Making Materials Work for Life – Introducing Producer Ownership

Project LAUNCH

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Executive Summary Producer Ownership Schemes

We are currently facing two linked global challenges: a rapid increase in carbon emissions coupled with an overwhelming increase in resource consumption and waste generation.

Circular economy models that decouple growth from primary resource consumption and waste generation could be the answer to a prosperous future. In the long term, circular economy models could increase GDP over current trends and ease resource dependencies, whilst businesses could save hundreds of billions of euros in material costs.

However, the current economic system we operate in is designed for linear resource use. Virgin materials are cheap and ubiquitous and over 90% of material and energy value is lost after one use cycle.

The system is currently stacked against circular economy models. Our finance, legal and taxation systems are not designed to promote circularity; costs of virgin material extraction, and product use and disposal do not reflect their full associated environmental and social costs.

We have seen over the past years the emergence of range of policy mechanisms that aim to support circularity and resource decoupling such as "Extended Producer Responsibility" (EPR) policies. EPR policies have been an important catalyst for improving waste management and recycling in Europe over the last decades. However, they will not drive the acceleration that is critically required to unlock new circular economy business models, product designs and after-use technologies that fundamentally decouple prosperity and growth from resource use, waste generation and carbon emissions.

Producer Ownership schemes have the potential to align incentives and accelerate the circular economy. Numerous businesses, especially in business to business environments, have shifted from product to service-based models, thus retaining ownership of their products and materials across multiple use cycles. The Producer Ownership model provides the right incentives to design products for durability, dematerialisation, re-use and high-value recycling. However, these models fail to scale at the speed required as the current economic and regulatory system does not provide the right conditions or incentives for them to succeed.

Producer Ownership schemes go beyond Extended Producer Responsibility. They provide incentives and regulations so that *producers are or act like owners of their products during and after the use of the product by the customer.*

Project LAUNCH has been established to provide the most comprehensive scientific support so far to develop actionable Producer Ownership schemes at the scale and speed required. It aims to do so through answering the following key questions:

- What options exist to create or emulate producer ownership of their products and/or the materials built into their products?
- What would be the outcome (and potential unintended consequences) if all producers owned their products throughout their lifecycle?
- What are the policy conditions that would enable widespread adoption of Producer Ownership schemes?
- What are the contractual arrangements that could exist between the "owners" and "users" of products and materials?
- How would the concept of Producer Ownership apply to different industrial sectors and product categories?

The results from this pre-study established that Producer Ownership provides significant business opportunities. These already exist today and will strengthen with the information economy through new business models based on data-rich customer relations, financially attractive service and performance business models, and increasing demand for high-quality secondary materials and feedstock supply.

The project will provide a high-calibre platform to assemble the best science, business and government perspectives and inform the EU in its ambition to drive the circular economy as a critical pillar of Europe's new growth paradigm, one that outcompetes the current model. Over the next three years UCL and SYSTEMIQ will cooperate closely to answer the key questions of the topic together with a growing stakeholder group and build on existing policies such as EPRs, eco-design rules or recycled content requirements to accelerate the transition to a circular economy.

This document introduces Project LAUNCH and outlines the results of the Project LAUNCH pre-study and consultation process. It shows significant potential for producer ownership innovation in all three industrial sectors that were studied – electrical and electronic equipment, apparel textiles and plastic packaging. The project is now seeking supporters and partners for a comprehensive multi-year programme of research and action.

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1. Closing the Circle on Materials – Taking Waste Out of the System

1.1 Introduction

Our global economy faces linked challenges that will come to a head within the next decade: rapidly rising carbon emissions coupled with unmanageable resource use. Finding ways beyond these challenges will require new ways of thinking for societies and how they run their economies. In particular, it will require a shift from a linear to a 'circular economy'.

The circular economy is defined here as a system that 'aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles: design out waste and pollution, keep products and materials in use, and regenerate natural systems' (Ellen MacArthur Foundation, 2019).

We need to make these changes now before the costs of mitigation and adaption become prohibitive. In 2017, around 92 billion tonnes of materials travelled the world to feed our hungry economies. By 2060, this is expected to double. Even at current levels the extraction and processing of these materials were responsible for around 50% of annual greenhouse gas emissions and more than 90% of biodiversity losses(IRP, 2019). We do not want to imagine what the effects of this doubling would be.

Our current linear economic system is based on cheap and ubiquitous raw materials. 90% of which – and the energy used to make them – are lost after only one use. The reason for the low cost is that the negative environmental and social impacts of these materials and discarding them are never fully accounted for. This is further aggravated by financial, legal and taxation systems that further entrench the attractiveness of linearity.

Achieving a vision of a circular economy that will maintain rising living standards, protect the environment and ensure our future on this planet requires step-changes, in particular in managing materials. Project LAUNCH has been initiated to explore one such proposed step-change: making the concept of 'Producer Ownership' the norm, and not the exception.

Proposed many times over the years, the Producer Ownership principle means that manufacturers are or fully act like owners of the materials in their products. The intention of such a change would be that products would be designed such that they or their materials could be easily re-purposed and that waste can be eliminated as much as possible. We argue that making producer ownership the default will encourage different thinking about material flows – and help us to achieve a more circular economy.

The European Union is the starting point for project LAUNCH project to understand how global society could adopt Producer Ownership. Both the Circular Economy Package and Circular Economy Action Plan cemented the EU's position as the trailblazers in the global push for aligning material and waste management with environmental needs. To retain this position rapid action is necessary at a larger scale. This would also put the EU in a favourable position to benefit from the hundreds of billions of euros in materials cost savings that businesses globally are expected to realise as a result of decreased material consumption.

1.2 Materials Management in the EU today

Today, managing materials in the EU begins at the end of their useful life, with 'waste'. This is defined as 'any substance or object which the holder discards or intends or is required to discard' (European Commission, 2012). Waste, and its removal, by definition costs money. To minimise this cost the EU issued the Waste Frameworks Directive that enshrines the principle of 'waste hierarchy'. This sets out the following order of desirability for reduction measures: waste prevention, reuse, recycling, recovery and disposal.

Once a substance is however declared 'waste', so-called 'end-of-life' criteria need to be met before the substance can be considered 'secondary materials' that is ready to be reused or recycled. Meeting these criteria can be onerous and act as a barrier to moving up the hierarchy, resulting in more, not less waste and higher costs.

Ensuring that the materials are considered valuable at the end of products' lives would by definition mean that they would cease to be waste. Our current system is not designed to do this. Not only do the price of raw materials not reflect their full environmental costs, producers and consumers also are unable to properly assess the value of their products.

When consumers buy products today, they are not typically in a position to understand what the after-use value of a material could be. As a result, the products are viewed as worthless and thus discarded as waste. On the production side, producers have knowledge about the materials they sell, but most often face no incentive to recover them. Once a product is sold, with few exceptions, society removes the responsibility from the producer for managing those materials at the end of the product's life.

The current set-up of most waste management systems, where most waste is treated equal and disposed of collectively, acts as another barrier to the recovery of material for productive use. The value of waste decreases significantly when mixed, denying important sources of revenue to waste collection systems and thus increasing its operating costs for the whole society. This is exacerbated by the low recyclability of many products, for example by blending various materials into a composite.

Around the EU we do however see innovative solutions to deal with the challenges of our waste systems. The introduction of the Extended Producer Responsibility (EPR) principle in Sweden in 1990 especially was a watershed. This principle seeks to make the manufacturer of the product responsible for the management of the product's materials at the end of its life and for the final disposal of these materials according to applicable legislation.

Such EPR schemes are intended to create a system that reinforces positive feedback loops. Manufacturers are obliged to contribute to or pay the full cost of treatment and disposal at the end of their products' lives. The desired effect of this levy is for manufacturers to reduce the amount of materials of their products, leading to less waste.

Although EPR schemes have provided a step in the right direction, they are still designed to cost-effectively manage waste, not to stimulate a full circular economy. Only a few schemes reward recyclability, and none directly promote reuse or remanufacturing of products. Therefore, if the EU aims to achieve a waste management system that comprehensively follows the waste hierarchy, additional measures are necessary.

1.3 Taking EPR to its Logical Conclusion

The fundamental issue we would like to address is who is responsible to sustainably manage our resources. We argue that in order to properly value materials, products should be considered merely as their temporary uses as they cycle through our economies again and again. With this philosophy, we can stop talking about waste management altogether, and talk instead about true materials management.

Policies are therefore needed that will give producers a true commercial incentive to design products that are compatible with a circular economy, so that they want to own their materials at the end of products' lives, rather than leaving consumers with the responsibility of dealing with waste materials from end-of-life products, a responsibility that they do not want and that they are ill-equipped to fulfil.

The policy innovation we discuss in this paper, making producer ownership the norm and not the exception, would be defined as follows: schemes that provide the right incentives and the necessary regulatory environment so that producers are or fully act like owners of their products during and after the use of the product by the customer.

These kinds of Producer Ownership schemes would provide the incentive for creating true circular economy practices for those in the best position to do so: the manufacturers of the products themselves. With this policy in place, the better the manufacturer can design goods and build a value chain that retains the value of their constituent materials, the more cost-competitive their product will be.

We believe that this proposed shift in principle, to product ownership as default, is a massive opportunity for businesses that addresses increasing concerns about natural resource availability and environmental degradation. Companies would, other than in most EPR schemes, fully benefit from the value, durability, and quality of design of their products. It will enable the development of innovative and profitable business models such as deposit-return and leasing or service-based models. These practices in turn could lead companies to develop new and better relationships with customers throughout the usage lifetime of a particular product, and beyond. Finally, the policy would substantially reduce costs of publicly funded waste management, which could reduce overall costs for society.

In order to achieve these benefits, the Producer Ownership principle would need to be supplemented by clear legislative guidance on the management of end-of-life products. Current legislation on different waste streams serves as a base, as not all waste streams are the same and they are already considered distinct. New complementary policies could further facilitate good materials stewardship, while supporting business and other practices that shift societies toward circular thinking.

This paper sets out to show how Producer Ownership schemes could lead to the decoupling of growth from resource consumption and environmental damage, and how to get there. To do so, we will first discuss EPRs in the current EU waste management framework. Subsequently, we explore if EPRs are successful in material decoupling for three material streams: textiles in apparel, plastic packaging and electric and electronic equipment (EEE). Finally, we propose next steps to accelerate the transition to a circular economy in Europe, and eventually at a global scale.

