Nordic countries

EPR schemes are implemented across countries using various policy instruments, including product take-back requirements and economic tools like recycling fees, or a combination of these approaches (IEEP, 2017). Walls (2006) highlights four of the most common EPR policy instruments that make producers financially or physically (as per Lindhqvist's definition) responsible for the environmental impact of their products at the end-of-life stage.

- "Product take-back mandate and recycling rate targets.
    - Government mandates that manufacturers and/or retailers take back products at the end of the products' useful lives, in combination with recycling or waste diversion targets that producers are required to meet.
- Product take-back mandate and recycling rate targets, with a tradable recycling credit scheme
    - Similar to the first approach but the targets apply to the whole industry, allowing firms to trade recycling credits among themselves.
- Voluntary product take-back with recycling rate targets
    - Firms within an industry voluntarily organize a take-back system for their products and set recycling goals, without government mandates or penalties for non-compliance.
- Advanced recycling fees (ARF)
    - A tax assessed on product sales, often used to cover recycling costs.
    - ARFs can be determined per unit or by weight, and they may be visible to consumers or assessed upstream on producers." (Walls, 2006)

This variety of organizational models, levels of responsibility and policy instruments reflects different EPR practices across countries. Due to this variation, from specific requirements to target-oriented approaches, the EU has implemented minimum requirements to harmonize EPR schemes and to ensure fair competition among actors. (Deloitte, 2020)

Table 1. Year of implementation of producer responsibility for packaging and single-use plastic products in the Nordic countries.

	Sweden	Finland	Norway	Iceland	Denmark
Packaging	1994	1997	1995	2005	In progress (2025)
Single-use plastic	2022	In progress (2023)	In progress	2023	In progress (2023)

As shown in Table 1, the concept of producer responsibility for packaging has long been established in several Nordic countries. The exception is Denmark, which is currently in the process of implementing such a system. On the other hand, producer responsibility for single-use plastics is relatively new and is either in the process of implementation or has recently been introduced. The following provides an overview of how these two EPR systems, primarily focusing on packaging, have been implemented across the Nordic countries, including recent or upcoming changes in regulations, as well as outlining some of the barriers and success factors. The information presented is based on the conducted interviews and relevant literature sources.

5.1 Sweden

EPR implementation

EPR schemes have been established for a range of product categories in Sweden, including packaging, electrical and electronic equipment (EEE), batteries, tires, end-of-life vehicles, pharmaceuticals, single-use plastics (such as fishing gear, certain tobacco products and filters, wet wipes, and balloons).

The extended producer responsibility applies to those producers that professionally manufacture packaging in Sweden or import packaging or packaged products to Sweden. Even businesses selling packaged goods to final users in Sweden from another country are subject to these regulations, although enforcement can be challenging.

Packaging producers in Sweden bear financial responsibility and are obligated to ensure the existence of collection systems. Producers are also responsible for developing products that are more resource-efficient, recyclable and do not contain environmentally hazardous or harmful substances. Furthermore, they are obliged to report data to the Swedish Environmental Protection Agency (SEPA) on the amount of packaging they place on the market, how much packaging that is collected as waste, and how the waste has been treated to follow-up the national and European recycling targets (Naturvårdsverket, 2022).

As the operational supervisory authority, the SEPA is responsible for ensuring that each producer fulfills their producer responsibility. This includes scrutinizing information from producers and ensuring compliance with the regulations regarding producer responsibility. Also, producers that supply a minimum of 1 ton of packaging per year on the market in Sweden must pay a supervisory fee to the SEPA. With the introduction of the Single-Use Plastics Directive, regulations on littering fees for certain products will be introduced.

Regarding plastic packaging, the two current Swedish collection systems for packaging, FTI and TMR, have both introduced differentiated fees for paper and plastic packaging since a few years, where fee levels correspond to recyclability. The packaging fee for plastic household packaging in 2023 is 5.52 SEK/kg or 8.56 SEK/kg depending on if the packaging is designed for recycling or not. The aim of the differentiated packaging fees is to reflect the actual cost of recycling. TMR also works to create incentives in the fee pricing for producers to choose and develop more recyclable packaging (Hammar, ., 2021). Unlike FTI, however, they are not transparent in presenting their fees. From January 2023, there are new legal requirements on transparent fees and mandatory differentiation of packaging fees for paper and plastic packaging. (Naturvårdsverket, 2023a) However, the design requirements set by the producer responsibility organizations themselves are much more detailed than the minimum requirements set up by SEPA. (FTI, n.d.)

Sweden's recycling statistics for packaging for 2021 show that four of nine national recycling targets were met, for paper and cardboard, ferrous metal, aluminum, and aluminum deposit cans. However, Sweden, like many countries, faces difficulties in meeting its plastic recycling targets due to the diverse nature of plastics requiring various recycling processes. The recycling rate for plastic (including deposit PET bottles) is currently 33% and hence, does not reach the target of 50%. (Naturvårdsverket, 2022). The recycling rate for plastic packaging excluding PET bottles was 18.1% in 2021 and 19.3% in 2022 (svensk plaståtervinning, 2023).

Changes/new regulation

As the current ordinance on the EPR packaging scheme was replaced in 2023, there are several changes and new roles for producers and municipalities. A significant change is that, starting from 2024, municipalities will take on the operational responsibility of providing collection services for household packaging (Naturvårdsverket, 2023b). This will simplify the sorting process for residents, allowing them to sort their waste at home rather than having to visit a collection station. The change is expected to contribute to a larger share of recycled waste, a more resource efficient waste handling and decrease the need for new raw material, resulting in reduced CO2 emissions. The municipalities are also given responsibility for informing households about preventive measures and sorting of packaging waste.

From 1 January 2026, the municipalities must also collect packaging waste in squares, parks and in other popular places outdoors, and from 2027, all municipalities must have introduced close-to-property collection from households of waste from packaging in the materials paper, plastic, metal, and glass (Naturvårdsverket, 2020).

The new regulation also affects the producers. Previously, they were required to be affiliated with a suitable collection system but from 1 November 2023, the producers must instead be affiliated with an approved producer responsibility organization (PRO). The PROs are the ones receiving the waste from the municipalities, being responsible for the treatment process. However, the producers will keep the financial responsibility for collection and pay both for the municipalities management of household packaging and PRO's waste handling. This shift of responsibility to municipalities to handle household collection will likely result in increased costs for the producers.

