



DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT **A**
ECONOMIC AND SCIENTIFIC POLICY



A Longer Lifetime for Products: Benefits for Consumers and Companies

- Economic and Monetary Affairs
- Employment and Social Affairs
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- Industry, Research and Energy
- Internal Market and Consumer Protection**

A Longer Lifetime for Products: Benefits for Consumers and Companies

Study for the IMCO Committee



DIRECTORATE GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT A: ECONOMIC AND SCIENTIFIC POLICY

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STUDY

Abstract

The report provides an evaluation of the potential impact of a longer lifetime for products in Europe on the economy, on society and on the environment. It provides case studies of existing businesses, the (non-)legal context for an initiative on longer product lifetimes, and a wide range of policy options to optimize benefits to society. A minimal increase of 1% of value added by economic activities related to a longer lifetime for products would have an aggregated effect of 7.9 billion EUR per year across the European economy.

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LIST OF ABBREVIATIONS AND/OR CORRESPONDING CONCEPTS

AELP	average expected lifetime of products
ALMP	active labour market policies
AM	additive manufacturing or 3D printing
B2B	business-to-business, normally related to transactions of products
B2C	business-to-consumer, normally related to transactions of products
BEUC	Bureau Européen des Unions de Consommateurs (The European Consumer Organisation)
CE	circular economy
CoA	Court of Auditors
CPPS	cyber physical production systems
CRD	Consumer Rights Directive
CSD	Consumer Sales Directive (also referred to as Directive on Consumer Sales and Guarantees)
DSM	digital single market
EDPS	European Data Protection Supervisor
EFSD	European Fund for Strategic Investments
EuP	energy-using products (also referred to as energy-related products)
EPR	extended producer responsibility
ETAP	Environmental Technologies Action Plan
GDP	gross domestic product
GHG	greenhouse gas
GPP	green public procurement

- GVC** global value chains
- GWP** global warming potential
- ICT** information and communications technology
- IMCO** Internal Market and Consumer Protection Committee
- IoT** Internet of Things
- IPP** Integrated Product Policy
- IPR** intellectual property rights
- KET** key enabling technologies
- LCA** life-cycle assessment
- NACE** Nomenclature générale des Activités économiques dans les Communautés Européennes
- NEEI** non-energy extractive industries
- NGO** non-governmental organization
- JRC** European Commission Joint Research Centre
- OEM** original equipment manufacturer, the organization actually manufacturing a certain good, opposed to merely trading, redistributing or using it
- Order effects** A first-order effect is a shock in supply or demand for a product or multiple products. Any higher-order effects are the resulting changes in demand, supply and prices of these products and related supply chains and other capital (machinery, building, nature, labour force, education, etc.).
- PSS** product service systems (Synonymous with collaborative economy, stewardship, sharing economy, servicing; the established—ubiquitous—services of either leasing or renting products are strongly related business cases of PSS, sometimes completely similar.)

R&D	research and development
R&D&I	research, development and innovation
SCE	Statute for a European Cooperative Society
Shadow prices	the theoretical cost of an action to society to cover unmonetized economic effects. Equivalent to Pigouvian prices, quantification of negative externalities, true cost, environmental cost indicators, non-market prefixes, etc.
SMEs	small and medium-sized enterprises
STEM	science, technology, engineering, math
TCO	total cost of ownership
Trade balance	The sum of value from imported and exported goods—a positive balance means exports exceed imports.
Transaction costs	costs incurred for consumers finding a supplier, finalizing the exchange of goods/services, ensuring the quality of the delivered good/service
TCO	total cost of ownership
Utility	the usefulness of a product as perceived by a consumer
VA	value-added is the broadest definition of profit, i.e., the residual wealth calculated by deducting the cost of applying capital (machines, intermediate goods, labour, etc.) from the value of its output.
VAL	value-added logistics are activities that are aimed at preserving or creating value while delivering a transport service
WEEE	waste of electrical and electronic equipment

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EXECUTIVE SUMMARY

Looking at the historical development of economic activities, we see that they have evolved away from the simple supply of food, shelter and raw materials to the supply of industrially manufactured goods to the supply of utility-optimizing services. Over the last 40 years, there has been an increasing concern with the environmental impact of economic activities where the durability, efficiency and sustainability of products play a major role.

A longer lifetime for products, like the overarching concept of the circular economy, has the potential to generate new economic activities, increase the total GDP of the EU and offer societal and environmental benefits, while, at the same time, spurring innovation in existing business models. Thus, evaluating the costs and benefits of longer product lifetimes is essential for policy development. This report offers a comprehensive review of the issues surrounding a longer lifetime for products in relation to consumer protection and the economic performance of enterprises. It offers an overview and a balanced representation of views from various stakeholders within the EU. It presents an assessment of the potential impact on the economy throughout Europe as well as reporting on social and environmental issues. And it provides pioneering examples of products with longer lifetimes that are already on the market, the policy context for an initiative on longer lifetimes and possible corresponding policy options to optimize the benefits related to longer product lifetimes in the EU.

Potential impact of a longer lifetime for products

Economic benefits are, in general, related to the competitiveness of the EU in terms of trade balance and utility for final consumers. Social benefits relate in general to the ability of all citizens to acquire skills, knowledge and employment and to provide for themselves. Environmental benefits generally relate to a reduction of negative external effects that reduce ecological capital without compensation in market price. In particular, the following can be highlighted in regard to economic impact.

- Economic activities related to a longer lifetime for products (maintenance, repair, rental services etc.) are used by all other parts of the economy. An increase of 1% of the use of these sectors, for convenience regarded as net Value Added, has an aggregated effect of 6.3 billion EUR. An increase of 1% of final consumption of goods and products from the EU represents 1.6 billion EUR. The total economic growth in the European economy, a growth of the annual GDP in the EU, would therefore be 7.9 billion EUR.
- Sectors providing services for research and development on specific products, repair, maintenance, leasing and renting are those most likely to benefit from longer product lifetimes. Economic activities might further shift to the service sector to benefit manufacturing tiers 1 to 3 to the detriment of the original equipment manufacturers and brands.
- Sectors manufacturing goods that are to offer products with a longer lifetime relative to today's lifetimes have the potential to both increase and decrease their value-added.
- All types of economic agents, (households, small and medium-sized enterprises, social enterprises, etc.) have the potential to benefit from longer product lifetimes. The more dependant agents are on the product for their income, the more likely it is that they will benefit from an extension of the product's lifespan.
- All manufacturing sectors have the potential to be affected negatively from longer product lifetimes, which could result in barriers and certain outright undesirable actions, from a broad well-being perspective.

- Public procurement is a key factor in the promotion of longer product lifetimes at the EU-28 level.

Pioneers of a longer lifetime for products

Successful cases of longer product lifetimes can be found in every sector, not only in those likely to benefit from it directly. Successful pioneers of extended lifetimes exist in coffee machines, for example, sportswear, specialized scientific equipment, consumer electronics and automotive products. These correspond to sectors like textiles, furniture, transport equipment, information and communications, machinery and plastic products. Diversifying narratives about longer-lived products beyond the iconic examples is necessary to inform consumers and policymakers, and could avoid the effect of good examples “being worn out.” Further examples of a longer lifetime for products, based on personal anecdotes, emphasize the fact that product life extension is an issue that affects each individual and thus appeals to every person.

Current policy

Europe has a wide and robust regulatory framework for product design and related lifecycle issues—arguably among the most developed in the world. This is also the case for environmental regulation, the single market and consumer protection. European policies that might, either directly or indirectly, affect the promotion of extending the life of products in companies and consumers were reviewed. This included consumer protection in the single market as well as thematic and horizontal environmental policies. The review included interviews with experts in product design and policy, environmental policy, energy policy and consumer protection policy at the European level.