2. Extended Producer Responsibility in the European Union

2.1 Overview of EPR on a European Level

Evidence shows that EPR schemes are a step towards establishing owner-like behaviour amongst producers and Europe has been at the forefront of employing them. Almost half of all EPR policies implemented globally are in the EU (OECD, 2013). They have become a core element of EU legislation on waste management, especially with the recent introduction of the Circular Economy Action Plan. The legislative framework underpinning this comprises general legislation on waste management and specific directives addressing particular waste streams.

EPRs are introduced by Article 8 of the Waste Framework Directive as follows:

> 'In order to strengthen the re-use and the prevention, recycling and other recovery of waste, Member States may take legislative or non-legislative measures to ensure that any natural or legal person who professionally develops, manufactures, processes, treats, sells or imports products (producer of the product) has extended producer responsibility. Such measures may include an acceptance of returned products and of the waste that remains after those products have been used, as well as the subsequent management of the waste and financial responsibility for such activities. These measures may include the obligation to provide publicly available information as to the extent to which the product is re-usable and recyclable.'

In 2015, the European Commission presented 'Closing the Loop – An EU action plan for the Circular Economy', which included legislative proposals to revise the EU legislative framework on waste underpinning EPR (European Commission, 2015). This aims to increase the circularity of the European economy and promote the decoupling of resource use and economic growth. The amendments were adopted by the Council of the EU in the waste framework directive in May 2018. The revised EU waste legislative framework entered into force in July 2018, and should be translated to the national law by July 2020. Some elements of the new framework are still under review or revision, for example, EPR fees.

The revised waste legislation package introduced new legally binding targets and set out new rules and requirements for waste management with important changes that have indirect and direct implications for EPRs[1]. These recent changes aim to provide a strong stimulus for EPR, including for innovative approaches to their design and implementation. They include:

1 The revision covered WFD, Packaging Directing and Landfill Directive. The basic information and links to the revised texts of directives are available at https://www.consilium.europa.eu/en/press/press-releases/2018/05/22/waste-management-and-recycling-council-adopts-new-rules/

- **New requirements and definitions:**
    - Minimum operating requirements for EPR across EU member states, and ensuring that EPR schemes for all packaging are established by 2024
    - Simplification and harmonisation of definitions and calculation methods and clarified legal status for recycled materials and by-products
    - Reinforced rules and new obligations on separate collection (bio-waste, textiles and hazardous waste produced by households, construction and demolition waste)
    - Strengthened waste prevention and waste management measures, including for marine litter, food waste, and products containing critical raw materials
- **New binding recycling and landfilling targets (table 2.1)**

Table 2.1 Recycling targets required by existing EU waste regulation

	2025	2030	2035
All packaging	65%	70%	
Plastic	50%	55%	
Wood	25%	30%	
Ferrous Metals	70%	75%	
Aluminium	50%	60%	
Glass	70%	75%	
Paper and cardboard	75%	85%	
Municipal solid waste	55%	60%	65%

Other recent legislation on EPRs concern single-use plastics and fishing gear containing plastic in the context of 'a European strategy for plastics in a circular economy' (COM(2018)28). The European Commission put forward a proposal for a 'Directive on the reduction of the impact of certain plastics on the environment' in June 2019 (COM(2019)904). After debate in the European Parliament and Council of the EU, and formal adoption by the Council of Ministers in June 2019, EU Member States will have two years to incorporate the directive into national law. This new directive will include an EPR scheme covering the cost of clean-up of litter composed of single-use plastic products made from oxo-degradable plastic and fishing gear containing plastic.

2.2 Implementation of EPR Schemes in the EU

Recent studies (Monier et al., 2014; OECD, 2016; Watkins et al., 2017) have analysed the governance and adoption of EPR across EU member states. These reviews make it possible to draw a number of lessons about individual EPR systems' design, implementation, progress and remaining challenges. The 28 member states of the EU have 36 EPR systems among them, serving different materials or products.

2.2.1 Governance Arrangements of EPR in the EU

While EU legislation provides the overall regulatory framework for EPR, national governments have sole responsibility for the scope, instrument design, and governance of individual EPR systems. Country-level regulatory and policy frameworks are, therefore, key for effective implementation of EPR systems.

The EU regulatory framework has led to heterogeneity in the way EPR systems have been designed and implemented across the EU. The organisation of EPR systems and the role of various actors, including producers, national governments, municipalities and consumers, vary substantially between countries. This diversity of arrangements and implementation practices has also affected the economic and technical performance of EPR in all waste streams (Monier et al., 2014).

In general, governance of EPR systems can differ in several aspects:

- mandatory or voluntary status
- individual or collective responsibility
- type of producer responsibility: physical, organisational, financial or informational
- mode of implementation: administrative, economic and informational instruments

The EU has both mandatory and voluntary EPR systems. At the EU level, mandatory EPR was originally introduced in the end-of-life vehicles (ELVs), Waste Electrical and electronic Equipment (WEEE) and Batteries & Accumulators (B&A) directives; a recent revision includes it in the Packaging Directive, which previously did not include an obligation to introduce EPR. Other mandatory EPR schemes are in place at the national level.

Many EU member states have implemented EPR systems for products that are currently not covered or are not mandatory in EU legislation. For example, many member states introduced EPR systems for packaging waste long before it became mandatory under the EU Packaging Directive. Some countries implemented EPR schemes for other products not covered on the EU level, such as used oils, used tyres, graphic paper, textiles, medicines, fluorinated refrigerant fluids, agricultural films, mobile homes, and furniture (Monier et al., 2014).

The responsibility imposed by EPR on producers may be taken individually or collectively. Individual schemes, in which a producer takes direct responsibility for its own products, are rare and limited to instances where one producer sells its products to a limited number of users such as in the case of German vehicle manufacturers (Monier et al., 2014). A number of established firms have recently introduced incentives for consumers to return their products. Apple, for example, offers discounts on their products in return for returned older Apple devices. The WEEE Directive establishes an obligation for large companies to take back their own used products.

Most EU producers, however, choose to collectively share responsibility for a waste stream through Producer Responsibility Organisations (PROs), which offer them a more cost-effective way to comply with regulatory requirements. In a PRO, producers in the same product group pay a variable or fixed fee for participation. While European PROs differ in terms of responsibility, legal status, cost coverage, implementation procedures and reporting, they typically fulfil three main functions (Monier et al., 2014):

- Finance the collection and treatment of a product at the end of its life by collecting fees and redistributing the corresponding financial amounts
- Organise and supervise these activities and ensure efficient management of products once they have reached the end of their use for consumers
- Collect and manage the corresponding data

Collective EPR systems may involve one or more PROs. While Belgium has only one PRO for its WEEE EPR system, the UK has 29 WEEE PROs. Multiple PROs frequently manage batteries in different countries' EPR systems. In contrast, a single PRO manages end-of-life vehicles (ELVs) in each member state's EPR system for that product. EPR systems for other product categories did not show a clear pattern (Monier et al., 2014).

The legal status of European PROs also varies. Most PROs are non-for-profit organisations. PROs can be also run by government agencies, quasi-governmental non-for-profit organisations or for-profit firms. For-profit PROs operated 13 of the 36 EU EPR systems in 2014.

The 2014 study by Monier et al. moreover reported two important changes in PROs that occurred between the early 2000s and 2013. First, producers' fees paid to PROs for solid waste management have gradually increased, in some instances reaching 100% of costs. Previously, the costs were shared with municipal waste management organisations and tax payers. Second, the activities of PROs have gone beyond managing producers' financial contributions to include other services such as operational interventions and data management, organisation of operations, launching bids and communication campaigns.

PROs offer an economically efficient way to manage an EPR system for individual companies. However, relying on the collective responsibility may lead to weaker incentives for individual producers to improve their products. In their current form EPR systems failed to encourage producers to invest in eco-design and environmentally friendly innovative products (Watkins et al., 2017).

2.2.2 Overall Trends and Implementation Progress in the EU and Globally

The number of EPR policies has steadily increased since the late 1980s, with faster growth since the early 2000s (Figure 2.1). Most EPR schemes have been introduced in North America and Europe (Figure 2.2), often to comply with regulatory requirements.

Figure 2.1. EPR policy adoption globally between 1970 and 2015

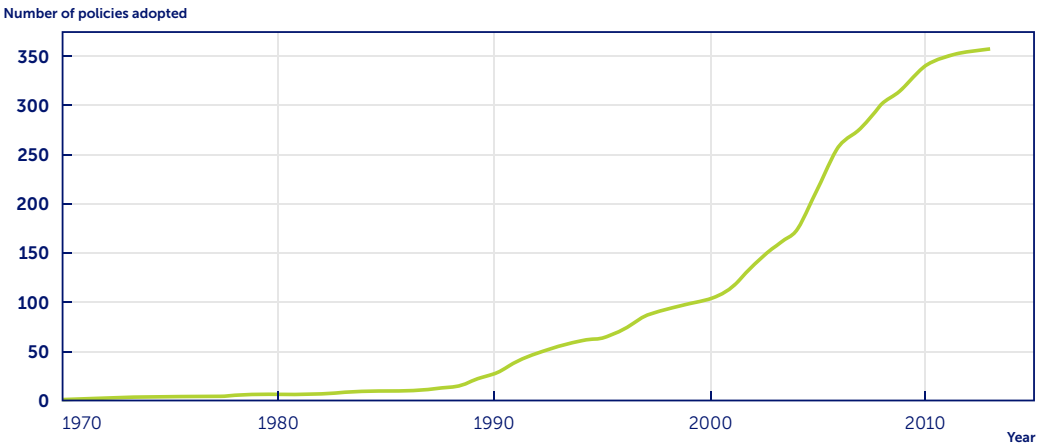
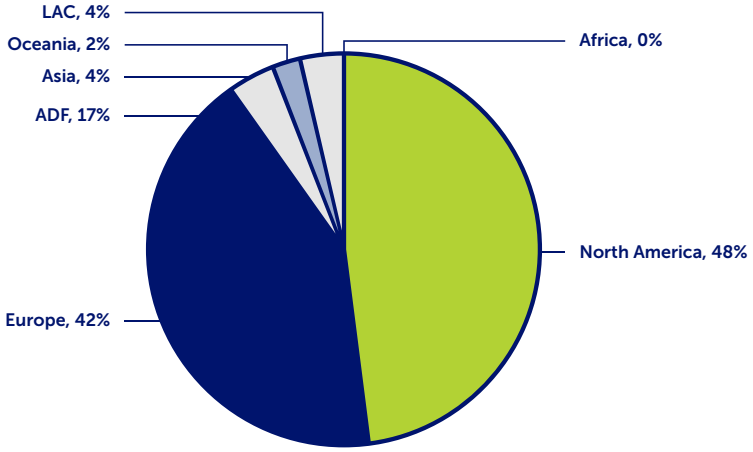


Figure 2.2. Regional distribution of EPRs



Source: OECD (2013)

European EPR systems are implemented through three policy mechanisms: take-back requirements (72%), advanced deposit fees (17%) and deposit-return schemes (11%). Deposit-return schemes are applied mainly to beverage containers and lead-acid batteries. Countries rarely use reinforcing policy frameworks, such as upstream combined tax and subsidy regimes, recycling content standards, and virgin material taxes (Watkins et al., 2017).