In 2021, the single-use plastics directive was implemented into Swedish legislation and was applied from 1 January 2022 (Naturvårdsverket, 2023c). The directive implies extended producer responsibility for certain single-use plastic products, including tobacco products with filter, balloons, wet wipes, and fishing gear that contains plastic. Consequently, starting from 1 January 2023, a littering fee regulation is in effect (Naturvårdsverket, 2023d). The fees, consisting of both a variable product fee and a fixed annual fee, fall upon those who place single-use products on the Swedish market. The fees are paid retroactively, with the annual fee being applicable from 2023 for most products and the product fee from 2024. However, for balloons and wet wipes, both fees will commence in 2025. The annual fee is intended to cover the SEPA's expenses, while the product fee compensates municipalities for waste management related to those products.

Barriers/success factors

In Sweden, people are used to sorting their packaging waste due to the long-standing presence of producer responsibility. The system can be considered successful in certain aspects, while there are some challenges, which will hopefully be improved with the new regulation (2022:1274). Overall, there is a high level of trust between Swedish producers and PROs as well as in the recycling system itself from the public in that waste is recycled and not landfilled. PROs also have close collaboration/cooperation with each other and with municipalities. In a collective system like the EPR schemes, the fact that the PROs today operate as non-profits is said to ensure transparency for the individual producers. (Naturvårdsverket, 2020)

However, just as in other countries, the system faces the problem of free riders who consciously or unconsciously do not take their producer responsibility. It could be either ignorance of their responsibility or the belief that they will not face consequences for non-compliance.

The Swedish EPR schemes are generally clear both in terms of legislation and in the division of roles and responsibilities, which is said to lead to a high willingness of producers to fulfill their obligations. (Naturvårdsverket, 2020) However, due to vague requirements regarding packaging design at present, enforcing these requirements can be difficult and may require additional resources.

The deposit system stands out for its effective performance, primarily because it deals with a limited range of products, enforces strict guidelines on product design, and provides clear directions for item returns. This leads to an effective separation of waste streams, contributing to high-quality material recycling, emphasizing the importance of cleaner material flows to achieve increased circularity. This is reiterated in a report by the SEPA (2020) where it is also highlighted that there is a strong domestic demand from the manufacturing sector, which also has the capacity to process the collected plastics.

A similar effectiveness is observed in the voluntary producer responsibility for silage plastic (SvepRetur) primarily due to its simplicity, involving only one product, fewer involved actors, and a clear, clean material flow.

5.2 Finland

EPR implementation

Within Finland, the concept of producer responsibility covers several product categories including batteries and accumulators, vehicles, packaging, paper and paper products, tires, and electrical and electronic equipment[3].

The responsibility associated with packaging lies with individual producers, such as Finnish packagers or importers. An interesting development since 2021 is the extension of this responsibility to distance sellers who directly sell to end-users. This means that even major platforms like Amazon would need to align with a Finnish Producer Responsibility Organization (PRO), as the European directive says that each country must include the responsibility of distance sellers in their legislation. However, the enforcement of this becomes challenging because these companies are outside the Finnish jurisdiction.

Producer responsibility covers the collection, transportation, and waste management, including recycling. The associated costs are covered by recycling fees paid by producers. These fees vary based on the product category. PROs have the responsibility of organizing waste collection and recycling efforts. Each PRO determines its fees based on its estimated expenses, ensuring they operate as non-profit entities and do not exceed actual costs.

3. The province of Åland operates its own system for producer responsibility, but this is not examined further within the scope of this report.

At the start of each year, producers must report their product quantities to RINKI, a service company working for the PROs, and the fee they pay (EUR/kilo) is determined using the previous year's data. Fee levels differ between consumers and businesses (B2B) for packaging, with B2B fees generally lower due to a less complex collection system. Material composition also influences fee levels, with initial steps taken toward modulated fees, primarily tied to material recyclability. In 2022, the recycling fee for consumer packaging for plastic was 0.18 EUR/kilo. In 2023, the recycling fee has been raised to between 0.27 EUR/kilo and 0.395 EUR/kilo depending on the plastic material (RINKI, n.d.).

To ensure compliance, the Pirkanmaa ELY Centre, that works closely to the Ministry of Environment, holds the responsibility of overseeing and conducting regular monitoring of producer responsibility. PROs are mandated to meet legislative targets. If these targets are not met, the ELY-center can inquire about improvement plans, although no sanctions are imposed.

The challenge of meeting targets becomes more apparent in plastics, where despite progress, new reporting rules, applicable to all EU countries, have led to a significant drop in the recycling rate. While previous calculations indicated a 45% recycling rate for plastic, the application of new rules resulted in a rate of 29% in 2021. Similar trends of declining recycling rates are also seen in other countries due to the new reporting rules.

Changes/new regulation

Notably, there has been a shift in the criteria for who bears producer responsibility. Previously, it was only applicable to those with turnovers exceeding EUR 1 million. Starting in 2024, this requirement will extend to all producers, irrespective of their turnover.

Finland is in the process of implementing the SUP directive where new obligations for companies with producer responsibility include paying a SUP fee and informing consumers. The 2023 costs are covered by a SUP fee which is invoiced from the companies in 2024 and varies by product group.

The SUP directive also increases the reporting obligations of producers when data on SUP products put on the market per SUP product group are needed for monitoring the SUP requirements. The separate packaging reporting as part of the regular packaging data reporting begins in 2024 when packaging data for 2023 is reported. (RINKI, 2022)

Barriers/success factors

The fee for packaging has been increasing in the last few years and will increase even more with the SUP directive. This poses a significant issue for the producers and could potentially affect the attitudes of the entire system. For instance, local decision-makers now seem to value low waste fees instead of improvements of the

waste collection services that instead could increase costs (Salmenperä, 2021). Additionally, the new reporting rules from the EU directive have intensified the workload, as now reporting is required for various materials and categories.

The cost increase presents a dilemma, particularly in encouraging more producers to join a PRO. However, PROs lack the authority to enforce participation, leading to a percentage of "free riders," estimated at around 15%. With the removal of the turnover requirement, more companies may join PROs from 2024, although their size may only represent around 5% of the market volume. A majority of the market's influence is held by about 10% of responsible producers.

An advantage that has been highlighted is that the system is structured to be producer-driven, where PROs can only be initiated by producers and must operate on a non-profit basis. This arrangement empowers producers by providing them with obligations and authority within the system.