The review indicates that, for the most part, the concept of a longer lifetime for products is currently not explicitly present in e-policies and regulations in the EU. Thus, the current policy framework does not provide sufficient mechanisms to guide and regulate longer product lifetimes. Although initiatives promoting eco-design, eco-innovation and the circular economy indicate an ambition to promote redesign of products and to consider and label the durability of products, the selection of pilot products remains on the horizon.

By making explicit linkages with mainstream innovation policies, the circular economy initiative opens synergies that capitalize on existing policy instruments that could support the extension of product lifetimes. Given the fast pace of product innovation, this also brings to the forefront a relative lack of coherence between current innovation policy and any policy package promoting a longer lifetime for products. A delicate balance must be stricken between policies enabling fast innovation that brings to the market better and more efficient products (in resources and energy) and new initiatives aiming to optimise in the long term the embedded capital stock of products currently in use.

Legislation related to the Ecodesign Directive presents no barriers, but initiatives to standardize design norms in some sectors already demonstrate that changes in norms and their transposition to the single market can take decades. Measures on consumer protection are mostly related to institutional and consumer behaviour. Measures on strengthening the internal market aim to overcome the barrier of reduced sales as a result of longer product lifetimes.

Policy options

Although not explicitly part of (non-)legal initiatives, the EU, and the internal market, could anticipate an increase of product service systems supporting a longer lifetime for products. This would require a new set of legislative tools. Product service systems do not, in and of themselves, allow or facilitate policy instruments for improved consumer protection.

Technology developments in the field of information and communications have positively and dramatically changed the prospects of policy around product lifetimes, and will continue to do so in the coming years. The bottleneck of consumer acceptance of a longer life for products is not primarily the result of a lack of information. The challenge is in making the content of available materials acceptable for both producers/sellers and final consumers, and supporting consumers and producers in their decision making.

Support to consumers

Support initiatives that provide information for consumers (e.g., labelling): this should facilitate incorporating product lifetime into purchasing decisions, while tackling the challenge of providing honest information to consumers without overloading them. This has implications for consumer protection and the flow of information across consumer segments. The information provided must be clear and reliable to generate consumer confidence on the use of products for a longer time. Empirical evidence indicates a positive and significant effect on consumer goods purchasing decisions and increased price elasticity in middle and high-end products.

Support initiatives to maximize the utility of products: this should include, among other things, harmonized repair costs, support of technical expertise and the dissemination of service manuals, aftermarket brands and information comparing sales channels, as well as support for service and repair through internet platforms.

Support to producers

Support initiatives to provide information to producers and new businesses that pioneer longer product lifetimes: this includes supporting businesses that consider the various models of total cost of ownership (TCO) over the long term. Standardization of TCO accounting rules could greatly increase the use of TCO in the decisions related to extending product lifetimes that producers make. Such standardization would be particularly interesting for companies within the EU that fully engage in global value chains, which could benefit from EU efforts to harmonize product standards in the regulation of international trade.

Support initiatives to incorporate longer product lifetimes in business decision making: this would require setting a minimum guaranteed lifetime, setting a minimum availability time for spare parts and promoting the modularity, upgradeability and reparability of products. Further potential measures are outlined in Table A, below.

Policy recommendations

The EU has a broad regulatory framework that could well fit and take up initiatives promoting a longer lifetime for consumer and durable goods. Many actors need to be involved in the process of setting the new standards and regulations that are needed to make a longer lifetime for products possible. The multifaceted promotion of longer lifetimes requires a systemic approach to policy, and the range of policy options available for the promotion of extended product lifetimes should be seen as an effort that must be approached with a broad policy mix. Table B provides a typology of pragmatic policy mixes that aim to organize the policy options offered in Table A.

A number of the recommended actions listed in Table C could contribute to a longer lifetime for products in Europe. Policy costs are estimated on a nominal scale from 1 to 5, denoted € (least costly) to €€€€€ (most costly); total societal benefits are estimated on a nominal scale from 1 to 5, denoted + (least beneficial) to +++++ (most beneficial); legal/cultural/technical feasibility is estimated on a nominal scale from 1 to 3, denoted to .

Table A: Potential Measures Related to a Longer Lifetime for Products

Dominant responsibility of IMCO committee	
Consumer protection	<ul style="list-style-type: none"> • Public debate concerning the benefits of a longer lifetime for products • Empowering repair initiatives • Communication with consumers • Extension and harmonization of consumer rights
Internal market	<ul style="list-style-type: none"> • New business models, based on ownership substitution • New business models, based on individualization • Capitalizing on social enterprises • Autonomous growth of digital services • Communication on environmental risks

Table B: Typology of Policy Mixes

Policy mix #	Policy mix name	Description
1	Product service system mix	Focused on acceleration of ownership-service transition, performance economy, collaborative economy, servitization, etc.
2	Consumer information mix	Focused on TCO provision and direct support “during sale decisions”
3	Direct governmental control mix	Focused on direct governmental mandate and budgeting
4	Prepare for the future mix	Anticipating disruptive and/or ambitious developments
5	Pragmatism mix	Adopting current ideas and practices, based on stakeholder input from sectors likely to gain from a longer lifetime for products

This rating and ranking should be taken as indicative and is open to further discussion and further elaboration in future use of the insights provided.¹ The table is primarily sorted based on societal benefits: recommendations with the greatest benefits are placed on the top rows. The second ordering is based on policy costs: less expensive policies are placed above more expensive options.

¹ All indicative scaling is based on a tentative expert judgment from various sources and interviews.

Table C: Recommendations to Support a Longer Lifetime for Products

Recommended initiatives	Policy cost	Total societal benefits	Legal, cultural, technical feasibility	Mix #
Provide standardized TCO information	€€€€€	+++++		2
Safeguard personal data related to consumer products	€€€€€	+++++		1
Flag additive manufacturing lock-in practices	€€	++++		4
Strictly regulate manuals and spare parts	€€	++++		5
Monitor non-EU guarantee standards	€€	++++		3
Create performance standards for PSS	€€€	++++		1
Use consumer associations	€	+++		5
Flag PSS lock-in practices	€	+++		1
Create assessment standards for green public procurement	€€	+++		3
Outsource public services to social enterprises	€€	+++		3
Standardize Consumer Sales Directive (CSD) definitions based on practice	€€	+++		5
Reduce taxes for circular services	€€€	+++		3
Support repair cafés	€€€	+++		4
Use social enterprises as educational institutes	€€€	+++		4
Extend guarantees in CSD	€€€€	+++		4
Extend consumer information available during sale	€	++		2
Shift after-use responsibilities	€€€	+		4
Flag planned obsolescence	€€€€	+		4

1. INTRODUCTION

In looking at the historical development of economic activities, it is evident that they have evolved: moving from the supply of food, shelter and raw materials to the supply of industrially manufactured goods to the supply of utility-optimizing services. Over the last 40 years, there has been increasing concern about the environmental impact of economic activities, where the durability and efficiency of products seem to play a major role.

As seen with the overarching circular economy concept, while modifying current economic activities or generating new ones, a longer lifetime for products has the potential to increase the total GDP of the EU and offer (societal and/or monetary) benefits, whilst at the same time spurring innovation in existing business models. Thus, when evaluating the costs and benefits of a longer lifetime for products, it is essential to have an understanding of how the utility of a product will change and where consumers will spend the resulting savings.

This report offers a comprehensive review of the issues surrounding a longer lifetime for products in relation to the economic performance of enterprises and consumer protection, with an overview and a balanced representation of views from various stakeholders within the EU. It presents an assessment of potential impacts in the economy Europe-wide as well as reporting on social and environmental considerations. It also provides examples of longer lifetimes for products already on the market, while examining the policy context for an initiative on longer lifetimes and possible corresponding policy options to optimize benefits related to longer lifetimes in the EU. It treats the concept of a longer lifetime for products as being part of the circular economy framework as presented by the Commission (COM 2014b).