In terms of products and waste streams covered, small consumer electronics are the most prevalent product group covered by EPR (OECD, 2013). Electronics, including mobile phones, renewable batteries, thermostats and auto switches, account for 35% of EPR policies globally. Packaging (including beverage containers) and tyres each account for 17%. End-of-life vehicles and lead-acid batteries are covered by 7% and 4% of EPR policies, respectively. The remaining 20% of policies cover products such as used oil, paint, chemicals, large appliances and fluorescent light bulbs.

Figure 2.3 presents an overview of EPR schemes in the 28 EU member states in 2013, based on the most recent comprehensive study on EPR across the EU (Monier et al., 2014).

Figure 2.3. Extended Producer Responsibility schemes in the EU 28 in 2013

MS	Batteries	WEEE	Packaging	ELV	Tyres	Graphic paper	Oils	Medical waste, old/unused medicines	Agricultural film	Other
AT	×	×	×	×	×		×	×		
BE	×	×	×	×	×	×	×	×	×	Disposable plastic kitchenware; photo-chemicals
BG	×	×	×	×	×					
CY	×	×	×	×	×	×	×			
CZ	×	×	×	×						
DK	×	×	Δ	×	×	×				
EE	×	×	×	O	×			O		
FI	×	×	×	×	×	×		×	×	
FR	×	×	×	×	×	×		×	×	Fluorinated refrigerant fluids; pharmaceuticals; lubricants; textiles; infectious healthcare waste; furniture; dispersed hazardous waste; plant protection product packaging and unused products; fertiliser and soil amendment packaging; seed and plant packaging; mobile homes; office equipment ink cartridges
DE	×	×	×	O			×		×	
GR	×	×	×	×			×			
HU	×	×	Δ	×	Δ					
IE	×	×	×	×	×				×	
IT	×	×	×	×	×				×	
LV	×	×	×	×	×	×	×			
LT	×	×	×	×	×	×				
LU	×	×	×	×						
MT	×	×	×	N/A						
NL	×	×	×	×	×	×				Window panes
PL	×	×	×	×	×		×			
PT	×	×	×	×	×		×	×		Packaging of medical waste, old medicines; packaging of phytopharmaceuticals
RO	×	×	×	O						
SE	×	×	×	×	×	×		×	×	
SK	×	×	×	×	×	×				
SI	×	×	×	×	×		×	×		Waste from hazardous pesticides; graveside candles
ES	×	×	×	×	×		×	×	×	
UK	×	×	×	×						
HR	×	×	×	×	×		×	×		Waste containing asbestos
Total	28	28	27	27	20	11	10	10	8	

× EPR scheme O Takeback obligation but no PRO Δ Product fee legislation / Governmental fund

Source: Monier et al. (2014)

2.3 Assessment of EPRs as Waste Management Policy

Recent overview studies conclude that the lack of data on the performance of EPRs make it challenging to conduct robust assessments of their efficiency and effectiveness (Monier et al., 2014; OECD, 2016). Existing evidence suggests, however, that they have contributed to a decrease in the volume of waste destined for final disposal, increased rates of recycling (Eurostat) and relieved pressures on public budgets (OECD, 2016). Monier et al. (2014) reported that between 2005 and 2014 increased fees and a focus on operational interventions have led to improvements in waste recycling and recovery performances in all EU member states. EPR has also contributed to the emergence of a waste and recycling industry, creating new jobs in the sector on a global scale.

Available evidence points to large differences in performance and design of EPR schemes (e.g. collection rates, recycling rates, fees) between waste streams and across EU member states. Based on existing data and case study analysis, Monier et al. (2014) presented three generic findings on EPR:

- In most cases, the best performing schemes are not the most expensive
- Producer fees vary greatly for all product categories. The differences reflect differences in scope, cost coverage or in the actual net costs for collection and treatment of waste
- No single EPR model emerges as the best performing or most cost-effective

We were also able to identify four types of challenges that face EPR schemes to decrease waste sent for disposal, increase recycling and decrease costs:

- Incentivising upstream innovation
- Scope and distribution of waste management costs covered by EPR
- Governance and transparency
- Enforcement of rules

2.3.1 Redesigning EPR Schemes to Incentivise Upstream Innovation

Although EPR schemes are intended to influence product design, recent reviews found no clear evidence for this claim. OECD (2016) concluded that while they have helped to stimulate eco-design in some countries and sectors, their overall impact has been below expectations. As a result, EPR in its current form remains mainly an instrument influencing the end of life of products.

While PROs offer an economically efficient way to manage an EPR scheme for individual companies, they weaken incentives to innovate. This is because the gains from improved product are averaged across all participants, while the costs are borne by the investing company. Promoting fair competition for all participants is essential (Watkins et al., 2017).

A key challenge is therefore to redesign EPRs so that they provide stronger incentives for innovation for eco-design and circular economy business models. The incentives need to be embedded in all instruments encouraging EPR, notably economic instruments. Target-setting and bonusses can be an important measure to enhance the effectiveness and promote innovation.

2.3.2 Paying the Costs of Waste Management

Most EPR schemes do not cover the full system cost of the waste management of the targeted materials. While they are sometimes able to pay the net operational costs of waste management of targeted materials or products, they rarely cover the fuller range of costs. This includes the costs of public information and awareness campaigns, waste prevention actions, and monitoring and surveillance. The costs not covered by producers often fall on municipalities and taxpayers (Monier et al., 2014).

The existing distribution of costs between actors is influenced by many factors. Some of these are external to design and implementation of EPR schemes, and include notably population density and geography, historical development of waste management infrastructure, value of secondary materials on the national market, awareness and willingness of citizens to participate, and complementary waste policy instruments (Monier et al., 2014).

Ensuring that waste management costs of certain products are internalised in their prices, for example through a levy on producers, would shift the burden from society to the beneficiaries of that product. This could be further enhanced by expanding the scope of the schemes. The wider distributional impacts of EPRs also need to be assessed. Equitable cost-sharing in EPR schemes between producers and consumers is desirable, as well as accounting for regional and sectoral differences. Where negative impacts on producers are concentrated in particular sectors or regions, policy makers need to anticipate them and consider appropriate courses of action to address the problem (e.g. revisit cost structures and, when justified, provide support to these sectors or regions).

2.3.3 Improving Governance and Transparency of EPR Schemes

Clarity is crucial. EU EPR schemes on the other hand suffer from unclear definitions of objectives, the roles and the responsibilities of key stakeholders. Monier et al. (2014) reports that in most of the EPR schemes examined, no specific dialogue mechanism had been established which sometimes resulted in contentious relationships among stakeholders.

The governance of EPRs should be made more transparent and inclusive, for example through mandatory reporting. According to Monier et al. (2014), the lack of transparency affects several aspects of schemes: fees and costs of EPR schemes, general access to the financial information flows, amount of products put on the market, amount of waste collected, treated and disposed of, and the location of these activities. It would also be helpful to be able to attribute the effects of EPRs in a wider socio-economic context. The collection of this data would significantly improve the ability to monitor and evaluate EPR schemes.

In the case of EPR schemes within a national or supra-national framework performance monitoring could further be improved by harmonising definitions and reporting modalities. and the establishment of a mechanism to check data quality and comparability (OECD, 2016). The more recent revision of the EU Waste Framework Directive has recognised these challenges and has put a strong emphasis on clarifying reporting obligations, harmonising and simplifying definitions and data comparability.

2.3.4 Better Enforcement of EPR Schemes

Better enforcement is widely recognised to enhance the effectiveness of EPR schemes. Monier et al., (2014) suggests that enforcement capacity is lacking in some EU member states and that some facilities and collection points operate without authorisation. Such inadequate enforcement can undermine the environmental effectiveness and the financial viability of EPR schemes. It can also foster the export of hazardous waste.

Leakage - occurring when EPR schemes do not capture all the products they were established to manage - has now reached a significant level for some waste streams (Monier et al., 2014; OECD, 2016). For instance, more than half of the WEEE collected in Europe is estimated to 'leak' to improper treatment facilities and illegal exports. In France, only about one third of WEEE generated on French territory is estimated to enter designated waste management systems, and between 45% and 75% moves through alternative channels, where it is eventually hoarded or exported (OECD, 2016).

The OECD (2016) underlines that the growing volume of internet sales created additional opportunities for leakage and so-called 'free-riding'. The latter occurs where firms do not pay their fees and benefit from others' payments. The French law on energy transition, for example, aims to avoid leakage by forcing authorised managers of WEEE to sign a contract with an approved compliance scheme, which could enable better monitoring and control of the collection and treatment of waste. However, identification of leakages and free riders requires dedicated resources, competences and capacity from governments (Monier et al., 2014).

3. Analysis of the Specific Material Streams in the EU: Apparel Textiles, Plastic Packaging, and EEE

3.1 Introduction: a Vision for the Future

Today, large quantities of clothing, plastic packaging, and electrical and electronic equipment are designed, used and disposed of unsustainably. Based on available Eurostat information, we estimate that less than a quarter of all products by weight across the 3 material streams are either recycled or reused within the EU.

This chapter focuses on the current challenges for these three material streams and explores the opportunities of a new ownership system, in which products and materials remain the responsibility of producers as the default. Such a system could help to maintain value of products and materials, in line with circular economy principles.