5.3 Norway

EPR implementation

EPR has been an important environmental policy instrument since the mid-1990s in Norway. Today, Norway has extended producer responsibility for electrical and electronic waste, discarded vehicles, tires, batteries, packaging (including beverage packaging), and insulated glass panes containing PCBs.

Regarding packaging, companies that produce or import a minimum of 1 000 kg of a packaging type are required to participate in a return scheme and become members of an approved recycling company. This obligation also extends to companies that import goods with packaging (Miljødirektoratet, 2023a). Through their membership, the companies contribute financially to the collection, sorting, material recycling and other treatment of used packaging and packaging waste. In 2021, approximately 28% of plastic packaging from Norwegian households and businesses was recycled.

Changes/new regulation (proposals)

In 2020, the Norwegian Ministry of Climate and Environment (Klima- og miljødepartementet, KLD) commissioned the Norwegian Environment Agency (Miljødirektoratet) to review and propose improvements to the extended producer responsibility systems. The assignment has been divided into a three-part mission, with the first two sub-missions already reported (Miljødirektoratet, 2022a).

In the first part of the assignment, challenges with the current system were identified, along with the need for changes to ensure compliance with the minimum requirements of the EU's waste directive. In part two, recommendations for how the systems can become more efficient, more robust, and better support a circular economy were suggested.

One key recommendation to clarify who has the obligation to be a member of an approved recycling company is to change the definition of who is a producer to "who professionally imports packaging or packaged products to the Norwegian market or in Norway manufactures packaging for the Norwegian market". The recommended definition is expected to reduce the number of liable producers and consequently decrease instances of free riding. Another recommendation to identify free riders is to establish a producer register. It is also recommended to assess whether the 1 000 kg limit should be changed or possibly removed. Additionally, the compensation that the producers pay to the recycling companies is recommended to be differentiated to a greater extent.

Part three of the assignment, which is ongoing, focuses on proposing rule changes for producer responsibility for packaging in line with the recommendations from part two of the assignment. Key areas include financing the waste management of packaging (and beverage packaging), assessing the lower limit for producers' obligation to be a member of an approved recycling company, refining the definition of a producer, mandating waste prevention reporting, and reducing the number of free riders.

The Norwegian Environmental Agency has additionally proposed two new schemes (Miljødirektoratet, 2022b). The first scheme targets plastic waste from fisheries, aquaculture, and recreational fishing. The second scheme aims to hold producers responsible for covering costs for waste management and cleaning up litter from single-use plastic products in public spaces. For the latter, the Norwegian Environment Agency has so far submitted a proposal for a regulation to the Ministry of Climate and Environment and are now waiting for response from the ministry before the proposal can be sent for consultation (Miljødirektoratet, 2023b). The Norwegian Pollution Control Act § 28 already contains a prohibition on littering and the basis of the regulation is that the litterer, the one who throws it away, should cover the cost of clean-up themselves (Lovdata, 2023). The littering ban is general, and therefore also applies to the single-use plastic products that end up as litter. However, it is only the municipality's costs for cleaning up littering of the single-use plastic that must be covered by the producers within the extended producer responsibility for single-use plastic (Miljødirektoratet, 2023b).

Barriers/success factors

A Deloitte report (2020) has highlighted weaknesses within the current legal framework for EPR for plastics in Norway, aligning with the Norwegian Environment Agency's findings. Among the identified issues are the unclear definition of the producer that is subject to the EPR obligations, limited cost coverage and transparency, and insufficient incentives for creating a circular value chain for plastic packaging within the current framework. In line with the recommendations from the Norwegian Environment Agency, Deloitte identified necessary changes, such as holding producers with the most influence on product

design responsible for the products they put on the market and introducing requirements for modulating fees based on true lifecycle costs.

5.4 Iceland

EPR Implementation

Iceland has had an EPR scheme for plastic and paper packaging since 2005, and for all other packaging types since the 1st of January 2023. In addition, there are also EPR schemes for other materials. The EPR systems are operated by the Icelandic Recycling Fund (IRF), a government-owned agency established in 2003 that uses economic incentives to increase recycling. The fund charges manufacturers and importers with a recycling fee, directing these fees toward enhancing recycling efforts. The IRF's board includes representatives from various stakeholders, including municipalities and producers, with the Ministry of Environment holding the decisive vote.

The EPR scheme implemented differs from those in other countries and is viewed as a valuable tool to enable higher recycling rates (Mager, Traxler, Fischer, & Finger, 2022). The system is set up so that producers and importers of specific products pay a recycling fee to the customs office, based on weight. The fee is collected to cover the cost of transport and recycling. The fee level is determined by the actual costs of waste management and the amount of waste collected, to accurately capture waste treatment expenses linked to the product rather than mirror the product's environmental impact. This implies that when environmental ambitions change, i.e., the recycling targets, then the fee level changes. For instance, the fee for plastic packaging has recently been raised from 40 ISK per kilo to 82 ISK per kilo, as it now also includes separate collection. The fee level differs between different categories of products and is, for example, 42 ISK per kilo for paper packaging and 10 ISK per kilo for wood packaging.

From 1 January 2023, producers are also responsible for the costs of cleaning up plastic products when they have become litter as well as informing consumers and preventing waste. A fee of 27 ISK/kg is imposed on wet wipes, tobacco products with filter, balloons, and other single-use plastic products, all of which fall under the scope of extended producer responsibility (Úrvinnslusjóður, 2022).

Changes/new regulation

Initially, the focus of the system leaned more toward waste management than prevention, a perspective that was not incorporated into the fund system. Today initiatives are taken by the fund to increase public awareness to prevent waste. Municipalities play a central role in public awareness, being the key actor in the operative waste collection. Public awareness campaigns, often utilizing social media platforms and influencers, constitute the primary approach to achieve higher collection rates.

Barriers/Success factors

While the separate collection was relatively recently implemented, Iceland encountered challenges during the initial phase. The response so far has not been as positive as hoped, but there is optimism that these challenges will be progressively resolved.

Overall, the fund system is considered to have been relatively successful, not particularly controversial. Since it is mandatory for producers to pay the fee, either at the customs office when they import, or by reporting the amount they produce to the tax office, compliance is good. Thus, there is no problem with free riders.