1.1. Basic understanding of a product's lifetime

In this study, we define products as the goods ready for intermediate (B2B – business-to-business) or final (B2C – business-to-consumer) consumption that are produced in today's economy. Political debate and even scientific research seems to have a biased perception of products, mostly aimed at iconic and/or fashionable goods intended for household consumption. For example, mobile phones, washing machines, clothing, personal computers, etc. In this study, however, we strive to interpret products in a broader sense, to overcome the possible underrepresentation of some products in the discourse. For instance products that are

- also intended to be used by companies and governments, i.e., professional, B2B, users (hence, the inclusion of “companies” in the title of this study) and/or
- the numerous intermediate goods (metal joints, insulation material, electronic components, etc.) and/or
- goods whose utility is often not actively perceived by consumers (building materials, transport equipment parts, infrastructure equipment, etc.).

When referring to products, this study has a focus primarily on goods that have a lifetime typically between one and 20 years, but it includes any product with a lifetime between one month and 30 years, to keep the scope consistent. This is based on a product's average expected product lifetime (AEPL). Table 1 shows an overview of products and their average lifetime as reported in the literature. It should be understood that the data on average product lifetimes is preferably presented in a stochastic way (an interval with a certain probability). Moreover, expected lifetimes can be controversial when presented as an empirical dataset, given the commercial implications for manufacturers, and given their existing business models. Perhaps even more controversial are the trends in decreasing average lifetimes, rather than the current figures (Cox et al. 2013; Huisman et al. 2012; TNO

2015; WRAP 2010). Consumer surveys show that there is a strong interest among consumers to receive independent lifetime information (Maurer 2015).

Table 1: Average Expected Product lifetimes

1–2 years	3–4 years	5-6 years	7–10 years	> 10 years
Small electrical appliances, (e.g., tooth-brushes, toys) mobile/smart phones, general clothing, shoes	Portable devices, personal computers, bed items, specific clothing (e.g., sports), bicycles, coats	Cameras, general kitchen-ware, lighting, power tools, vacuum cleaners, washing machines, curtains	Automotive, TVs, kitchen appliances, general furniture, carpets, beds, refrigerators	Appliances attached to house (boiler, sunroof, etc.), kitchen and bathroom, specific furnishings

Source: Cox (2013), Huisman et al. (2012), TNO (2015), WRAP (2010).

1.2. Benefits: A longer lifetime for products in the context of a circular economy

The hypothesis underlying this study is that a longer lifetime for products could offer benefits to both consumers and companies. This hypothesis is also the basis for research into the potential of the circular economy (COM 2014b). There are many aspects of a longer lifetime for products that are part of the analytical framework of the circular economy.

A longer lifetime for products should, however, not be treated as synonymous with the ability to retain the value of the materials used in a product, which can be seen as a definition of a circular economy. Moreover, alongside materials, a product's lifetime has implications for the service the product provides and the necessary market transactions involved in the supply of the product. In the literature we find four aspects of a longer lifetime for products that broaden the scope of accurately assessing benefits for consumers and companies (EMF 2015a; Lacy et al. 2014) (discussed further below): (1) material use, (2) knowledge and skills, (3) utility and (4) transactions. Table 2 shows a summary of these aspects as related to impacts in terms of environmental, economic and consumer welfare.

1.2.1. Sustainable material use

The environmental impact of a product is mainly determined by its material component, as related to its lifetime. Potential measures for a longer lifetime for products should consider the materials used and how they retain their value (predominantly through recycling when in a state of raw secondary material) (Stahel 1994).

1.2.2. Enduring knowledge and skills

Potential measures for a longer lifetime for products should consider the preservation of the know-how required to maintain, repair or refurbish them. Many activities aimed at a longer lifetime for products do not require highly skilled/professional workers, but can also be done by so-called transit workers: marginalized people (Meissner et al. 2010, as quoted in Gelbmann and Hammerl 2015).

1.2.3. Extended utility

The utility that a consumer gets from a product should determine its economic value. Potential measures aimed at a longer lifetime for a product should consider extending its utility, i.e., giving it a longer economic lifetime. This assessment enables us to focus on the utility of a product rather than the product itself: the cornerstone of service-for-product

substitution. Opportunities to capitalize on the interaction between services and products are not new (Tukker and Tischner 2006) but seem only ready to be translated into viable business models given the current state of technology.

Table 2: Four Aspects of a Longer Lifetime for Products

Key research question	Four aspects of longer lifetimes	Related topics
A longer lifetime for products	Continuing transaction	Single-market, customer relations, marketing, economic impact
	Extended utility	Consumer protection, total cost of ownership, functionality, product-service systems, economic impact
	Enduring knowledge & skills	Ability to repair and/or refurbish; research, development and innovation; intellectual property rights; societal impact
	Sustainable material use	Recycling, waste directives, reverse logistics/take-back systems, environmental impact

1.2.4. Continuing transactions

The main negative effect of the lifetime of a product is rooted in the manufacturer’s fear regarding loss of sales and/or market share. Potential measures aimed at a longer lifetime for products should acknowledge the possibilities that enterprises have for strengthening their relationships with their clients. Client relationship management, a well-established concept in business management, addresses opportunities such as customer intimacy (EMF 2012).

The framework illustrated above is rooted in the concept of performance economy, collaborative economy and servitization (Botsman and Rogers 2010; Stahel 2010; Tukker and Tischner 2006). It is the latest manifestation of the economy that has evolved from agriculture over millennia, first aided by industry and subsequently infused by services. It is part of a prolonged evolution to let consumers experience utility not merely from being supplied with goods, but also being supplied with services that enable optimal “enjoyment” of the good’s function. A simple example of this evolution would be the rhetoric sequence: do you want the drilling machine or do you want the hole? Do you want the painting or do you want the sense of fulfilment of looking at the painting? (Botsman and Rogers 2010). Here, we will refer to this concept predominantly as “product service systems” (PSS). It will provide the cornerstone of many possible measures and resulting recommendations in chapters 6, 7 and 8.

A longer lifetime for products does not, in itself, guarantee net societal benefits. Shortening the lifetime could, in theory, provide the same benefits as a longer lifetime for products, as long as the full “circular context” is operational. A “full circular context” means that the

product's design, reuse, remanufacturing and recycling all maximize the value of the material used and minimize environmental burdens. Most important in this is for supplier-customer relations to be strong and aimed at maximizing utility. Unfortunately, an intimate and coordinated supplier-client relationship is currently the exception; the full circular context is, in most cases, not present. This supports the central hypothesis for this study: that a longer lifetime for products is related to different economic, social and environmental impacts than is a shorter lifetime.

1.3. Exclusions from the scope of the study

This study only evaluates the legislation of Member States (MS) in terms of best practices that have a clear relationship with potential EU initiatives. A longer lifetime for products is deemed to originate at any stage in a product's life: from design, value chain organization, repair and remanufacturing. Therefore, recycling is only part of this study when it has direct links to these elements. The same goes for reuse of goods.

From a geographic point of view, a non-EU perspective is only considered when it comes to interesting case studies or increased/decreased demand for imports.

Perishable goods, including their packaging, are excluded from this study. Because their value can diminish solely as a result of biological processes, they do not fit the analytical framework of this study as presented in chapters 2 and 4.

1.4. Report structure

The rest of the report is organized in seven chapters. Chapter 2 provides a macro-economic quantitative assessment of what a slight increase of emphasis on a longer lifetime for products in the economic process at the sectoral level (in a few sectors) could bring into the European macroeconomic level. The assessment shows what sectors could be the most affected in positive (or negative) terms as well as providing an overall picture for changes in gross domestic product (GDP) for the European economy.

Chapter 3 presents a number of case studies that show that encouraging a longer lifetime for products differentiates some innovative business models and illustrate the promise of the concept in practice. Chapter 4 has a more detailed assessment of the implications of a longer lifetime for products in terms of economic, environmental and social terms.