While these conclusions eventually should apply on a global scale, our immediate objective here is an EU in which leakage of these materials is kept to a minimum; where products are designed and produced more sustainably, and used longer and more intensively by one or several users; and where these behaviours lead to a decrease in the consumption of primary raw materials and promotion of secondary markets. This is an EU where:

- Fashion is not 'fast' but 'slow', where clothing items last longer, are reused more often, and returned to producers for recycling at the end of their life cycles. Fashion would become a service and not a fast disposable product.
- Plastic packaging has virtually disappeared from our waterways, and bins in the streets of cities and parks are nearly empty. Instead, plastic packaging, if needed at all, is something that is returned to manufacturers to be recycled in a closed-loop system.
- EEE is more durable and repairable, returned to producers when faulty or unwanted, and efficiently recovered for further applications. It is no longer shipped to low-cost unsafe treatment plants or informal settings abroad.

In this vision, the EU maintains a higher value of products for longer through waste prevention, repair, remanufacturing, reuse and recycling. Its economy benefits from the intrinsic value of the materials and creates jobs and growth in the service industry and closed-loop recycling of materials. It is less dependent on suppliers of critical raw materials and becomes a global leader in circular economy business models and technologies. Achieving this vision requires stimulating an innovative industrial base in the EU that can recover products and materials, remanufacture them and keep them in the productive cycle for longer, generating wealth and employment.

This vision can be achieved by providing the right incentives for businesses and consumers. Some of these incentives can be put in place by granting producers ownership of their materials and products, so that they can adopt measures that allow them to maintain the value of the materials throughout their entire life cycles. Additional measures would be required to ensure that producers stand to benefit economically, by making the extraction of virgin materials and disposal of used materials less attractive, and stimulating demand for products as a service through use of regulations, standards and procurement.

3.2 Industry and Life Cycle Profiles

3.2.1 Material flows

Apparel textiles, plastic packaging and EEE are distinct material flows. Each has a set of characteristics that together represent a large part of the variety of physical, economic and environmental properties of products and services in the economy.

- Apparel is made from both natural and man-made fibres and sold for a variety of purposes, ranging from 'fast fashion' to very durable work wear. While some clothing exemplifies the worst of the linear economy, a second-hand market thrives both domestically and internationally to offset it, as does innovation in the development of fibres with substantially lower environmental impacts. Apparel has significant environmental impacts throughout its life cycle and current material flows directly affect economies and the environment domestically and abroad.

- Plastic is largely made from fossil fuels and is for many applications the most convenient and ubiquitous form of packaging. Plastic packaging breaks down to become microplastic pieces, which are now found all over the globe, in waterways and oceans, and even in the food chain, including in food and water ingested by humans. A large fraction of plastic packaging is not recyclable and incineration of these plastics contributes to carbon emissions.

- EEE covers a range of products including large household appliances (e.g. fridges), small appliances (e.g. toasters), and other items including smart phones and solar panels. It mostly consists of plastics, metals and glass. A single product can contain many different metals, including those identified as precious or critical raw materials such as rare earth elements. Collection and recovery have greatly improved for EEE, but many valuable materials are still lost.

We conducted an initial material flow analysis of these three product streams to show an estimation of production, trade and discard volumes and quantify the scale of the flows and current disposal routes in the EU. It covered manufacturing, trade and waste management. The exercise did however reveal important data gaps and fragmented information. Further work needs to enhance data detail and consistency, as well as provide further analysis of the early life cycle stages of material extraction and processing. The results are presented in Sankey diagrams in figure 3.1-3. The width of the flows represents the quantity, indicated in millions of tonnes.

To allow for comparability among all three waste streams, the material flow analyses are based on Eurostat data supplemented with product weight data (Eurostat, 2019a, 2019b, 2019c). The diagrams feature discrepancies but these can be removed through adjustment and balancing of the flows based on additional data sources and assumptions. A detailed description of flow figures, data sources and calculation methods can be found in Table 6.1, Table 6.2, and Table 6.3 in the Annex. The three diagrams reveal several commonalities and differences between the material systems.

- Products reaching the end of their life cycles through formal routes are only a very small fraction of the products consumed. Concern is rising over the huge amount of products that enter the economy every year and end up in limbo, as well as leakage that is not accounted for because materials escaped formal disposal routes.

- Recycling and recovery only make up a small proportion of final waste treatment for all flows, with large quantities escaping separate collection and therefore not finding their way to recycling. The separate collection rate for packaging could not be inferred from the available data.

- For all waste streams, some of the waste is exported. This stream is very small for EEE, which is probably due to a data gap. Significant amounts of EEE are likely shipped from the EU to West Africa and Asia but reported as exports of second-hand goods.

- For apparel and EEE, trade flows are relatively large compared to domestic production and import exceeds exports. However, for plastic packaging, The EU is a major producer and trade flows are relatively small.

Based on the Sankey diagrams, we calculated several performance metrics for the three material systems; see Table 3.1. All metrics are calculated as a fraction of total discards. For apparel and EEE, the recovery rates are very close to the collection rates, suggesting that collection is the bottleneck. Apparel has the lowest domestic recovery rate due to very large export flows to developing countries. Compared to other waste streams in the EU, such as paper and metals, the recovery rates can be much improved.

Table 3.1 Performance metrics of the material systems in 2016.

Waste stream	Apparel	Plastic packaging	EEE
Separate collection rate	35%	N/A	38%
Recycling and reuse rate	32%*	43%	33%
Domestic recovery rate	11%	27%**	33%

*This figure excludes clothing donated to charities **Based on the fraction of all plastics that are recycled domestically (PlasticsEurope, 2017).

Unfortunately, the data do not allow the quantification of closed-loop recycling or recycled content of products. For the category 'domestic recycling', we cannot tell from the data whether the waste is used for the same or a similar product or for an altogether different product. Most materials likely are used for 'open-loop' or 'down-cycling' to other, lower-value product categories. Besides, large quantitative losses are likely in some recycling processes. Efficiency of recycling processes varies by material and recycling technology but is also influenced by segregation systems in place, which will impact the level of cross contamination. A transition towards a circular economy will definitely require more comprehensive data regarding the destination of waste destined for 'recycling'.

Figure 3.1. Material flows in the EU apparel system in 2016. Values given in million tonnes.

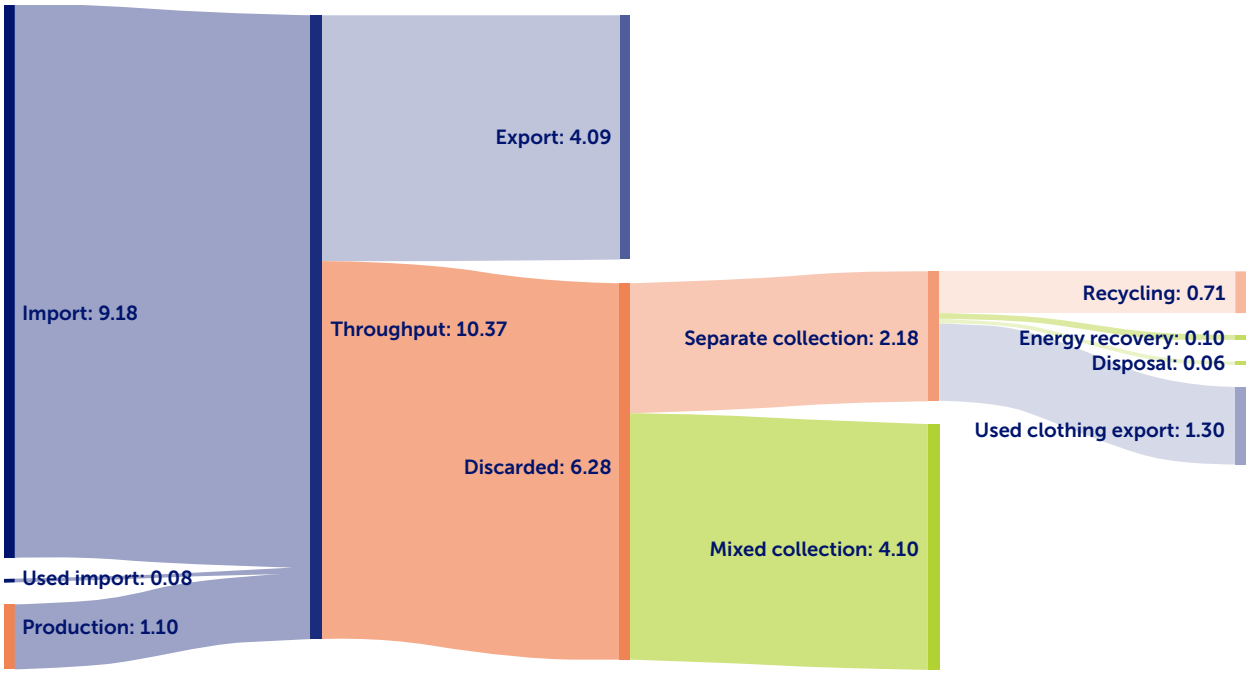


Figure 3.2. Material flows in the European plastic packaging system in 2016. Values given in million tonnes.