The IRF's overarching goal aligns with meeting the minimum requirements of the waste directive. Thus far, Iceland has met the targets for plastic recycling but is still striving to attain the target of 50% for 2025. However, a drawback of the fund system is the absence of penalties for not meeting the targets.

Another issue is the inflexible tariff codes that cannot be modified for customers. Currently, there is only one tariff, regardless of whether the material is environmentally friendly or not. These tariffs lack differentiation between sustainable and less sustainable resources. However, a significant fee modulation based on the products durability, reusability, dismantlability, and recyclability shall be implemented (Mager, Traxler, Fischer, & Finger, 2022).

5.5 Denmark

EPR implementation

In Denmark, there is currently no Extended Producer Responsibility (EPR) scheme in place for managing plastic packaging. However, EPR schemes for batteries, used vehicles, and WEEE have been implemented. Denmark' complies primarily to the packaging targets set by the EU through a national action plan for a circular economy, which consists of a national plan for the prevention and management of waste for 2020–2032. Furthermore, there is a political agreement on climate change relating to waste management, which includes initiatives to support increased recycling and thereby will support EU-targets on packaging waste.

The legal framework for waste management in Denmark is established by the Environmental Protection Act, with specific Statutory Orders governing packaging and packaging waste. In Denmark, municipalities have the general responsibility for waste management from households, whereas handling of business waste is generally privatized. Municipalities often collaborate on waste management through public companies. Denmark did not implement EPR schemes for packaging waste previously as other member states did because the existing municipal system was considered efficient. In fact, Denmark has already reached the 2025 EU

recycling target for glass and wood packaging and in 2021, 23% of plastic packaging waste, 71% of fiber packaging waste and 66% of metal packaging waste was recycled.

In 2021, new legislation on waste collection was implemented, which streamlined municipal waste collection. All households are now required to sort waste into ten different waste types, including plastic. This means that recyclable packaging waste is generally mixed with recyclable non-packaging waste in the collection system. Municipalities are obliged to collect selected recyclables curbside, but there is also access to public recycling stations. Waste management costs are covered by a municipal waste fee paid by citizens, with a few exceptions. Littering is, for instance, financed through taxes. Businesses are obliged to sort waste in the same ten waste types as households, and they also have access to public recycling stations. Small businesses may use household collection systems provided by municipalities.

Denmark also employes a deposit-return system for a beverage packaging and refillable bottles. The deposit-return system has very high recycling rates and was recently expanded to include juice containers.

In Denmark waste handlers are obliged by law to report waste data to the national waste data system in Denmark (ADS), including the amount of waste collected. The data from ADS forms the basis for mandatory reports to Eurostat and national statistical reports of waste which are published annually. The latest report regarding packaging waste includes data from 2021. (Miljøstyrelsen, 2023)

Producer responsibility for tobacco product filters was implemented in the beginning of 2023 and was the first of eight product groups becoming subject to producer responsibility, and the producers now have the financial responsibility to pay for the cleaning up of this type of litter. Moreover, the producer responsibility extends to marking and providing information on the product. Producers are also obliged to register with the Danish Producer Responsibility (DPA), report to the Danish Environmental Protection Agency as well as to pay a fee. From the 4th quarter of 2023, the fee is 0.0092 DKK per filter put on the Danish market.

Most producers in Denmark use PROs, known as collective systems in Denmark, to fulfill their producer responsibility.

Changes/new regulation

In 2022, necessary adjustments for minimum requirements according to the WFD for WEEE and ELVs were made. Currently, Denmark is in the process of implementing EPR schemes for packaging and single-use plastic products (under the SUP Directive). This is expected to be fully implemented in 2025. From 2025, EPR for fishing equipment will also be implemented, but this will not entail a responsibility for cleaning up litter.

There is a widespread political consensus regarding the impending regulation for producer responsibility for packaging waste. In line with this, Denmark is expected to implement a hybrid model for EPR on packaging waste, where municipalities continue to collect waste from households while producers take over the organizational responsibility for waste treatment. For business waste, businesses will continue to be responsible for waste collection and treatment while producers will bear the financial responsibility. Administrative tasks such as the producer register and allocation of waste to producers or PROs will handle by a private non-profit organization, the Danish Producer Responsibility (DPA), established in 2005. The Danish Environmental Protection Agency will be responsible for guidance, oversight, and enforcement. Ultimately, there is an expectation that most producers will join PROs to fulfill their responsibilities and that there will be three or four competing PROs on packaging waste.

The Danish Parliament has decided that producer responsibility for packaging should lie with the person who has the most significant influence over packaging design, which is usually not the packaging manufacturer but the person who orders the packaged product. (European Union, 2022) However, prior to going into effect, the "producer" term needs to be defined more precisely at the executive level. In this regard, Denmark is also looking into current EU negotiations on a new packaging regulation, in which a common producer definition is on the table.

Barriers/success factors

Denmark has lower plastic packaging recycling rates compared to other Nordic countries, which may be due to the following reasons. Firstly, municipalities in Denmark have mainly collected plastic waste at local recycling stations, and not by the household (curbside), and the country is still waiting to see the full results of the streamlining of waste collection. Secondly, Denmark has relatively few sorting facilities for packaging waste, probably due to the country's relatively small amount of waste compared to other EU countries. This may also explain the significant portion of Danish plastic waste exported to EU countries such as Germany.

According to the latest report regarding packaging, which includes data from 2021, Denmark exports about 21% of plastic packaging. (Miljøstyrelsen, 2023) The streamlining combined with producer responsibility is expected to result in greater and more uniform amounts of waste, which is expected to encourage companies to invest in sorting facilities in Denmark and result in increased recycling. There is currently a private sorting facility for plastics and metal waste under construction in Esbjerg, which is expected to open in 2025.

As previously mentioned, Denmark has a specific deposit-refund scheme for beverage packaging and refillable bottles This deposit-refund scheme has been largely successful. (McKinsey & Company, 2019)

According to a 2019 report by McKinsey & Company, some key components of the DRS's success include:

1. Producers registering cans and bottles with DRS for participation in the deposit refund system.
2. Consumers returning used products, receiving a deposit refund, and ensuring that packaging is reused.
3. Shops and restaurants being obligated to handle empty bottles and cans after sale, with support from DRS.
4. DRS managing product registration, fee and refund handling, and collection and sorting.
5. Reprocessing of recycling cans and bottles into new ones at facilities located abroad. (McKinsey & Company, 2019)

6. Analysis

In this section, the implementation of EPR is analyzed. In section 6.1 different kind of responsibility are discussed and in section 6.2 fee structures and take back policies is analyzed. In section 6.3 a comparative analysis between the observations from the Nordics is presented, focusing on producer definitions, how EPR is carried out. Barriers, success factors, and lessons learned from the implementation of EPR are also compared and considered.