Chapter 5 offers a broad review of the regulatory framework (environment, single market and consumer protection), indicating that there are no current mechanisms that support the implementation of longer lifetimes in the single market. Chapter 6 offers a review of the trends and issues that are likely to affect the implementation of policies aimed at a longer lifetime of products in Europe. Building on the insights of Chapter 6, chapter 7 offers a framework to classify and outline a number of potential policy measures to support a longer lifetime for products from the perspectives of consumer protection and a single market.

Finally, chapter 8 offers conclusions and recommendations in the form of combinations (mixes) of policies that could best support the promotion of benefits related to a longer lifetime of products in the single market.

2. LONGER LIFETIME FOR PRODUCTS: AN EVALUATION OF SECTORS MOST AFFECTED

KEY FINDINGS

- An increase of 1% of value added by economic activities related to a longer lifetime for products has an aggregated effect of 6.3 billion EUR. An increase of 1% of final consumption of goods and products from the EU represents 1.6 billion EUR. The economic growth in the European economy therefore adds up to 7.9 billion EUR.
- Sectors providing services for research and development (R&D) on specific products, repair, maintenance, leasing and renting are most likely to benefit from a longer lifetime for products. Economic activity might further shift to the service sector to benefit manufacturing tiers 1 to 3 to the detriment of original equipment manufacturers (OEMs) and brands.
- Manufacturing sectors that are to offer products with a longer lifetime relative to today's lifetime have the potential to either increase or decrease their value-added.
- All types of economic agents (households, small and medium-sized enterprises [SMEs], social enterprises, etc.) could potentially benefit from a longer lifetime for products. The more dependant the agent is on the product for its income, the more likely it is to benefit from an extension of product lifetime.
- All manufacturing sectors could potentially suffer from a longer lifetime for products, which could bring about barriers and, from the perspective of broader well-being, certain outright undesirable actions.
- Public procurement is a key factor in the promotion of longer lifetime for products at the EU-28 level.

This chapter presents a quantitative assessment of longer product lifetimes across the European economy. It provides an analytical framework and a set of definitions that are used to determine how the benefits and costs of a longer product lifetime would be distributed across society. First, it presents the sectors and corresponding products that are, based on the literature, most likely to benefit or to be affected in general, from a longer product lifetime and corresponding consumer protection. Subsequently, the possible effects of longer product lifetimes are discussed, along with geographical considerations. An example of quantified economic modelling is provided and the social groups that play a role as producers and/or consumers are listed. These aspects are necessary to differentiate between "winners" and "losers" in both single and the global markets.

2.1. Sectors likely to benefit or likely to be affected

The sectors (and their related key features) that are likely to benefit from a longer product lifetime are taken from the literature: repair, design, (material) science, waste treatment and rental activities (DEFRA 2011; EMF 2012; TNO 2013). These are presented in Table 3. A key element in this selection is that these sectors create most of their value-added by extending either the utility or the lifetime of a product. They stand to lose little or even nothing if a product is consumed over a longer period of time. However, to consider a broader perspective, these sectors have at least one of the following features:

- They provide services that influence the lifetime of a product when investments in R&D and research, development and innovation (R&D&I) are made.
- They provide services that extend product lifetime after sale through shared use, reuse or repair.
- They provide services that influence the lifetime of materials used in the product.

Following the literature review and the set of criteria given above, it was determined that the sectors most likely to gain from longer product lifetimes would be sectors 33, 38, 72, 77 and 95, based on the Nomenclature générale des Activités économiques dans les Communautés Européennes (NACE). These sector names, products and services are outlined in Table 3.

Table 3: Sectors Most Likely to Gain from a Longer Lifetime for Products

NACE 2-digit code	Sector name	Description of goods and services involved
33	Repair and installation of machinery and equipment	Specialized repair of professional goods produced in the manufacturing sector with the aim of restoring machinery, equipment and other products to working order
38	Waste collection, treatment and disposal activities	Local hauling of waste materials and the operation of material-recovery facilities (i.e., those that sort recoverable materials from a waste stream)
72	Scientific research and development	Three types of R&D&I: basic research, applied research and experimental development
77	Rental and leasing activities	Includes rental of motor vehicles, recreational and sports equipment, personal and household equipment; leasing of professional machinery and equipment, other transport equipment; leasing of intellectual-property products and similar products
95	Repair of computers and personal and household goods	Includes the repair of communications equipment, consumer electronics, home and garden equipment, footwear and leather goods, furniture and home furnishings, clothing and clothing accessories, sporting goods, musical instruments, hobby articles, etc.

Source: TNO, using NACE standard sectoral classification.

Other subsectors that could profit from a longer lifetime for products are part of wholesale, transport & logistics and retail activities. They are not included in Table 3 because only specific subsectors and enterprises have the same likelihood to gain from longer product lifetimes. These sectors are part of any value chain, and can offer highly specialized services that directly or indirectly influence the lifetime of a product. An example of direct influence is, for instance, the care provided to avoid damage to a product during transit: value-added logistics (VAL). An example of indirect influence is the use of material resources to add all kinds of value by supplying repair services.

The benefits of a longer product lifetime are not self-evident for the main manufacturing sectors: textiles, wood products, paper, printed materials, fossil fuels, chemicals, pharmaceuticals, rubber and plastics, building materials, base metals, metal products, electronics, electrical equipment, machinery, automotive equipment, other transport equipment, furniture, other manufacturing and construction.

These manufacturing sectors stand to both gain and lose from longer product lifetimes. The sector definitions at the NACE 2-digit level do not allow probable benefits in subsectors to be highlighted, because they are related to specific product properties (current distribution of lifetime, complexity, cultural aspects, use of raw materials, etc.). Sectors that are part of the non-energy extractive industries (NEEI) are least likely to gain from a longer lifetime for products. (Eunomia 2015). They could benefit if they expanded their activities with reverse logistics and the production of secondary materials.

2.2. An overview of the effects of longer product lifetimes

An overview of the reported positive effects generated by longer product lifetimes is essential for understanding the opportunities and threats presented by longer lifetimes. These effects affect household, corporate and governmental use of products.

A summary of cross-sectoral effects concerning the economic (redistribution of value and creation of net value), social and environmental aspects of sustainability are presented in a qualitative manner below. If not otherwise referenced, the benefits listed are taken from EIB (2013). Examples of actual reported quantification of cases with beneficial effects are presented and discussed in Chapter 4.

Table 4: Overview of Effects of Longer Product Lifetimes

Sector name	Description of goods and services involved
Positive economic effects, redistribution of value	Increase of consumption of goods and services from within the EU to the detriment of demand for non-EU goods and services (Lacy et al. 2014)
	Improvement of attractiveness for locating enterprises within the EU, to the detriment of territories outside the EU
Positive economic effects, net value creation	Increased efficiency as a result of economies of scale or reduced transaction costs; strongly related to the significance of the EU's internal market; increased efficiency results in reduced costs and therefore a better market position for the company
	Evaded costs (i.e., internalized negative externalities related to waste collection/treatment and healthcare) can represent a significant share of a company, making cost reduction a significant competitive element
	Better utilization of e-capital stock (by convention in the System of National Accounts, anything with an expected life time of over a year): buildings, transport equipment, office equipment, machinery, other equipment; if it is reused in a better way, the consumer gets more value out of the product, resulting in net economic growth