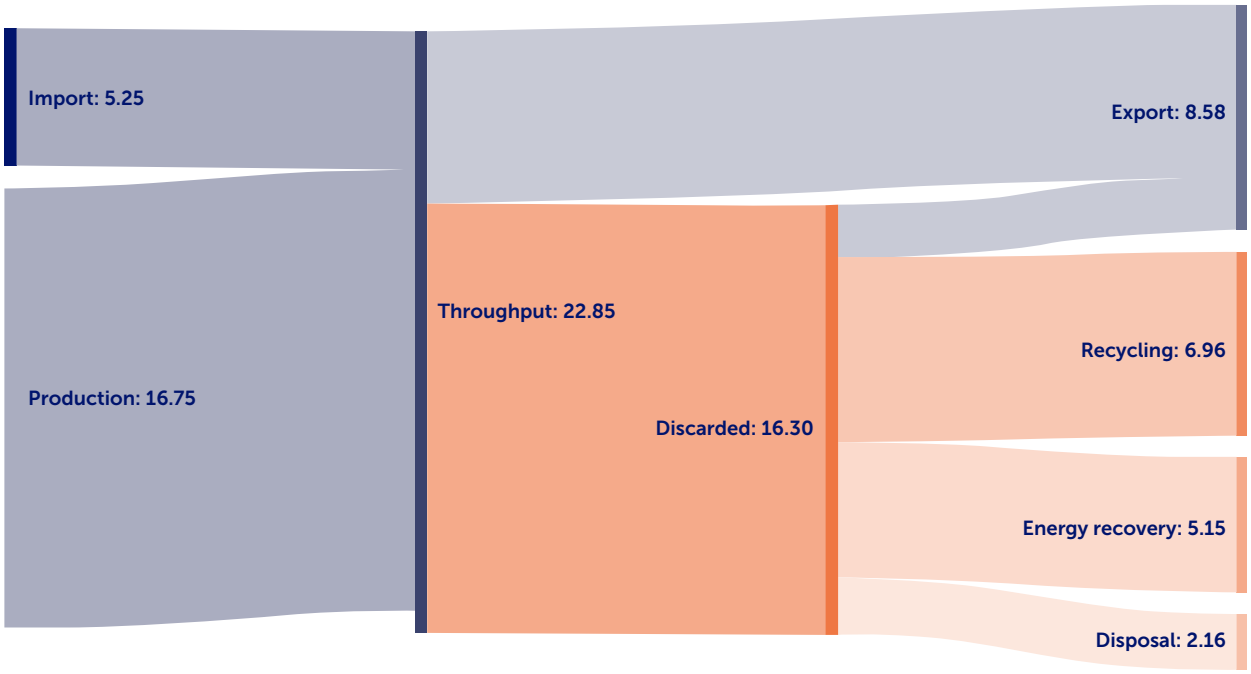
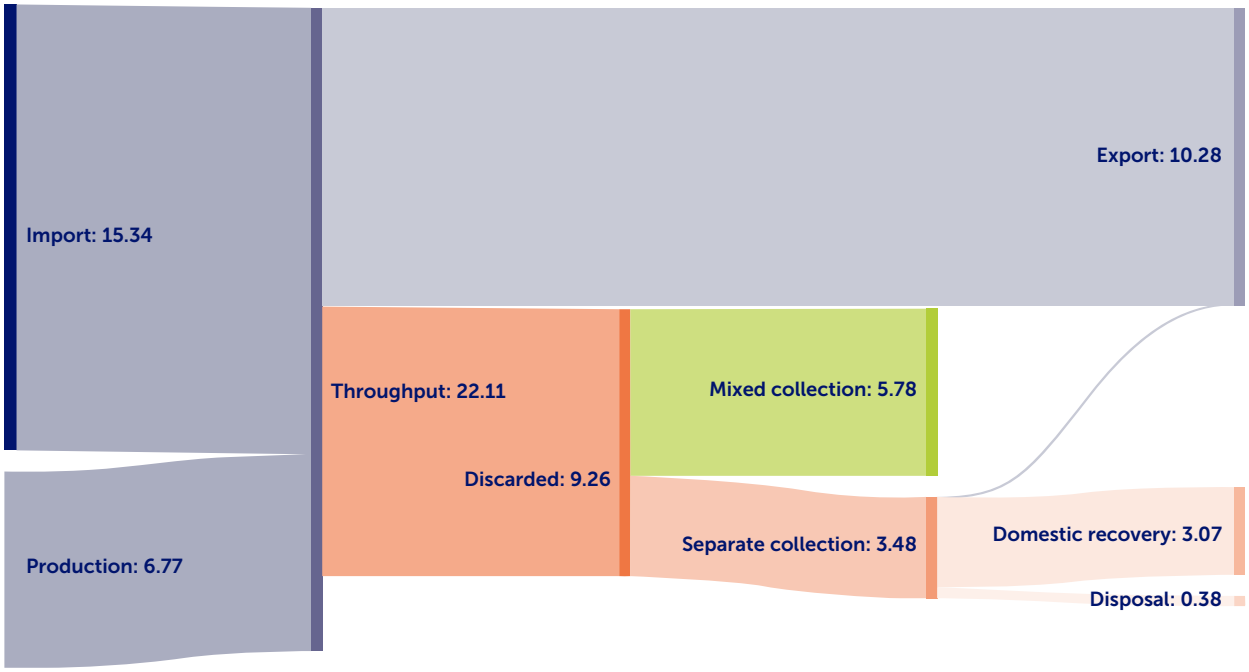


Figure 3.3. Material flows in the European electrical and electronic equipment system in 2016. Values given in million tonnes.



3.2.2 Economic Significance

All three product categories and the associated waste flows have great economic significance for the EU. Table 3.2 lists the number of businesses, turnover, production value, and employment for the relevant manufacturing sectors (Eurostat, 2019a). Apparel and plastics packaging have similar figures for number of businesses, turnover and production value; however, apparel has much higher employment. The electrical and electronic equipment sector is by far the largest and features much higher employment. Together, the three material streams account for 4.6 million jobs in manufacturing alone.

Table 3.2 Economic significance of apparel, plastic packaging and EEE manufacturing in the EU.

Indicator	Apparel	Plastic packaging*	EEE
Businesses	123,000	9,000	180,000
Employment	941,000	264,000	3,405,000
Turnover (million EUR)	71,000	55,000	744,000
Production value (million EUR)	67,000	52,000	708,000

*Figures only include the subsector 'plastic packing goods' and may underestimate the plastic sector activity associated with packaging.

3.3 Challenges and Opportunities

3.3.1 Environmental Challenges and Opportunities

The three material groups and the relevant waste flows have significant impacts on the environment. Table 3.3 lists the main impacts regarding climate change, resource depletion, water use, land use, ecosystems and human health, and plastic pollution. The last is a relatively new concern and has no standardised approaches for measuring it. However, plenty of evidence shows that plastics affect marine life and that microplastics, which are found almost everywhere, have potential impacts on human beings through the food chain.

Table 3.3 Main environmental and human health life cycle impacts of the three products.

Environmental impact	Apparel	Plastic packaging	EEE
Climate change	Energy consumption during production and use (laundry)	Energy consumption in production and fossil fuel feedstock; release of CO2 through incineration	Energy consumption during production and use (electricity)
Resource depletion	No major impacts	No major impacts	Wide use of almost all of the critical raw materials
Water use	Irrigation for crop cultivation and water use for laundry	No major impacts	Water use in the mining of minerals and metals.
Land use	Agricultural land for crop cultivation, in particular for cotton	Potential land use issues for production of bioplastics	Land use for the mining of minerals and metals.
Ecosystems & human health	Various contaminants including pesticides, dyes, and detergents	Additives can migrate to soil, air, water and food	Toxic emissions from mining, manufacturing and waste sorting
Plastic pollution	Microplastics from synthetic clothing in marine environment	Macroplastics such as plastic bags in the terrestrial and marine environments	No major impacts

Our analysis is based on the following references: Beton et al., 2014; Ceballos and Dong, 2016; Crippa et al., 2019; Grant et al., 2013; Hahladakis et al., 2018; Hann et al., 2018.

For each waste stream, certain environmental impacts stand out. First, for apparel, the life cycle greenhouse gas emissions from clothing consumption in the 28 EU member states in 2016 are between 191 and 271 million metric tonnes of carbon dioxide equivalents. The upper value (~5% of EU total) being more likely because it is based on a more comprehensive assessment (sources and calculation in Table 6.4 in the Annex). In addition, the growing and production of cotton textiles require massive amounts of water, while synthetic textiles are responsible for a large part of microplastic pollution.

Second, plastic packaging has received much attention because of littering and pollution of the marine environment. Studies have found marine litter in many marine species and the main sources of plastics in the ocean are uncollected plastic waste. This is expected to grow significantly over the coming years. Plastic production and incineration are also responsible for major greenhouse gas emissions, likely to account for 15% of our total carbon budget by 2050 (Zheng and Suh, 2019).

Third, EEE has particularly high impacts during the end-of-life phase. A variety of e-waste and e-waste components contain persistent organic pollutants (POPs), dioxins, and toxic elements including lead, chromium, and cadmium. Combustion of e-waste can release dioxins and polyaromatic hydrocarbons (PAHs). The pollutants are released into air, dust, food, water, soil, and food and reach human beings through ingestion, inhalation, dermal contact, and across the placenta. Impacted groups include workers and local communities in rich and poor countries, with children and mothers being particularly vulnerable (Ceballos and Dong, 2016; Grant et al., 2013).

Moving to a circular economy would mitigate some of worst environmental impacts through the following mechanisms:

- For apparel, according to an analysis by Beton et al. (2014), increased reuse and recycling led to the largest impact reductions for 6 out of 15 mid-point impact categories, including climate change.
- For plastic packaging, the recommended measures to reduce marine pollution focus on key countries in Asia, which contribute the most marine litter and trade intensively with Europe (Hann et al., 2018).
- For EEE, better product design can reduce hazardous elements and increase the ease of disassembly. Better assessment and control measures in the recycling sector can reduce health impacts for workers and their communities (Ceballos and Dong, 2016).

3.3.2 Economic Challenges and Opportunities

The three waste streams represent considerable value that is not currently exploited because of a linear take-make-dispose model of production and consumption. We propose 3 key explanations for why a more circular model that would decouple material consumption from well-being has not yet been adopted for these streams in particular.

- Current prices do not cover the full social and environmental cost of material extraction, processing, use and waste management for the three material streams. Long-term resource implications are not part of short-term business planning.
- Current business models do not allow companies to retain or return their products to exploit the residual value after initial use. For apparel and EEE, many products are not expected to last longer than a few years; for plastic packaging, single use is often assumed.
- Consumers have come to expect low upfront investment and short product lifetimes. Fast fashion, continuous renewal of products such as smart phones, and a lack of affordable repair or upgrade options stimulate high throughput.

Each material stream has unique challenges. For example, for apparel, the practice and context of collection and sorting textiles is changing locally and globally, putting increasing pressures on the sector in EU. A study for the Mistra Future Fashion project (Ljungkvist et al., 2018) found declining demand for low-quality used textiles in developing countries, increasing competition with cheap Chinese-made textiles and second hand exports from high income countries, and actual bans on imports in some cases.

Locally, in Sweden, the collection and sorting market is increasingly competitive. Municipalities now sometimes ask consumers for a fee to pick up used textiles. Higher collection rates have led to lower average quality and therefore increased recycling of fabric, as opposed to reuse, of apparel. These economic trends put pressure on textile sorting and recovery: higher supply of but lower demand for used textiles, along with an increase in wages, leads to higher sorting costs, lower sales prices and lower margins for the collectors and processors.