6.1 EPR – Different kinds of responsibilities

Lindhqvist (2000) presents four categories of producer responsibility: liability, physical, financial, as well as informational responsibility. Liability refers to the accountability that producers could be held to for any environmental harm derived from their products. Physical responsibility manifests in the obligation of actively participating in the management of waste products, i.e., in the collection, sorting or disposal of waste products. Economic responsibility, on the other hand, is the financial obligation of handling costs related to this waste management. Lastly, the informative responsibility refers to producers informing and spreading awareness to consumers about proper recycling practices. (Maitre-Ekern, 2021)

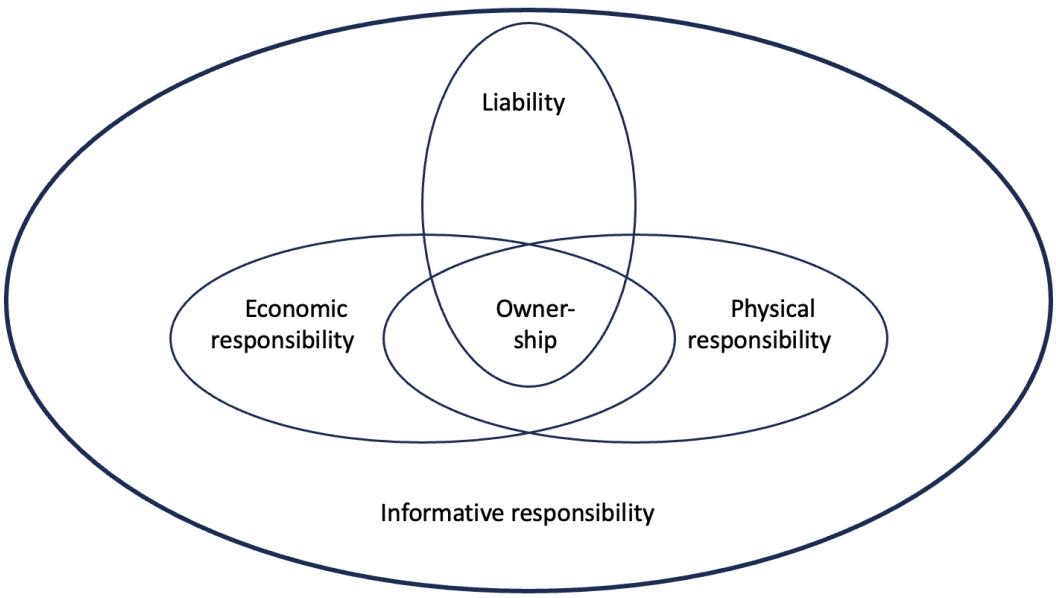

Figure 2. Models for Extended Producer Responsibility. Source: (Lindhqvist, 2000)

Based on Lindhqvist, others have made distinctions between the different approaches to EPR or, as some call it, different levels of responsibility that producers typically take on. Generally, there's a distinction between a financial model, a hybrid model (with partial operational responsibility), and a full operational model. The financial model is where producers assume financial responsibility, while municipalities bear the operational burden of waste management. In contrast, the operational model is where producers assume both operational and financial responsibility for waste management, including collection and sorting. However, these tasks can be outsourced to professional collection and treatment services. The hybrid model entails shared operational responsibility between municipalities and producers. In this model, the responsibilities can shift between tasks and stages of sorting the waste. (Deloitte, 2020) (Pouikli, 2020)

Moreover, there is a wide range of organizational models for EPR schemes. Firstly, many schemes offer the flexibility to impose responsibilities on producers either individually or collectively, through Producer Responsibility Organizations (PROs). The latter is more common, and producers can then organize themselves and share responsibility within the same product category, sector, or the same waste streams, and finance the collection and/or recycling of producers through the PRO. Notably, a collective scheme entails equal contributions from all members, regardless of the specific recycling capabilities of each product. This approach offers limited incentives for improving product design. On the other hand, individual responsibility proves more effective in promoting better design because producers face the actual costs of managing their products at the end of their life cycle, though it presents practical challenges. (Deloitte, 2020)

EPR schemes can also be either mandatory, making it compulsory for producers to take part, or voluntary, i.e., producers have the option to participate. (WWF & Institute for European Environmental Policy, 2020)

6.2 Implementation of fee models and take back policies

In the implementation of EPR, there seems to be two types of problems in the design of EPR instruments. The first type of problem is that EPR is considered to have the ability to reach different objectives at the same time. Oftentimes, these objectives are general and vague. For example, Walls (2006) observes that there are many different environmental objectives associated with EPR. Some objectives that EPR systems are supposed to reach include reduced generated waste, waste disposal as well as littering and hazardous waste. EPRs are also often expected to decrease material use while simultaneously increasing recycling rates. Moreover, EPR is described in reports from the Nordic Co-operation as an instrument to mobilize private resources for waste management and to promote circularity. Circularity is a general goal that can be reach in many ways, and the design of an effective policy for circularity is not necessary the same as one that mobilize private

resources. If environmental objectives for policy instruments are not clearly defined, it will inevitably lead to design difficulties that jeopardizes possibilities to reach desired environmental improvements.

The second type of problem in the implementation of EPR is that policy instruments often fail to distinguish between behavioral objectives and environmental outcomes of the instrument. In terms of objectives from a behavioral perspective, it is important to distinguish between objectives and outcomes. Policy instruments, if well designed, strives to make polluters pay for the damages they cause in the economy. Even if the policy instrument is not well designed, its objective is to change behaviors. This will lead to several incentives throughout the economy that lead to seemingly different effects. An environmental tax or a fee has the objective to change behaviors, i.e., introduce incentives in the economy, with the aim to reach desired outcome such reduce generated waste, reduce waste disposal, reduce hazardous waste, and decrease material use. Not distinguishing between the behavioral objective and the environmental outcome can lead to wrong or unnecessary policy adjustments, which may increase policy costs and in the long run may question the environmental policy instruments legitimacy. One common misconception is for instance that specific policy instruments are necessary to increase circularity and to reduce material intensity in the economy. In many cases, it may be enough to design stringency of environmental regulation in proportion to the waste generated by each product.