Sector name	Description of goods and services involved
Positive economic effects, net value creation (continued)	Increase in value resulting from more profitable R&D&I investments coming from an accelerated pace of innovation of existing products, an increase in newly launched products, investment in lifetime-extending measures not attractive before, etc.
	Autonomous increase of utility (“perceived value of product”): for example, from customer intimacy or warm-glow effects, which is arguably also a positive social effect
Positive social effects	Increase of social capital in segments of population with lower and medium skills, enabling them to be productive, employed, at a level that would justify earning a national minimum wage or a salary above that of threshold; most likely due to the increase in jobs requiring low, medium or high technical skills from people with only vocational training working in the repair sector
	Decentralization of corporate decisions, improving the balance of power over all size classes of businesses, notably in favour of SMEs and social enterprises (Daya 2014)
	Improved geographical spread of wealth over EU, given typical distances covered while supplying newly manufactured goods versus the supply of services aimed at a longer lifetime (as presented in §2.1)
	Increased consumer confidence in supplying companies as well as in all the institutions surrounding the markets (Warneryd 2008)
Positive environmental effects	Decrease of negative external effects, captured in shadow costs and environmental impact (see also §4.3.1 for more disaggregated impact); by “negative external effects,” we mean all environmental impact on the planet (greenhouse-gas [GHG] emissions, erosion, toxification, acidification, loss of biodiversity, etc.)
Negative economic effects	Loss of sales for manufacturers (Stegeman and Jansen 2015)
	Increased exposure to liability from guarantees or other kinds of extended producer responsibility (EPR) (Massarutto 2014)
	Diminishing positive spin-off effects from private R&D&I (Dasgupta and Stiglitz 1977); incentives for companies to invest in new generations of products jeopardized if products are replaced by new types at a slower rate (a faster rate legitimizing R&D&I offering faster return-on-investment)
	Potential structural tension between policies aiming to speed innovation cycles and those aiming to promote the circular economy

No negative social effects from longer product lifetimes were found in the literature. The only negative environmental effect comes from the delay in using more resource-efficient products during the use phase (Cooper and Gutowski 2015; Scheepens et al. 2015). As this is a

negative effect that would be directly offset by rational decision making, it is not included in the table 4.

The limited number of negative effects, as compared to the positive effects, does not necessarily imply that many private stakeholders perceive longer product lifetimes as a desired development. The negative effects are directly related to the reluctance of original equipment manufacturers (OEMs) to change their business operations. Many of these changes, like more durable product designs, transparent sale conditions, extended guarantee periods, provision of means to repair or refurbish products, etc., are discussed later in this report.

2.3. Geography and the value chains of global structures

We need to highlight the fact that a geographical dimension must be considered in discerning the difference between positive and negative effects. In accounting for loss of sales, for example, taking a European perspective could mean that this effect is negligible if a product is imported from a non-EU country. In economics, the laws of supply and demand not only apply to sectors and their products, but also to the geographical location of these sectors, i.e., the businesses. This brings trade-offs between economies of scale and scope and corresponding distribution effects to regions and companies.

When considering the geographic aspects of sectors that are likely to benefit from longer product lifetimes, it is generally assumed that positive effects will accrue in the EU. Greater opportunities to benefit from economies of scale have led to outsourcing of manufacturing in the past (cheaper land, labour, etc.), but the scale of demand for services in design, maintenance and repair is not equal to initial production. It is smaller and likely to be broadly distributed across many small businesses. There are examples of transport equipment (aircraft, ships, etc.) being repaired overseas, given that it is more practical in terms of risk reduction, the transport costs of spare parts or costs of local maintenance services. According to the Department of Transport of the USA, major US air carriers outsource 71% of heavy airframe maintenance work, with about 27% of that going to foreign stations (TTD 2012). For virtually all other products, however, the costs of transport and labour, combined with the quantity of products in need of extended lifetime services, are not expected to result in the outsourcing of these services over long distances (Simpson 2012).

Along with the geographical aspect, the composition of contemporary global value chains (GVC) can be highlighted. For an adequate quantification of effects, the origin and destination of goods along the value chain need to be established. The current framework of national accounting makes a distinction between the following:

- intermediate use (solely business-to-business);
- final consumption (government, NGO, households);
- capital stock investments (businesses).

GVCs have become highly complex over recent decades. For instance, it is well possible that products are fully designed in the EU, produced partly outside the EU and consumed all over the globe (or many other variations of that scenario).

If these stages are mapped along the value chain, together with geographical information, the positive and negative effects can be accurately allocated. For examples of this kind of research see Cambridge Econometrics and BIO IS (2014), Ivanova et al. (2014) and EEA (2013).

2.4. Quantification of impact in the European economy (EU-28)

Several studies are available that quantify the economic and/or social and/or environmental effects of future scenarios relating to one or more products (e.g., EEA 2013). These studies are discussed in chapter 4. We can think of them as taking a bottom-up approach. The common alternative is a top-down approach, in which targets from major European documents (e.g., the growth of a “green” sector, a target for recycling rates set in the circular economy package, a certain share of jobs in knowledge-intensive industries, etc.) are evaluated and related to specific actions on a sectoral or product level.

For assessing the impact of longer product lifetimes, we take as a guideline the Europe 2020 targets, published in “Taking stock of the Europe 2020 strategy for smart, sustainable and inclusive growth” (EC 2014). The main targets set for the period of the Europe 2020 strategy are related to the employment rate among 20- to 64-year-olds, gross domestic expenditure on R&D, greenhouse-gas emissions, share of renewable energy in gross final energy consumption, primary and final energy consumption (in million tonnes of oil equivalent), early leavers from education and training, tertiary education attainment, people at risk of poverty or social exclusion and severely materially deprived people. All of these targeted areas are affected by longer product lifetimes.

2.4.1. Quantification, first-order economic effects

An essential evaluation principle when assessing economic, social and environmental impact is the distinction between direct and indirect effects. Direct effects in this sense relate to a product and its corresponding individual link (i.e., phase in the value chain). Indirect effects in this sense relate to effects accrued throughout the economic system. Familiar concepts that can be used to distinguish between direct and indirect effects are “footprint” calculation in general, raw material equivalents, cradle-to-gate or cradle-to-grave life-cycle assessment (LCA) modelling, multipliers, consumer and producer perspectives, upstream and downstream effects, etc. These concepts have one element in common: they try to model the effect of a change in a single element on the whole economy. The shocks produced by changes of this element (for instance a longer product lifetime, legislation, taxation, subsidies) are felt along the value chains across an economy. Thus is vital if policy developers are to know where the effects will be felt at geographic and sector levels.

Chain analyses, like those described above, can prove to be a costly analytical tool (in terms of research resources required). An alternative is a custom-made “single shock” assessment aimed at the stakeholders directly affected. This assumes that all other things remain equal and focuses only on the first-order effects. Following the criteria set in section 2.1 (i.e., considering sectors closely related to the concept of the circular economy), we conducted an aggregated top-down estimation of impact.

This is a “first-order effect” analysis, for which we conducted a simplified calculation of the increase in added value for business-to-business (B2B) and business-to-consumers (B2C).

- B2B value: For all five sectors most relevant to longer product lifetimes, we looked at the current use of the services provided to all other sectors by these sectors. We assumed a shock the size of a 1% increase of this current use. The initial growth, following the basic single shock, is considered to be value-added (VA).²

² Alternatively, we could have just assumed a VA increase of the five sectors: repair and installation of machinery and equipment, waste collection, treatment and disposal activities, scientific research and development, rental and leasing activities, repair of computers and personal and household goods. This would represent economic growth of 3.5 bio EUR, rather than 6.3 bio EUR. However, this would treat a longer product lifetime as a stand-alone positive effect, ignoring the fact that it is the interplay between the services that enable a longer product lifetime and all other sectors that provide opportunities for growth.

- B2C value: A 1% increase of products from within the EU was assumed; we assumed an improvement of the trade balance of the EU-28.

The effects of this increase were quantified by looking at the EU-28 aggregated input-output table, which accounts for European economic activity from a macro-economic level. The results of the calculations are presented in Table 5.

Table 5 indicates the services provided by sectors like repair, waste treatment and rental and leasing (vertical blue column) to other sectors like agriculture, industry, construction, wholesale, information and communications technology (ICT), etc. (horizontal blue column). The crossing of a vertical sector with a horizontal sector indicates the increase of economic activity (trading) between those two sectors. For example, the annual supply-use relation between the household-repair and industrial-product sectors is 3 709 million EUR (highlighted pink cells in the table). The annual 11 308 024 million EUR in the yellow cell at the right of the VA row represents the total VA and thereby the brunt of the total GDP of the EU-27 (Croatia is not part of the 2011 statistics). The annual value of 6 315 million EUR in the orange cell represents an economic gain for the EU-28 Member States associated with activity growth based on longer product life for B2B business. The annual value in the orange cell of 1 581 million EUR would represent an economic gain from final consumption based on B2C business.