A change in the incentive structure for businesses could unlock the value of materials and products and bring wider benefits in terms of growth and employment. In addition to job creation, a recent review of more advanced economic models by the OECD confirms that circular economy strategies are consistently shown to bring positive economic benefits (McCarthy et al., 2018).

3.4 Policy Landscape

3.4.1 Overview of the Policy Landscape

The policy landscape of each material stream differs per category. While specific directives have been laid down for packaging and WEEE, some member states have also introduced specific instruments for apparel.

- For apparel, no directive currently requires an EU-wide EPR scheme. However, France has an EPR scheme for textiles, which covers clothing. Clothing or textiles have some priority in EU legislation, for example in relation to end-of-waste criteria, but there are currently no specific recovery targets.

- For plastic packaging, the most relevant piece of legislation is the EU Packaging Directive, which has led many member states to introduce EPR to achieve the collection and recycling targets. An additional directive is in place for lightweight plastic carrier bags, which includes consumption targets and mandates certain actions to reduce the use of such bags.

- For WEEE, the most relevant piece of legislation is the WEEE directive, which demands EPR for a large variety of electrical and electronic equipment. Additional relevant EU policy includes directives focused on eco-design of energy-consuming products, standards and labels for such products, and a range of directives and regulations covering the use of chemical substances in such products.

Additional relevant policies include waste and product legislation more broadly and legislation relating to trade and production. For example, economic instruments such as landfill taxes, introduced by many member states, stimulate a step up the waste hierarchy towards eliminating waste. The next sections provide an overview of the policy landscape for each waste stream.

3.4.2 The French EPR for Textiles

For apparel, currently France is the only member state that has an EPR scheme. Figure 3.4 provides a summary of the French EPR system. Basically, funds are raised by a central PRO by charging producers for putting textiles on the market. The PRO then distributes the funds to sorting centres. A fraction of the funding is reserved for R&D projects related to textiles and to support local communities with awareness-raising campaigns. The EPR policy has more than doubled collection, which rose from 76 kilotonnes (kt) in 2007 to 184 kt in 2016.

Figure 3.4. Structure of the French EPR scheme (Eco TLC, 2016).

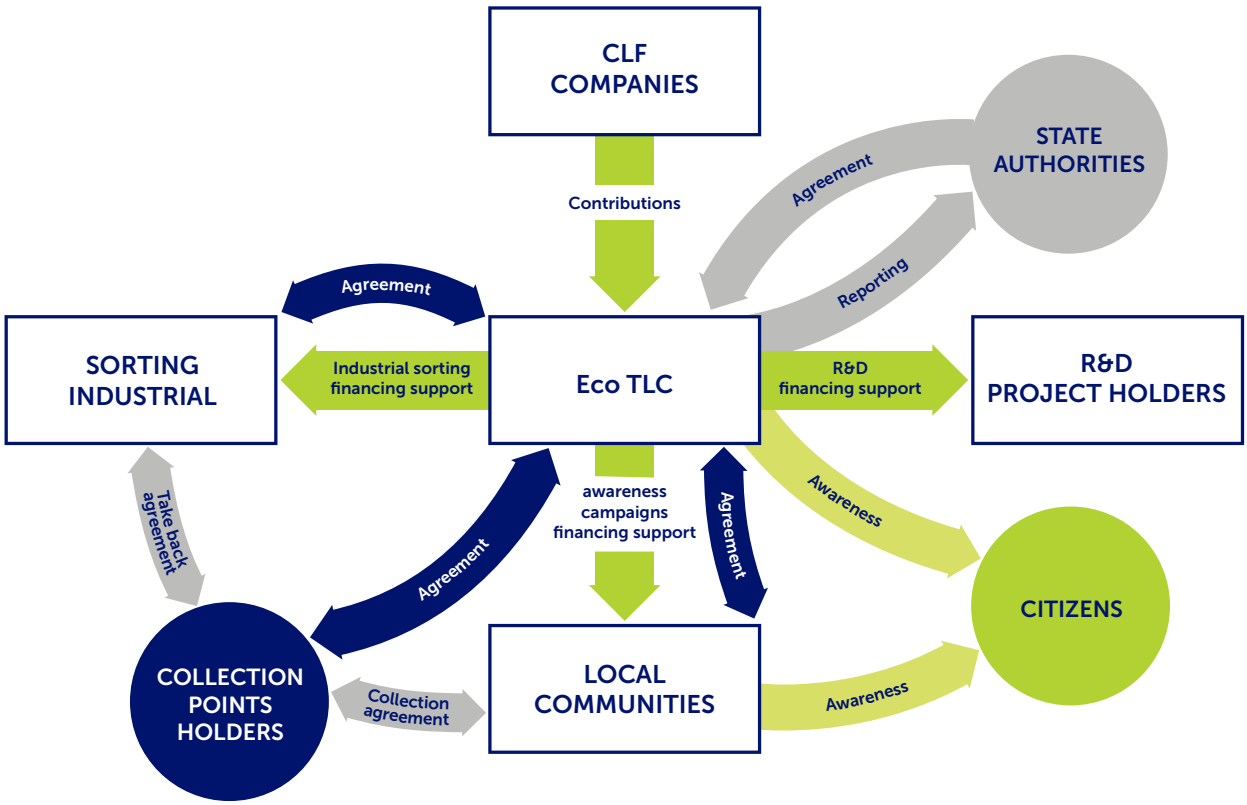


Table 3.4 summarizes the main aspects of the policy, the associated mechanisms, the main results, and some of the challenges faced, for 2016. The EPR scheme has particular strengths in terms of job creation for vulnerable groups, which was one of the reasons it was implemented in the first place. The policy works in conjunction with French legislation regarding such groups in the labour market (WRAP, 2018).

Table 3.4 Overview of mechanisms, results, and challenges in French EPR scheme, 2016 (Bukhari et al., 2018; Eco TLC, 2016).

Goal	Mechanisms	Results	Challenges
Fundraising	Fees differentiated by item size, ranging 0.001 – 0.05 Euro/item	17.2 million Euro for 2.55 billion items put on the market	—
Collection & sorting	Financial support for sorting centres in France and abroad. R&D funding for textile separation and preparation techniques	12.8 million Euro for 64 sorting centres. Collection points in 670 communities that cover 86% of population 6 R&D projects funded since 2010*	—
Employment	Support of (previously struggling) sorting industry, with higher rates for those hiring vulnerable groups	1,400 sorting jobs with 49% held by people 'facing employment difficulties'	—
Awareness and information	Financial support and tools for publicity campaigns; Online information, outreach activities, social media channels	2.2 million Euro for 1,370 publicity campaigns in preceding year; 672,000 visitors for website with practical information	—
Reuse and recovery	Reuse and recovery upon sorting; R&D funding for textile recycling projects	Reuse: 59.4% Unravelling: 22.5% Wiping cloths: 9.3% Energy recovery: 8.5%** Disposal: 0.3% 14 R&D projects funded since 2010*	Reuse constrained by decreasing demand from developing world
'Green' or eco-design	Modulated fees for recycled content. R&D funding for eco-design projects	0.004% of contributions in discounted category. 2 R&D projects funded since 2010*	Fees and discounts too small to cover the producer administration costs of eco-fees

*A total of 2.8 million Euro was spent 2010-2016 on R&D projects, which corresponds to roughly half a million Euro R&D expenditure annually.

**This is 7.5% of solid recovered fuel (SRF) and 1% of direct disposal with energy recovery.

Since 2016, fees have been changed to reflect the environmental friendliness of apparel, with discounts available for more durable clothing, which can be measured with existing standardised tests. This measure seems to have been more successful than the previously introduced discount that was based on recycled content (WRAP, 2018), but no evidence shows that producers actually changed designs because of it.

Furthermore, in terms of 'comprehensiveness' of the EPR system, allocation of responsibility to stakeholders along the product life cycle is not necessarily effective (Kalimo et al., 2012, 2015). The subsidies for sorting centres have an advantageous effect on the price of recyclable materials, which only indirectly supports recycling and recovery of textiles after sorting. Manufacturers that could process recycled fibre are not directly supported. The products that are put on the market are not

returned to producers and it is unclear whether a take-back system would exempt producers from the fees (thus creating incentive for such take-back systems). No evidence shows that producers have increased incentive to recycle or reuse their own products.

These limitations are typical for a collective EPR system and may partly explain why 'recovery' so heavily relies on the exporting of used textiles to developing countries – after all, the alternative would require building up domestic capacity to recover these materials. However, as the previous analysis of the sector seems to suggest, EU-based productive capacity in textiles is limited, as the vast majority of the flows of new apparel are imported from third countries.

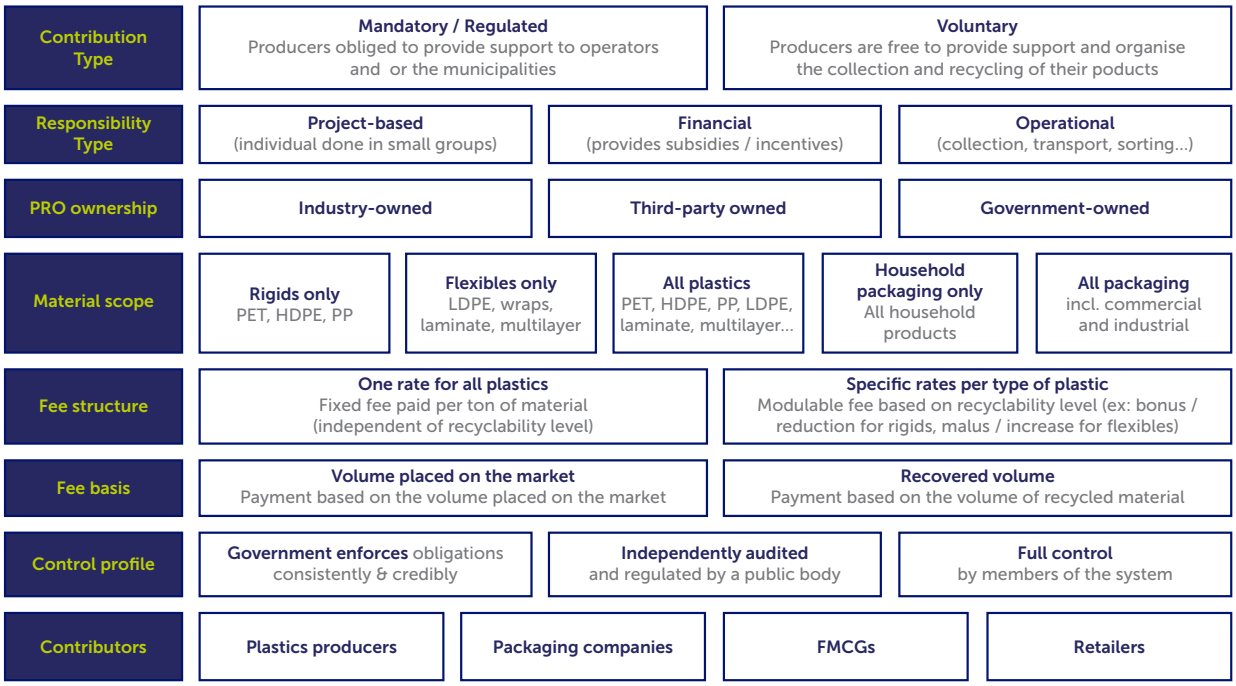
3.4.3 EPR Schemes for Packaging

Almost all member states have EPR schemes for packaging in order to support the requirements of the EU Packaging Directive of 1994 (Monier et al., 2014). A review by Watkins et al. (2017) summarises the characteristics, weaknesses and opportunities for these schemes. The scope of the EPR schemes varies by member state and can include household waste only or all packaging waste (household, commercial and industry). We think the most relevant distinctions between the schemes are the following:

- Fees and cost coverage. For example, the fees for plastic packaging vary between 5 euro per tonne (€/t) of plastics in Poland and 660 €/t of plastics in Greece. Clearly, not all fees cover the full cost of waste treatment and recovery.
- 'Eco-modulation' or shifts for ecologically friendly practice. Various schemes feature eco-modulation of fees based on a range of material and product properties, including type of plastics, biodegradability, reusability and recyclability.

Figure 3.5 provides an overview of the how the different schemes between EU member states vary, in at least eight aspects. To what extent all these variations impact on the effectiveness of the schemes is hard to tell. Although this variation allows for learning and experimentation, the lack of harmonisation is also a barrier to effectiveness, as it does not provide producers with a consistent strong incentive to reduce waste.

Figure 3.5 Key design elements of European EPR systems based on (Monier et al., 2014)



Watkins et al. (2017) emphasise that EPR can play an important role in achieving packaging waste policy targets, such as recycling rates. While existing schemes suffer from multiple shortcomings and described in chapter 2, they identify the seven following measures that could improve existing schemes, especially for packaging:

- Clarifying and harmonising definitions
- Improving allocation of responsibilities
- Maximising cost coverage
- Promoting fair competition
- Increasing transparency
- Expanding of scope
- Introducing the eco-modulation of fees

3.4.4 The EU WEEE Directive

The EU WEEE Directive, which first entered into force in 2003, mandates producers to join a compliance scheme and finance the collection and recovery of their waste. Legislation in member states varies in how they assimilated the mandate.

The directive was amended in 2012 to address concerns regarding the clarity of its scope, means to ensure compliance, and free-riding producers (Kalimo et al., 2015; Ylä-mella et al., 2014). Free riders would put products on the market while not contributing to collection and recovery, and therefore these producers had no incentive to design their products ecologically or for easier recovery and reuse. Third parties also collected only the most valuable WEEE to meet quantitative targets and assumed no responsibility for the rest of the waste stream, which weakened schemes.

However, the amended directive is unlikely to fully address all these concerns, and challenges remain. For example, limited consumer engagement continues to affect the collection rate of WEEE and thus the total amount of WEEE that can be recovered. A recent review by the OECD of online sellers (Hilton et al., 2019) found that free-riding is still likely to be a significant problem. The report called for a legal provision to allow for prosecution of offending companies in other jurisdictions.

3.5 **Changing Ownership**

3.5.1 Producer Ownership

The challenges we describe above can be fundamentally addressed through advancing today's EPR models in a way that mandate producers to be or act like full-cycle owners of the material. Rather than aiming for a more stringent form of the current best in class EPR schemes with eco-modulation, Europe could consider requiring a Producer Ownership model as an avenue to advance existing EPR schemes and achieve decoupling.

With such a model, the producer would provide incentives to the consumer to ensure appropriate return of items for repair, reuse or recovery. A Producer Ownership policy could put in place a number of incentives that directly address the challenges currently observed with existing EPR systems in the EU as described in chapter 2.3 and 3.4.

These incentives would follow from a policy mix illustrated in Table 3.5. This overview describes push, pull and context policies and distinguishes four types of policy instruments: regulatory, economic, informational and voluntary. The strategic level in this model encompasses all of these, to ensure ambitious goal and target setting and policy processes that enable learning.

Table 3.5 Circular economy policy mix including producer responsibility (Van Ewijk, 2018).

	Push	Context	Pull
Strategic	Coordinated policy strategy to achieve a clear goal, guided by specific targets and with a policy process that enables learning		
Regulatory	Producer responsibility, eco-design, permits	Waste frameworks, market regulation	Green public procurement
Economic	Public support of R&D	Fiscal reform, infrastructure provision	Product, resource or waste taxes
Information	Waste exchanges, material flow data	Education system, collaborative projects	Product labelling, campaigns
Voluntary	Innovation and research partnerships, product design, waste treatment agreements, discussion platforms		

Producer responsibility is part of the policy mix, as shown in the table under regulatory pushes. The most immediate requirements in terms of supporting policies are those that address the previously mentioned challenges of incentives, infrastructure, and data:

- Enhance regulatory and economic instruments that strongly discourage or prohibit the use of the lower options of the waste hierarchy
- Introduce information instruments to help producers develop and implement changes in product design and business models
- Promote green public procurement where possible to ensure a market share for innovative circular business models
- Further develop standards and approaches for material and product tracing and public infrastructure that supports take-back schemes
- Require return and recovery by the original producer of all products placed on the market, to avoid third parties focusing only on the most valuable streams of for example EEE
- Encourage and reward businesses that develop capacities to communicate with and incentivise consumers to increase separation at source, product return and information provision

In the longer term, an important prerequisite for a shift towards a circular economy based on producer ownership of products is investment in appropriate education and training. Another important prerequisite will be realignment of the many product, material and waste policies that are currently in place.

We think such policies would also have other side benefits, by encouraging the sustainable design of products and services in closed loop systems. And such practices would keep valuable products in use in Europe, which would protect businesses from global volatility in the prices of primary commodities and promote secondary material markets.

3.5.2 Relevant Business Experience

Producer Ownership represents a departure from current forms of EPR. And yet, many ongoing business activities already fit this model. Companies already engaged in such practices should be considered front-runners in the transition towards producer ownership of products, and their experiences could inform policy design.

In the case of textiles, some large retailers, such as H&M, already have programmes for creating incentives to consumers to return their end-of-life clothing items, to be recycled into new clothing. The industry is already familiar with reverse logistics, used to dispatch and take back new clothing items every day, through online channels and stores. Business interest in alternative approaches is evidenced by the involvement of large retailers with the Ellen MacArthur Foundation, a UK-based charity focused on the circular economy (Ellen MacArthur Foundation, 2017), and the Nordic voluntary textiles program.

Other businesses that support this shift include clothing repair and adjustment, which is currently a small industry. But tailors used to be much more common, and under favourable conditions, growth in this sector is very likely. Sharing or rental business models are already common for high-value occasional clothing, such as wedding dresses, tuxedos and costumes. New businesses that use this model for more everyday items, such as jeans, have been launched over the past few years, emphasising services over ownership.

For plastic packaging, some of the same arguments can be made. For some business-to-business shipping, reusable and returnable packaging is already in use, including the required reverse logistics. The packaging industry, by virtue of being closely involved with logistics generally, is in a good position to further develop reverse logistics.

Some businesses have already introduced returnable packaging for consumers, with incentives for consumers to return the packaging. Strong public support exists for addressing issues around plastics and packaging and a Producer Ownership policy is therefore likely to gain support. For businesses whose primary activity is not packaging, the reduction and reuse of packaging is high on their agendas as a result of costs and changing costumer preferences, and their support is therefore likely.

Finally, for EEE, companies already have considerable experience with producer ownership. Large appliances such as washing machines are already available on rental contracts and the same model could be applied to smaller models. Repair and refurbishment of some products, such as electronic notebooks and other kinds of computers, are already implemented by some brands and have proven to be an established revenue stream.

EEE have high residual value, so that producers are likely to be interested in ownership just because of the very significant economic opportunity. Some innovative business models for electronics allow upgrading based on a modular design, which could be further expanded.

4. A Step Change in EPR: Building the Foundations for a Circular Economy in the EU

Right now, the EU has real momentum for introducing innovations to ensure a circular economy, which could drive competitiveness and prosperity in the European economy. A good starting point is rethinking EPR systems across Europe. This opportunity could redefine the role of the EU globally and position it as the reference for policy, technology and business model innovation in relation to a circular economy.

However, this system change can only work with the right incentives for both consumers and producers. As we have argued above, we believe an effective way to attain this goal is to redefine product resource ownership and stewardship. Producers should remain or act like the owners of the materials in their products throughout their lifetime and be responsible for their appropriate management. For many materials, this management would involve take-back systems for remanufacturing, repurposing, reuse or recycling. This Producer Ownership model would give the necessary incentives to businesses for the circular economy to be more attractive than the old linear take-make-dispose model of material use. It would also mostly lift the burden from consumers who are not in the right position to carry out these activities themselves.

Producer Ownership is a concept with a long pedigree and a proven success rate for resource efficiency. It is certainly not a new concept. Despite this, the Producer Ownership model remains rare. A growing business in leasing light and other electronic appliances, for example, is not far behind cars. But people still find it easier to buy light bulbs. People are more likely to rent clothes for special occasions, but not an entire wardrobe – ready-made clothes remain cheap and disposable, in many consumers' minds. Depending on the value of the material, the Producer Ownership model may not be able to compete with the take-make-dispose model, given the current conditions in EPR systems and wider policy frameworks.

To make Producer Ownership the default model the EU now needs to create conditions so that all producers design and manage their resources as circular instead of disposable. Policies should establish the right mix of incentives for both producers and consumers to support Producer Ownership schemes, which would ensure a complete transformation of our current resource flows with large benefits.