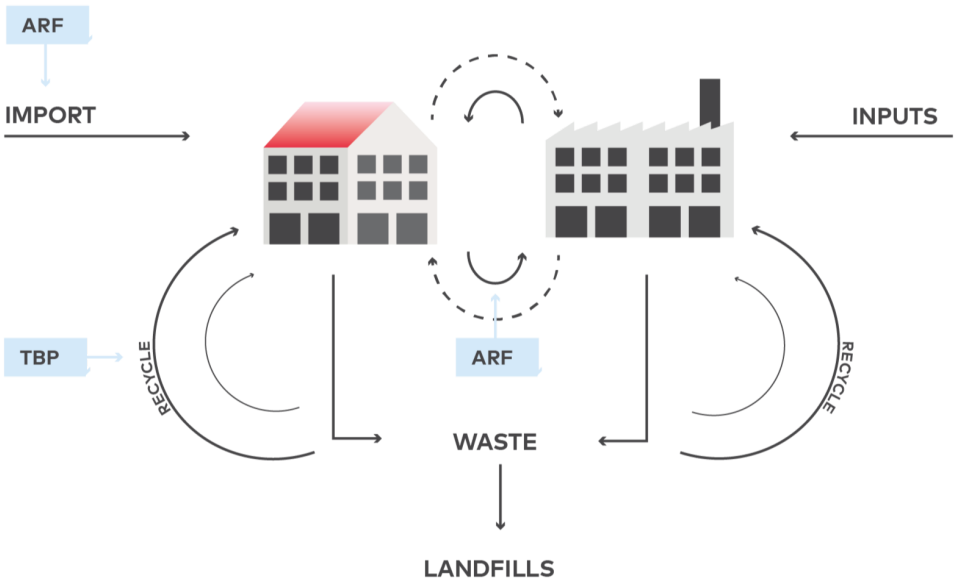

Figure 3. The implementation of EPR instruments Advanced Recycling Fees (ARF) and Take Back Policies (TBP) in Nordic countries.

Figure 3 shows where in the economy Advanced Recycling Fees (ARF) and Take Back Policies (TBP) are implemented. ARF, or differentiated producer fees, are fees paid by producers, i.e., those introducing products in the market (which may be manufacturers, importers, or resellers) in relation the amount of material they put on the market and how easy it is to recycle. For plastics in packaging, ARFs target import of packaging or packaged products and production of packaging. TBPs on the other hand target how much of the waste is collected and recycled back to the economy. Mandatory collection systems combined with recycling targets is a good example of TBPs.

In Figure 3, it is obvious that these EPR instruments do not directly target the amount of waste generated from households or industries. In a well-functioning economy, policies set upstream at producers or downstream at consumers will have full effect in the economy, and ARF and TBP can be enough to obtain efficient solutions. Calcott and Walls (2000) and Fullerton and Wu (1998) have shown that when recyclability is perfectly observed in the economy and market failures due to undefined property rights do not exist, well designed ARF and TBP are enough to reach efficient policy outcomes. In a more realistic model, for instance when recyclability is difficult to observe, Calcott and Walls (2005) show that an optimal combination of policy instruments, need to include disposal fees in addition to ARF and TBP. The literature emphasizes that EPR may contribute to improvement, but that it is not enough for achieving effective management of waste in the transition toward a circular economy. All streams of material in Figure 3 are potential means to affect waste, and an efficient policy package is one that exploits all these means such that their cost on the margin is equal. That is, the marginal cost of reducing waste or increasing circularity by design, recycling and depositing waste should be equal. A policy package that is directed to exploit only some of these means can evidently not reach this efficient outcome. In other words, EPR policies need to be coordinated with other policy instruments for waste management. If waste is not reduced or circularity increased, EPR policies will only shift material flow to other unregulated or less regulated streams in Figure 3 and the overall waste policy will not improve and maybe even become less cost-efficient. For instance, if landfilling is under- or unregulated and relatively cheap, more material will be landfilled.

As already noted from Figure 3, it can be observed that ARF does not directly affect waste. This results in some regulation difficulties as it is challenging to observe how much waste can be prevented by design. Even if material-intensity may give some indication of how to regulate, the final impact of waste in the economy is related to other factors such as recyclability, durability, and toxicity, that are difficult to observe upstream in a product's lifecycle. If the ARF can be adapted and differentiated to reflect the degree of recyclability, durability, and toxicity, then it would create strong incentives for good design that could prevent waste and increase circularity. However, in most cases, these factors are difficult to observe, and ARF has limited capacity to create these incentives.

Take-back-policies (TBP) often consists of targets for recyclability. That is, reuse of goods, material and energy, and different measures to reach these targets. To reach these targets it is often necessary to invest in an infrastructure for sorting and collection of materials, which raises the need for policies to pay for these investments. Calcott and Walls (2000) and Fullerton and Wu (1998) discuss that subsidies for recyclability are instruments to reach effective TBP. In Figure 3 it can be observed that take-back-policies (TBP) are close to the stage when waste is generated. Since one criterion for efficient policy instruments is that policy instrument is set close to the source of the problem, TBP have the potential to reduce the amount of waste that goes to incineration or landfill by increasing recycling. The incentives created in the economy depend however on how TBP are financed. In EPR schemes the idea is that producers pay for recycling, thus there are great opportunities to design effective TBP policies within EPR.

When TBP are implemented in EPR schemes in many countries, including the Nordic countries, they are often financed by different kinds of ARF. Actors responsible for EPR in the Nordic countries in the interviews reveal that produces take the economic responsibility by the fees they pay to PRO, which based on costs of their activity for recycling have fees are used to activities to increase recycling. The basic principle for determining the level of these fees is to cover costs for recycling or other waste management. The incentives introduced by such financing systems are however odd in relation to the recycling targets. First, it can be noted that costs for recycling are not necessary cost to reach the targets. Often cost to reach targets may include investments in new technologies, infrastructure or ideas that are not related to the actual costs of recycling. Second, since the level of ARF is determined by PROs or government agencies that use historical data (data from the previous year), the incentives are created by historical costs, which do not mirror costs for reaching recycling targets. Third, the cost covering principle may introduce contra productive incentives. This is because the producer's costs for recycling depend on the volume of material recycled, and accordingly, the economic incentive in the market is to keep the recycling volume as low as possible. To introduce incentives in line with the intention of increasing recycling and reducing generation of waste the level of ARF should be more related to the costs of reaching targets. Such as that ARF instead of compensating costs for recycling rewards efforts to increase recycling. Note that differentiating fees with the degree of recyclability do increase recyclability but do not necessary reach a specific target for recycling. One such case is when recycling capacity is exhausted and investment in recyclability capacity is necessary.