The values of 6 315 and 1 581 million EUR come from the simple-shock assumption of 1% as explained above (1% of total intermediate use by companies in the five sectors most likely to gain is 6 315 million; 1% of final consumption from the five sectors most likely to gain is 1 581 million). The size of the simple shock of 1% is supported by references in §4.1.1.

The annual sum of B2B and B2C growth would be 7.9 billion EUR in this example. The use of this figure in this report and in future policymaking is that it serves as a simple yardstick, a unit, for discussion about costs and benefits. Depending on the policy initiative, this “first-order” annual growth of 7.9 billion EUR could vary, creating a bandwidth of growth scenarios.

A final significant fact taken from Table 5 is the size of final consumption by government. Out of the total of 8 962 009 million EUR, 27% is from governmental consumption. This represents a massive market for public procurement at an EU, Member-State and regional scale. The title of this study, “benefits for consumers,” truly refers to households, businesses and governments alike. Implicit in any scenario is the leverage that public procurement could have in promoting a longer lifetime for products in Europe.

2.5. Describing groups of consumers in society

Apart from defining actual effects, we need to define the groups in society that experience these effects. The list below is based on macro-economic standards in input-output analysis, complemented with the specific interests of the Internal Market and Consumer Protection Committee (IMCO). Given the scope of products in this study, a business enterprise, a social enterprise, a government or a household can be a “consumer.” As mentioned in §1.1, this study has the subtitle “benefits for consumers AND companies.” All consumers described below can benefit from longer product lifetimes because they all consume products at some point. Sooner or later, all are the final recipients of goods or services.

- Households: A household may be a single person or small group of people who share the same living accommodations, pool some, or all, of their income and wealth, and consume certain types of goods and services (mainly housing and food) collectively.

Table 5: Use of Relevant Services by Other Aggregated Sectors of the Economy, Explicating Value Added (VA) and Final Consumption (Values in Millions of Euro, 2011, EU-27)

NACE sector	Products of agriculture forestry and fishing	Industrial products (except construction works)	Construction and construction works	Wholesale and retail; transport and storage; hospitality and food services	ICT services	Financial and insurance services	Real estate services	Scientific and technical services; support services	Public administration, defence, education, health and social work	Arts, entertainment and recreation services of households	Total intermediate use by companies in value chain	Final consumption (households, companies, government)
#33 Professional repair	3 433	80 681	10 225	22 699	5 587	797	5 134	4 675	7 496	1 135	141 862	3 853
#38 Waste treatment	1 374	77 243	4 137	11 794	1 700	794	6 738	5 196	18 042	1 629	128 648	71 519
#72 Research	432	50 920	735	2 850	6 438	565	192	8 640	13 577	535	84 883	35 844
#77 Rental and leasing	3 654	53 160	23 898	55 490	15 877	9 108	3 310	39 146	14 792	5 389	223 824	31 458
#95 Household repair	115	3 709	385	2 347	1 350	1 032	219	1 176	3 743	879	14 957	15 475
All other sectors (i.e., "rest of the economy")	191 597	3 955 464	879 259	1 789 783	470 627	588 887	433 086	812 287	738 015	187 178	10 046 183	8 803 860
Total	200 605	4 221 177	918 639	1 884 964	501 580	601 183	448 679	871 119	795 666	196 745	10 640 357	8 962 009
Current VA	193 316	2 184 409	683 830	2 135 713	533 502	633 184	1 235 728	1 140 753	2 168 444	399 146	11 308 024	
1% increase of VA or consumed value	Increase in VA is created by all sectors, as a result of interaction with the five sectors most likely to benefit from a longer lifetime for products. Increase of consumed value is considered growth as a result of an increase of final consumption of goods and services produced within the EU-28.										6 315	1 581

Source: TNO calculations, data source Eurostat.

- Enterprises:
 - Multinationals: A corporation that has its facilities and other assets in at least one country other than its home country;
 - Large enterprises: Enterprises employing more than 250 persons and not venturing outside the country of origin;
 - Small and medium-sized enterprises (SMEs): Enterprises that employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million (2003/361/EC);
 - Micro-enterprises/Embryonic: Part of the SME category, these are enterprises that employ fewer than 10 persons and whose total annual turnover and/or annual balance sheet does not exceed EUR 2 million.
- Public authorities: Government or other public administration or any legal entity performing public administrative functions under European or national Law (2003/4/EC). As their name suggests, public authorities are less clearly defined. A significant number of legal cases are related to organizations classified either as public authorities with corresponding responsibilities or not.
- Social enterprises: There is no universally accepted definition of a social enterprise; their most distinguishing characteristics are a social and societal purpose combined with the entrepreneurial spirit of the private sector. Their work is generally acknowledged as admirable or socially beneficial in their intention and result. Social enterprises are not statistically prominent. The lack of clear definitions of their membership, commitment and flexibility means that this group does not get the visibility it deserves in social and economic terms in national accounts, which makes it difficult to account for them quantitatively.

3. CASE STUDIES OF VOLUNTARY INITIATIVES ON LONGER PRODUCT LIFETIMES

KEY FINDINGS

- Examples of a longer product lifetime can currently be found in every sector, not only in those sectors likely to benefit from lifetime extension or even only in manufacturing in general.
- Diversifying narratives about case studies (i.e., iconic examples) on longer product lifetimes is necessary to avoid the effect of good examples being “worn out.”
- Case studies on longer product lifetimes relate only to a subset of possible policy initiatives.
- Case studies based on personal anecdotes put emphasis on the fact that a longer product lifetime is an issue that affects each individual and therefore appeals to experiences every person—as a consumer—has.


Enabling longer lifetimes for products can be seen as a social norm that was widespread before the turn of the 20th century. Mass production in the 1920s and 1930s brought not only an abundance of new products but also a faster pace of innovation and business cycles and a reduction of product lifetime. The idea of a longer life for products is still very present in the social fabric of industry and services, but is currently applicable mainly to durable and high-end consumer products. Chapters 1 and 2 provided an indication of the complexity of describing current practice and the effects of longer product life. There are many aspects to be considered. A good set of case studies is required to show what it means in current practice.



This complexity means that it is relevant to look at current front runners, who voluntarily challenge existing economic, technical, legal or cultural norms, thus setting new norms regarding product durability. An industrial renaissance in the EU might rely on proactive consumers and businesses (COM 2014a); it is and therefore worthwhile to understand initiatives that go beyond the legal standards. Various policies encourage industry-led initiatives (i.e., self-regulation) and standards for voluntary use (COM 2013a).



3.1. **Best examples of voluntary initiatives aimed at a longer lifetime for products**


Producing products with a longer life span can underpin new business opportunities, but this requires a rethinking of prevalent business models, under a new rationale. Table 6 provides illustrations of front runners offering products that use the concept of a longer product lifetime as an important component of their business innovation model by engaging in product design for service (i.e., maintenance), reuse, repair or remanufacturing. Below, we indicate synthetically the overall concept of these companies, the kinds of innovations offered, the core concept in their business model and the potential barriers for scaling up and replication in other contexts.