Specifically, we expect improvements in the following:

- Increased value of recovered materials
- Increased recycling efficiency
- Increased material recovery
- Enhanced consumer engagement
- Improved data collection and knowledge across the value chain
- Reduced volume and hazardousness of waste generated
- Reduced environmental damage from inappropriate waste disposal
- Reduced primary resource extraction and associated environmental damage
- Reduced collection costs

This policy innovation fits perfectly into the current EU Circular Economy Action Plan, Circular Economy Package and builds on the new EU directives on waste management by ensuring that the following targets will be met:

- Harmonised EPR systems across all member states
- Implemented waste hierarchy as the foundation for waste management models
- Reduced total waste generation
- Increased recycling rates of municipal solid waste to 65%
- Increased separate collection
- Ensured producers pay for waste management
- Reduced regulatory burden
- Improved dialogue between stakeholders

The EU's experience with EPR systems forms the ideal basis for the development of the concept of Producer Ownership. The EU also leads the global trend to manage different waste streams according to their respective characteristics, such as EEE and packaging. This differentiation is crucial to the design of any successful ownership model, as one size does not fit all. Making Producer Ownership the default model for every waste stream would enable combining the various EU targets for waste management and achieve lasting transformative change of resource decoupling.

4.1 Questions that Remain to be Answered

LAUNCH has started with the summaries above of the foundational legislation and systems that could lead to a circular economy. Some of the questions that we will tackle in our project in the next three years follow.

- What options exist to create or emulate producer ownership of their products and/or the materials built into their products?
- What would be the outcome (and potential unintended consequences) if all producers owned their products throughout their lifecycle?
- What are the policy conditions that would enable widespread adoption of Producer Ownership schemes?
- What are the contractual arrangements that could exist between the "owners" and "users" of products and materials?
- How would the concept of Producer Ownership apply to different industrial sectors and product categories?

Follow-up research will focus in detail on the following issues:

- **Materials and Products:** The main material flows through the European economy, and how these are related to different industrial sectors and product groups, what proportion of them are imported and exported, their rates of reuse, recycling or recovery, and the environmental implications of their production and current means of disposal. As noted, the material streams to be examined could include vehicles, furniture, other textiles, other electrical and electronic products in more detail, and other packaging.

- **Producers:** Each of the sectors and product groups needs to be mapped for their use of different materials, their value and supply chains (both inside and outside Europe), their employment and value-added, their logistic arrangements, the fate of their end-of-life products, and their life-cycle resource and environmental implications. We will undertake intensive engagement with companies in the sectors and those related to the product groups, to investigate their current business models and to what extent they already seek to recover their products; how these situations might change under Producer Ownership schemes; what other impacts and changes in behaviour and operation might be induced by this policy; and what the associated costs and benefits of these changes would be.

- **Existing Materials Policies:** The EU has extensive current policies on materials management for all stages of product life cycles, but different European countries implement these policies in different ways, including through different kinds of EPR systems. Follow-up research would extend the analysis in this paper of these existing policies and how they have been implemented, in order to understand better how they might be amended, developed or further implemented in response to Producer Ownership schemes and what new complementary policies might be required to accelerate moves towards circularity.

- **Definitional and Legal Issues:** Proposing a change in the formal ownership of the materials in products clearly has extensive legal implications that need to be explored. Another issue is the legal definition of waste and when materials become, or cease to be, waste. At present materials become waste when their owners, consumers, wish to discard them. With this policy innovation, materials would become waste when producers had no further use for them, and no one else had either, so that the producer might wish to discard them. The project would need to explore how such a regime would need to differ from current waste management and enforcement regulations. Moreover, the new business models under Producer Ownership policies may generate large amounts of data about consumers. As data becomes an increasingly valuable commodity, what are the legal and ethical implications of this?

- **Consumers:** Research with consumers and on their needs to determine consumer reactions to the policy innovation, and whether it would be perceived as leading to costs (e.g. the upfront charges that producers might make in order to incentivise the appropriate return of the materials) or benefits (e.g. freedom from the costs and responsibility of organising waste disposal in other ways, more durable and longer-lasting products that can be more easily repaired, reductions in taxation as waste management was funded by companies rather than local government); and how these costs and benefits would be distributed across different social groups.

4.2 Three Steps to Circularity

We propose a three-phase action plan to implement our proposal, to be executed over the next decade as part of the EU circular economy action plan.

Phase 1: Identify appropriate waste streams.

The objective of the first phase is to build political support for the concept of Producer Ownership. This will be done by stakeholder engagement that informs the identification of the most suitable waste streams for Producer Ownership scheme, together with an analysis of their characteristics and existing EPR structures. Over a three-year period, we will take the following actions:

- Build political support for the concept of Producer Ownership through outreach of relevant political, academic and business stakeholders
- Calculate the total economic, social and environmental contribution of the proposed EPR transformation across the most suitable waste streams in the EU by 2030 and define the key milestones and leverage interventions to deliver this step change in policy
- Engage with stakeholders of suitable waste streams to understand current system failures and field check findings with experts
- Based on the previous actions above, define a list of improvements to current EPR systems by relevant waste stream
- Define a stakeholder engagement plan to create a movement stimulating wider consumer and producer behavioural change
- Draw up a standard for investment criteria to mobilise capital

The key deliverable for this phase would be a practical action plan that is ready for implementation. This plan would enable the proposal of the policy immediately as an EU directive, aligned with other related existing directives.

Phase 2: Initial implementation and application across key waste streams

The objective of the second phase is to start implementing the ownership model in key waste streams and ensure that lessons learned from one are included in implementation of all. The specific waste streams to be selected for the initial phase would cover a variety of characteristics to allow for rapid implementation, maximised learning, and effective reduction of resource waste. Over a three-year period, we will assist stakeholders through the following actions:

- Implement a distinct action plan for each key waste stream that is based on their respective characteristics
- Set up a standardised data collection system
- Regularly assess progress with a focus on including lessons learned from other waste streams
- Communicate results clearly and transparently
- Support the raising of capital to fund necessary infrastructure investments

The intention would be to strengthen both the operational and economic conditions for circularity to the materials in key waste streams to the top right-hand segment in Figure 4.1, with the acknowledgement that the degree and speed of implementation will vary depending on the level of complexity of each waste stream.

Phase 3: Implementation across all major waste streams

The objective of the last phase is to expand rollout of the ownership model across all major waste streams in the EU, deploying the conditions for a fully circular economy. We propose the following actions:

- Expand tried and tested models of phase 2 to all remaining waste streams
- Continue the engagement process across private, public and civil society
- Ensure integration of continuous learning from every model

The key deliverable is the complete implementation of the foundations needed for a circular economy to outcompete the current resource-intensive, linear model of economic activity in the EU.

To make this new vision a reality, we call upon the EU Commission leadership to participate in this bid for a circular economy with the three following steps:

1. An EU directive with associated national legislation that enforces ownership and mandates product stewardship in a phased approach, to ensure that producers and consumers have ample time to adjust to the changing environment.
2. The establishment of national and international infrastructure, both physical and digital, to support the ownership model. This can include the strengthening of markets for secondary products and developing technology to trace materials and systems that streamline returns.
3. The creation of an EU-wide cross-sectoral cooperation platform that aims to reduce the high information costs associated with this objective by collecting relevant data and spreading best practices throughout the system.

Europe needs a game changer to remain a leader in the global economy for the next century. The proposed innovation would take the concept of responsibility towards a much-needed concept of accountability through producer ownership. It will build a strong foundation for economic competitiveness, environmental protection and social progress. We believe this shift in mind set is far from a regulatory or policy conversation only. It is the starting point of a global revolution towards a new development paradigm – one that will start in the EU and guide the rest of the world.

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Annex

Table 6.6.1 Data sources and calculation for the material balance of apparel.

Flow	Qty (Mt)	References
Export	9.18	PRODCOM statistics and product weight data from (Beton et al., 2014)
Production	0.08	COMTRADE statistics
Stock_out	4.09	PRODCOM statistics and product weight data from (Beton et al., 2014)
Separate collection	1.10	PRODCOM statistics and product weight data from (Beton et al., 2014)
Recovery_out	6.28	Mass-balance principle
Recovery_in	2.18	Mass-balance principle
Disposal	0.71	Eurostat textiles treatment data, adjusted for apparel fraction
Used export	0.10	Eurostat textiles treatment data, adjusted for apparel fraction
Stocks or second-hand market	0.06	Eurostat textiles treatment data, adjusted for apparel fraction

Table 6.6.2 Data sources and calculation for the material balance of plastic packaging.

Flow	Qty (Mt)	References
Import	5.25	PRODCOM statistics, average prices for p/st values
Export	6.55	PRODCOM statistics, average prices for p/st values
Production	16.75	PRODCOM statistics, average prices for p/st values
Stock_out	16.30	Eurostat packaging waste treatment data
Recycling_out	6.96	Eurostat packaging waste treatment data
Energy recovery	5.15	Eurostat packaging waste treatment data
Disposal	2.16	Mass-balance principle
Export_waste	2.03	Eurostat packaging waste treatment data

Table 6.6.3 Data sources and calculation for the material balance of electrical and electronic equipment.

Flow	Qty (Mt)	References
Import	15.34	PRODCOM statistics and product weight data from (Forti et al., 2018)
Export	10.25	PRODCOM statistics and product weight data from (Forti et al., 2018)
Production	6.77	PRODCOM statistics and product weight data from (Forti et al., 2018)
Stock_out	9.26	Eurostat WEEE treatment data
NaS	0.00	Mass-balance principle
Collection	3.48	Eurostat WEEE treatment data
Recovery_domestic	3.07	Eurostat WEEE treatment data
Disposal	0.38	Eurostat WEEE treatment data
Export_waste	0.03	Eurostat WEEE treatment data
Mixed collection	5.78	Mass-balance principle

Table 6.6.4 Calculation of carbon impacts of apparel system.

	(WRAP, 2017)	(EMF, 2017)	(Beton et al., 2014)
Emissions calculation			
Consumption level (Mt)	6.4	48	9.5
Total emissions (Mt CO2e)	195	1,200	413
Emissions intensity (tCO2e/t)	30	25	43
EU consumption in 2016 (Mt)	6.3	6.3	6.3
EU estimate (Mt CO2e)	191	157	271
Details of the reference			
Geography	EU-28	Global	EU-27
Time	2015	2015	2008
Scope	Clothing	Clothing	Textiles
Production	Yes	Yes	Yes
Use	Yes	-	Yes
End-of-life	Yes	-	Yes

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