One of the major challenges with regulating waste generally and implementing EPR specifically is that waste is generated in a complex economy. Waste is a residual of many streams of materials and as such, the actors that are involved are many and difficult to observe. A well-designed policy instruments should assign responsibility in proportion to the waste each producers generate. However, in a complex economy and when EPR by design attempts to assign responsibility to producers

upstream in the market in order to regulate household waste downstream it is extremely difficult to assign responsibility to each producer in proportion to the waste they generate. Therefore, when EPR schemes are implemented, it is necessary to find pragmatic solutions. One such solution is collective take back responsibility, that is producers collectively are responsible for sorting, separation, and recycling of waste. This is often designed such TBP are financed by ARF, which inevitably leads us to conclude that the financial responsibility producers take is not related to the amount of waste they generate. This means that EPR have difficulties introducing incentives that follow polluter pay principle and therefore alone struggle in achieving efficient policy outcomes.

To conclude, EPR is best introduced in combination with other policies such as weight differentiated waste fees for households (common in many Swedish municipalities) and landfill bans, high landfill taxes or other restrictions. It is also important to keep track of statistics of volumes put on the market versus what is collected and recycled, to ensure that producers take the responsibility all the way to recycling of their products.

6.3 Barriers, success factors and lessons learned

Financial and operational models

Producers in all countries have financial responsibility in some way, except for in Denmark where this is about to be implemented. For instance, in Sweden, this entails responsibility over waste management, ensuring collection systems exist, and the design and development of recyclable products. On top of this, Swedish producers must take informative responsibility concerning making the public aware of how waste should be sorted and how it is collected.

Sweden and Denmark also exhibit different strategies regarding responsibilities. Sweden is shifting the operational responsibility for plastic packaging waste to municipalities in an effort to simplify the sorting process for households and increase collection rates. It has been observed that municipalities with curbside collection (collection in or close to consumers' homes) have higher collection rates. The municipalities are then paid by the producers for their efforts, following a reimbursement model overseen by the competent authority (SEPA). Denmark, on the other hand, is introducing producer responsibility for packaging through new regulations, and in doing so, shifting the responsibility from municipalities to producers.

Overall, collaboration between producers, municipalities, and PROs, coupled with transparent systems, seems to contribute to effective implementation of EPR schemes, as long as the responsibilities are clarified, and economic models are negotiated and accepted by all parties.

Different design requirements, reporting standards and fee levels in all member states make EPR compliance a resource-intensive task for producers, who often call for more harmonized legislation. However, achieving a common EU-level regulation could also be challenging due to variations in how different countries implement it. Another commonly discussed issue is the problem of direct import by consumers which is hard to control and regulate and that not all products are manufactured within the EU.

Vague definitions

The significance of clear and well-defined legislative frameworks cannot be overstated in the context of EPR success. The Nordics generally define producers as companies that "put plastic packaging or packaged plastic goods on the market for the first time", targeting manufacturers and importers. However, these definitions are fairly broad with some nuances among the countries. For instance, Sweden and Finland include "distance sellers" or foreign enterprises that offer packaged items to end-users in their respective nations. Norway, in contrast, has a more defined concept, requiring a minimum quantity (1000 kg) of a particular package type for producer classification. However, there is a proposal to revise Norway's definition, possibly lowering the threshold for who is classified as a producer by removing or changing the quantity limit, potentially affecting recycling targets.

Simultaneously, Finland is taking a different approach requiring producers with a yearly revenue of more than 1 million EUR to bear responsibility. However, starting 2024, all producers irrespective of revenue will be included. In this case, there are concerns regarding increased administrative costs that will lead to more difficulties with compliance and ultimately more free riders in the system as producers avoid joining PROs. Again, it could lead to unfulfilled recycling targets.

Free riders

The extent of free-rider issues also varies among countries, and apart from the unclear definitions and legislations, this could be derived from the lack of supervision and sanctions toward those producers that do not take responsibility or simply fall outside the producer definitions. While Sweden faces significant challenges with this within its system, Iceland's EPR system stands out as the only country without significant issue of free-riding producers, possibly because producers in Iceland are obligated to pay fees, leaving them with limited options for avoidance. Such a system could be facilitated by Iceland's relatively small size, which may make it more manageable.

Fees and reporting of data

The Nordic producers all have to report data and pay fees associated with their packaging, to cover operational recycling costs. However, these fees are structured in different ways and the reporting standards and design requirements vary.

For example, Sweden has voluntary implemented ARF in the shape of two differentiated fee systems based on recyclability, which has had a positive impact on recycling targets but is still not fully effective. This can be compared to Finland where material composition and packaging type is considered in the fee level set by a single PRO, that is also based on data from the previous year. The fees also differ between consumers and producers. Iceland also stands out in this context because they have an ARF in the shape of a tax applied to all producers of plastic without them having to join a PRO. This is closely tied to and dependent on the actual costs of waste management, the amount of waste collected, and the recycling targets. However, Iceland currently lacks differentiated fee structures but are about to introduce it.

Another important lesson from all countries is the importance of a correct calculation method to determine recycling rate. The previous method where packaging going into sorting was considered as recycled has been proven to result in false, inflated recycling rates. The correction of this flaw has a risk of undermining the public trust in the recycling industry, and in the collection system, making people less inspired to sort their waste correctly.

Flexibility in adjusting fees to align with changing targets can help promote recycling targets and incentivize producers to design recyclable or reusable products. The introduction of minimum requirements for differentiated fees is expected to yield economic incentives for the design of recyclable products.

Deposit systems could lead the way

One type of system that is considered effective is the deposit-refund system, due to their high collection rates. This is driven by financial incentives and increased recycling rates resulting from standardized material quality of recycled PET (rPET). For example, the systems cover a limited range of products and have strict product design guidelines, while also providing clear instructions for recycling and returns. In contrast to other systems, deposit-refund systems offer a financial incentive for consumers to return containers for recycling. The Swedish voluntary producer responsibility system for silage plastic (SvepRetur) is also deemed successful, for similar reasons, such as focusing on a single product and maintaining a clear and clean material flow. Notably, this system functions effectively even though it operates voluntarily.