Table 6: Iconic Case Studies of Voluntary Longer Product Lifetimes

Short Case Study	General description	Innovation and benefits	Business model	Scaling up potential and possible barriers
1. Malongo coffee machines	<p>Malongo is a family firm from the area of Nice. They produce 7 000 tons of coffee each year. Their statement 'Our quality ethics and the commitment of our personnel are the key to our success' illustrates their focus on the long term, although the website fails to specifically mention investments in extending the lifetime of their coffee machines.</p> 	<p>Malongo launched the unique concept of machines and pods. The design is based on durability, not on take-back systems. The interplay between machines and processed raw materials (coffee) with corporate social responsibility ensures the exchange of knowledge between stakeholders involved in their value chain.</p>	<p>Malongo describes itself as a company that creates quality coffee rather than merely machinery. It aspires to be a company that appreciates fair trade. They won the Environment Award in 2008, which recognizes the policy initiatives of companies in regard to the environment.</p>	<p>There is no specific barrier related to Malongo's business model. Scaling up of manufacturing operations will be determined by classic competitive market issues such as price and quality.</p>
2. Rapha	<p>Rapha is a small but rapidly growing company that sells cycle wear. Rapha back up their products with long lasting guarantees and high standards of after sale service.</p> 	<p>Rapha offers a free repair service where a crash or accident has damaged a garment or a failure has occurred, even after significant use.</p>	<p>Rapha wants to build a relationship between the company and the customer (akin to the "customer intimacy" concept). This is done by voluntarily selling products with a 90-day warranty, providing free repair service for people who crash on their bikes.</p>	<p>By selling the full Rapha collection on the internet, Rapha can grow even more. It has to be seen if the generous repair service can be maintained when sales increase to the level of the main suppliers of cycling sportswear.</p>

Short Case Study	General description	Innovation and benefits	Business model	Scaling up potential and possible barriers
3. Project TARA	<p>Project TARA is an initiative of a charity foundation. It helps educators build an interest in science, technology, engineering and math (STEM) by giving students access to a live robotic telescope in California.</p> 	<p>Project TARA helps to build interest in STEM. Classes enrolled in the project can check the weather and sky conditions, direct and target the telescope, use images taken by the telescope and view live webcams of the telescope. This contributes to building knowledge (i.e., social capital) within society.</p>	<p>Project TARA is a good example of the collaborative economy and a facility shared to optimize and maintain STEM infrastructures. It makes no profit, but is funded by charity and sponsors. It appeals to the community for support, mainly for maintenance and potential investments to increase the utility of the telescope (“install extra gadgets”).</p>	<p>Educational organizations (or social enterprises) can initiate any project like TARA. It depends on the ability to pool resources, which allows access to all kinds of highly specialized equipment (machinery, transport equipment, other measuring equipment) that will implicitly encourage demand and thus a longer</p>
4. Regeneris	<p>Regeneris is a global provider of diagnostics, repair and data erasure services to the consumer electronics industry. They help their clients and their customers to successfully deploy, protect, maintain, and retire technology.</p> 	<p>With an international network of repair centres, Regeneris provides product repair, refurbishment, parts management and logistics for mobile, IT, home entertainment and B2B infrastructure product vendors. Their industry-leading fault diagnostics can improve consumer satisfaction and materially reduce the incidence and cost of product returns for clients.</p>	<p>The business model from Regeneris is founded on a platform of services and innovation, which drives recurring income across multiple complementary lines of business. This enables Regeneris to afford the best operating platform in their segment.</p>	<p>Regeneris is a prime example of the importance of economies of scale. Companies like this need a catchment area that is sufficiently large to support specialized services yielding only a small profit margin.</p>

Short Case Study	General description	Innovation and benefits	Business model	Scaling up potential and possible barriers
5. leapp Apple remanufacturers	<p>leapp is a company that refurbishes Apple products. Like its OEM counterpart, it has an iconic status in certain EU Member States for its service and price level.</p> 	<p>leapp sells Apple products with the service and guaranty of new Apple products. Because they purchase used products and refurbish them, cost (i.e., the price) is lower than new Apple products, with the voluntarily benefit that all products have at least a 12-month warranty.</p>	<p>leapp buys used Apple products from business companies. Because a lot of companies need to refresh their hardware early, for different reasons, LEAPP buys them, deletes all software and "refurbishes" the products to virtual new products.</p>	<p>Scaling up is not likely for leapp. These products depend solely on a single OEM. Moreover, people are likely to sell this product on reuse-oriented social websites. However, similar companies could develop businesses like LEAPP.</p>
6. Fairphone	<p>Fairphone is a crowd-funded social enterprise. It aims to understand and inspire change in the electronics industry worldwide. It currently has around 50 employees, but has proven their market value for some years. Fairphone actually manufactures the phones.</p> 	<p>The design of smart phones (i.e., mobile phones) normally performs poorly in terms of cost-effective durability, reparability and upgradeability; however, the lifetime of Fairphones is around 2.5 times higher than average phones.</p>	<p>The economic, social and environmental impact of Fairphone activities has spanned the whole value chain. Both upstream (material suppliers) as well as downstream (sellers) have stated increased turnover following their relationship with Fairphone.</p>	<p>According to the EU project PROSUITE, only 11% of mobile phones are recycled. Over 60% of used phones are hibernating in homes or otherwise unaccounted for. If Fairphone stays in business, it proves that a major renaissance of this electronics manufacturing is possible.</p>

Short Case Study	General description	Innovation and benefits	Business model	Scaling up potential and possible barriers
7. Tesla	<p>Founded in 2003, Tesla is a US-based manufacturer of automotive products. The company has issued shares and in 2014 had a revenue of over 3 billion USD and currently has 12 000 employees worldwide.</p> 	<p>Tesla cars have body and motor designs that clearly set the product apart from other manufacturers in their sector. Moreover, Tesla allows customers to upgrade components (e.g., battery swaps) in their cars, allowing new functionality to consumers without having to replace the total product. Finally, Tesla allows others to use their technology (effectively, sharing patents) if they use it "in good faith."</p>	<p>Apart from creating automotive products featuring a distinguished design and propulsion system, Tesla's business model is based on selling through company-owned channels and supplying power-train components to other car manufacturers.</p>	<p>The development strategy is based on developing subsequent generations of cars. Each generation needs to fund the development of the next, envisaging a decreasing value per unit and increasing production volume. Only recently has Tesla attempted to develop cars for the mainstream automotive market, suggesting big scaling up potential.</p>

3.2. Overview of case studies per sector representing the scope of this report

A List Case Studies Covering The Whole Scope/Canvas Of The Report Is Shown Below (Table 7). This is a necessary addition to the best examples of voluntary case studies because it underpins the need to cover the full range of products consumed in European society by all types of economic "agents" (also discussed in §1.1). However, the case studies do not provide examples of all the potential benefits discussed in §2.2, due primarily to the wide variety of products used.

Table 7: Case Studies Covering the Whole Scope/Canvas of the Report per Sector

Sector case study	General description case study	Example of innovation and benefits	Example of business model	Example of potential for scaling up and possible barriers
Textiles	Hydrowear (NL) protective clothing for professional use	Family business, engaged in developing specific garments	Extend primary lifespan and improve performance during lifetime	Applying to general clothing could be possible, but is not pursued given reluctance to reveal specialized fabrics
Building materials	Selena (PL) construction chemicals, owning brand names such as Tytan, Quilosa, Artelit and Matizol	Front runner in polyurethane foam in the world	Extend primary lifespan and enable maintenance during lifetime	The demand for Selena products is fixed, limited possibility to expand to other products
Plastic products	Tecno Plastic Engineering (IT), supplying plastic products for agriculture, civil, transport, marine, automotive and rail use	Strong ties with related businesses in regional cluster of companies	Custom-made production and delivery; databases of products and clients enabling quick, cheap repair	Application field of their products is virtually the whole of the manufacturing sector; however, case study is interesting mainly in reduction of transaction cost
Machinery	Hilti (H) product service systems for construction and energy sectors	High degree of customer intimacy	Offering lifetime services for professional clients; guarantees greatly exceed legal minimum	Markets served by this company are highly specialized and business model is exceptional for its execution, not for its concept
Transport equipment	Caterpillar (US) construction vehicles	Most advanced take-back system in branch, using many used components in new products	Cost saving and standardization of product; guarantees greatly exceed legal minimum	Business model applicable for any transport equipment manufacturer; however, given relatively high value per transaction new players on market are unlikely to mimic this model
Furniture	EPS (DE) rental of furniture and accessories	Specialized in maintaining and renting objects used in demanding conditions	Offering utility rather than material; customer satisfaction clause in place	Both the business model and certain modular custom-designed objects could serve a broader market
ICT*	eské Radiokomunikace (CZ) is a well-established company in the Czech market, now privately owned; it is a front runner in "Internet-of-Things"	Serving fast-growing economies, the company operates in less saturated markets; clients are more likely	Specialized in cloud computing services (enabling IoT, engaging in communities by offering free	The possible impact of innovations based on the principles of "Internet-of-Things" or "industry 4.0" (see also §6.0.3) is seemingly endless; these innovations are prime examples of disruptive innovation; the biggest barrier