Thus, for the deposit systems, there is incentive to design according to strict guidelines, which is seemingly absent in the context of EPR for other types of packaging. The current design requirements for packaging lack specificity, making them challenging to control and monitor. In the upcoming EU-level proposal currently under negotiation, there is a clear emphasis on incorporating more stringent design criteria for packaging, with a focus on ensuring that the product materials are recyclable. These upcoming requirements are expected to provide more specific guidelines, particularly regarding the segregation of different plastic

types. It is anticipated that the upcoming requirements will incentivize product design, similar to deposit-refund systems, thereby contributing to enhanced recycling outcomes as waste streams become more refined. In parallel, ongoing EU level work to develop more material quality standards for recycled plastic fractions will be helpful to drive markets for recycled plastics.

7. Conclusions

EPR systems have multiple aims; to change public behavior, increase recyclability and recycling rate and to finance both take back, information and recycling. When EPR is implemented, as in the Nordic countries, it is often a trade-off between effectively assigning responsibilities of producers and to handle the complexity by pragmatic policy design. This report has aimed to gather experiences from the Nordics' history of EPR as a policy instrument and reflect on learnings for the future of EPR schemes.

Description of current landscape and products covered

When mapping the current landscape for EPR schemes for plastic products, it is interesting to observe how the EPR for packaging can be implemented so differently even in neighboring countries like the Nordics. Mandatory EPR systems in the Nordic countries cover a diverse range of product categories such as packaging, electrical and electronic equipment, batteries, tires, end-of-life vehicles, pharmaceuticals, and single-use plastics. Denmark is the exception as the country has not introduced EPR for packaging until now. It remains to be seen if producer responsibility systems for packaging waste and single use plastic products can improve the collection and low recycling rates.

The countries struggle with different issues related to EPR systems. Iceland for example, has focused on a system with minimum administration, but cannot influence the design of products as it is not possible to differentiate fees in the current fee system. In Finland, increasing the scope to cover all producers could become difficult, with the current level of administration already being higher than some smaller producers can handle. Clarity is key, as seen in the Norwegian example where vague producer definition has caused uncertainties. The roles and responsibilities of all actors must be very clear and well communicated, i.e., through guidelines from the responsible authorities and well-designed reporting systems.

Theory and obstacles

In theory, the main objective of extending producers responsibility is to lower societies' cost of managing waste. Since the traditional way of managing household waste lack incentive to alleviate waste in the long run, it tends to increase the volume of waste and their costs. The environmental problems with household waste may be described as a collection of all environmental problems that are not solved upstream in the economy. Furthermore, full circularity is impossible, and some waste is inevitable. In most cases, the responsibilities

producers take for waste is financial and often, there are also informative requirements. Thus, how EPRs are implemented, as in the Nordic countries, can be summarized by a combination of Take-back-policies (TBP), Advanced Recycling Fees (ARF) and information obligations. TBPs, as part of EPR schemes, can potentially be efficient to prevent waste by increasing recycling but it depends on how it is financed.

In many countries, including in the Nordic countries, the level of these fees is determined to cover costs for recycling or other waste management. The costs for recycling are not necessarily equal to the cost of reaching the set targets. Oftentimes, the latter may include investments in new technologies or infrastructure. This may introduce counterproductive incentives as producers' costs for recycling depend on the volume of material recycled, and accordingly, the economic incentive in the market is to keep the recycling volume as low as possible.

Learnings from the Nordics

In any case, a number of learnings can be drawn from the Nordics' experience of implementing EPR systems that have partly led the way for their own forthcoming changes in regulation but could also serve as useful recommendations for countries about to introduce EPR.

It is evident that systems focusing on a single product type, like PET bottles or silage plastic, has higher recycling rates than EPR for packaging. This seems to be true regardless of the systems being mandatory or voluntary, connected to less material complexity or their reliance on material quality standards such as rPET. Although it is not feasible to introduce separate systems for each packaging type, more stringent design requirements could be helpful, in combination with development of material quality standards for more types of recycled plastics. If design requirements, reporting requirements and fee models could also be harmonized in the EU, this would ease the administrative burden on producers and possibly prevent free riding to some extent. Differentiated fees also drives higher recyclability, as seen in Sweden.

To reach recycling targets it is important to support sorting and recycling capacity, both on national and EU level. Transforming from a history when most packaging waste was exported outside the EU, the capacities are slowly building up to be able to handle the volumes generated. Higher sorting and recycling capacity is also important for assuring that future quota obligations for recycled content in new packaging can be met. Both mechanical and chemical recycling technologies are needed, and measures should be taken to ensure that they complement each other in a good way, achieving the best overall recycling rate on system level.

Better enforcement of the regulation and sanctions for non-compliance is also desirable, but often difficult for authorities to manage due to limited resources. A

mandatory producer register is a first positive step in the right direction. This can hopefully help to quantify the free rider problem and provide means to deal with it. Monitoring statistics of volumes that are put on the market versus collected and recycled is also important to ensure that producers take their responsibility and that targets can be fulfilled over time.

Finally, to truly be a powerful, multifunctional tool and promote plastic circularity, EPR systems should be combined with other policies and considered a complement to them. Such policies could be weight differentiated waste fees for households that could incentivize waste reduction among consumers. Landfill bans and high landfill taxes are useful to make sure that plastic waste does not end up in the wrong place. EPR is a complement to these policies.

Moreover, in order for these policies to work as a policy package, it is crucial that all flows of waste product are targeted. The force of each of the policies should be balanced so that the sources of waste creation will bear the same responsibility regardless of which flow their waste is generated within. If not, material could avoid the regulation through the product flows that are less or not regulated. This is an important prerequisite for the efficiency of EPR systems. As such, and because of the complexity of waste streams, EPR should perhaps not be viewed as the main instrument to reduce waste, but rather as a complement to policy instruments that are more directly targeted toward the sources of waste generation.

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8.1 Interviews

Interviews have been conducted with representatives from the list below:

- The Swedish Environmental Protection Agency, Sweden
- The Centre for Economic Development, Transport and the Environment for Pirkanmaa (ELY), Finland
- Icelandic Recycling Fund (IRF), Iceland
- The Ministry of Environment, Denmark

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