Sector case study	General description case study	Example of innovation and benefits	Example of business model	Example of potential for scaling up and possible barriers
	services in Central Europe. The role that the Internet of Things can play for a longer lifetime for products relates to better maintenance, repair and reverse logistics (see also §6.1.1)	to adopt new services based on sharing information through an IoT, and services replacing the need of ownership of ICT hardware	training programmes through the “Veda nas bavi” organization. The cloud services offer increased possibilities for remote monitoring, but technical and legal challenges are still present.	is offered by the extent to which producers are allowed to request and use clients’ personal information

*This is the only case-study example that refers to a service rather than a tangible product (i.e., a “good”).

3.3. Value creation vs. market distortion of potential business cases

The cases presented above illustrate a different way of explaining why net positive economic effects can be expected from a longer product lifetime. Money saved by households and companies from lower (transaction) costs for repair will, for the most part at least, be spent on something else. These changes in consumption patterns would not represent market distortion from government intervention; quite the opposite. They would give consumers the freedom to spend money on other products (goods or services) they truly want, and therefore increase the individual utility for consumers.

Voluntary case studies based on a longer product lifetime for avant-garde businesses can be illustrative, but so can consumer experiences at the individual level. We encourage anyone involved in debating a longer product lifetime to consider lifetime decisions made in their own households. This makes discussing a longer product lifetime essentially different from other policy fields. It is based on information that is familiar to most citizens.

To demonstrate this, three examples of a consumer decision to increase the lifetime of products are taken from interviews with experts, illustrating that the topic of a longer product lifetime makes every EU citizen an expert by experience.

3.3.1. Broken cupboard (metal part)

In the workspace of a social enterprise, the metal knee-bar on the door of a cupboard in the kitchen was damaged, preventing the use of the cupboard and thereby compromising the value of the whole kitchen, given the age of the kitchen (7 years) and intensive use of the space. Instead of being forced to buy a new kitchen (expected purchase higher than 10 000 EUR), efforts were made to replace the knee-bar. The retail shop and the OEM could not determine which part it was, and offered no replacement. A small repair shop eventually replicated the small piece of metal, at a cost of 120 EUR: a small repair that allowed the full functioning of the kitchen, thus extending its life.

3.3.2. Broken door (building material)

A vital door in the façade of a home office could not be opened or closed because a small cog had broken off as a result of metal failure, disabling the door handle. Consulting a contractor

to replace the whole door would have cost over 2 000 EUR. An independent retailer, specialized in metal parts, could identify the manufacturer and part number of the cog. After four working days, the spare part was delivered at a price of 8 EUR.

3.3.3. Ball-casing in wheel of hybrid car (transport equipment part)

The mandatory annual recurrent check-up of a car used for home delivery services exposed a minor flaw in one of the wheels. The well-established garage repair services in the area offered to replace the ball-bearing directly to extend the use of the car. The cost of the replacement was 220 EUR. No information was given about the cause of the failure of the wheel part, or the likelihood that other ball-casings would break as well. This example shows both the value of evaded costs in the case of a breakdown on the road, as well as the “principal agent” problem that is common in many transactions. This problem arises when the (probably only) individual or organization able to give advice on the required action by the other party, stands to gain from this advice.

4. IMPACT OF A LONGER PRODUCT LIFETIME

KEY FINDINGS

- The impact of a longer lifetime for products is part of the reported impact of an increase in circularity. However, the impact (economic, social and even environmental) from a longer lifetime for products is not, by definition, the same as maximizing the valorization of (raw) materials alone. There are economic, social and environmental benefits. Economic benefits relate to an increase in the overall competitiveness of Europe via the increase of the value added to products, the positive effect in the European trade balance and the counterbalance of long-term trends in the availability of low- and medium-skilled jobs. In social terms, there is a positive effect on the revaluation of the current distribution of skills enabling a more inclusive environment by enabling citizens to exploit skills and knowledge to provide for themselves and to gain access to new jobs. Environmental benefits in general relate to a reduction in the negative external effects that reduce ecological capital without compensation through market price.
- Despite the presence of many mechanisms for regulating the price of relevant products, increasing standards can actually increase a manufacturer's profits.
- Assessments of the trade-off between environmental impact in the production and the use phase of a product are important. At the same time, this trade-off is prone to misguided results because it could legitimize an increase in the consumption of newly produced products.
- The potential for job creation depends on the Member State and sector, so an accurate total estimate is not feasible within this study.

This chapter presents the results of the impact of a longer product lifetime reported in the literature and other relevant material. It will treat these effects as being part of some of the positive effects of a circular economy (a relation discussed in more detail in Chapter 1).

Translating the positive effects (i.e., benefits as discussed in §2.2 on societal impact), we can describe the potential impact as follows (EIB 2013):

- Economic: retaining living standards in the EU, which are among the highest in the world, an increase in R&D&I investment, quality of higher technical education.
- Social: use of social capital (especially tacit knowledge), more confidence in own ability to be self-supporting in long-term product usage, increased confidence in government, access to education that is perceived as useful in daily life, less dependence on borrowing.
- Environmental: evading negative externalities in countries where final consumption takes place as well as originating economies, evidence of feasibility of various kinds of substitution as a result of R&D&I investments (between goods, between materials and between goods and services).

Examples of these types of effects are described in the next three sections.

4.1. Economic benefits, being smart

Of the three elements of the European 2020 strategy, economic benefits appeal most directly to the interests of all societal groups. To support a longer lifetime for products, evidence of positive economic effects is most important to overcome any barriers from stakeholders.

As discussed in §2.2, potential negative effects are almost exclusively economic and potentially primarily affect stakeholders representing, for example, OEMs (Olivetti et al. 2008). Introducing economic benefits therefore requires an awareness of the so-called “split incentives.” Benefits may accrue to different individuals within an organization over a long lifetime and accrue to different market players. These effects can be shown quantitatively in terms of changes in value-added (at the company, sector or nation level), changes in trade balances and changes in labour markets. These effects are described below and examples of effects are provided.

4.1.1. Change in value-added

Economic value is, first and foremost, expressed as “valued-added.” In the years following the potential creation of this new value, this increase in economic value has a limited number of main destinations: investment in economic capital stock, investment in labour force (training existing employees, hiring new people), improvement of the financial status of a legal entity (“put it in the bank”), increased tax yield for governments, investment in R&D&I. (for instance, ranging from creating fundamental technology, renewing corporate processes, investing in advertising campaigns, etc.).

Companies benefit from a longer lifetime for products in the same way households can enjoy more of a product’s utility, from a longer, better or more efficient use of capital stock, for instance. These benefits translate directly to an increase in value-added and therefore competitiveness (Lacy et al. 2014). Table 8 summarizes the economic results of some studies that set out to economically quantify the economic gains of a more circular economy (comprising—in addition to the effect of longer product lifetimes through extended servicing—additional gains from material recycling and second-hand use). See §1.2 for a discussion about the overlap of a longer product lifetime with a transition to a circular economy.

Table 8: Overview of Reported Economic Benefits

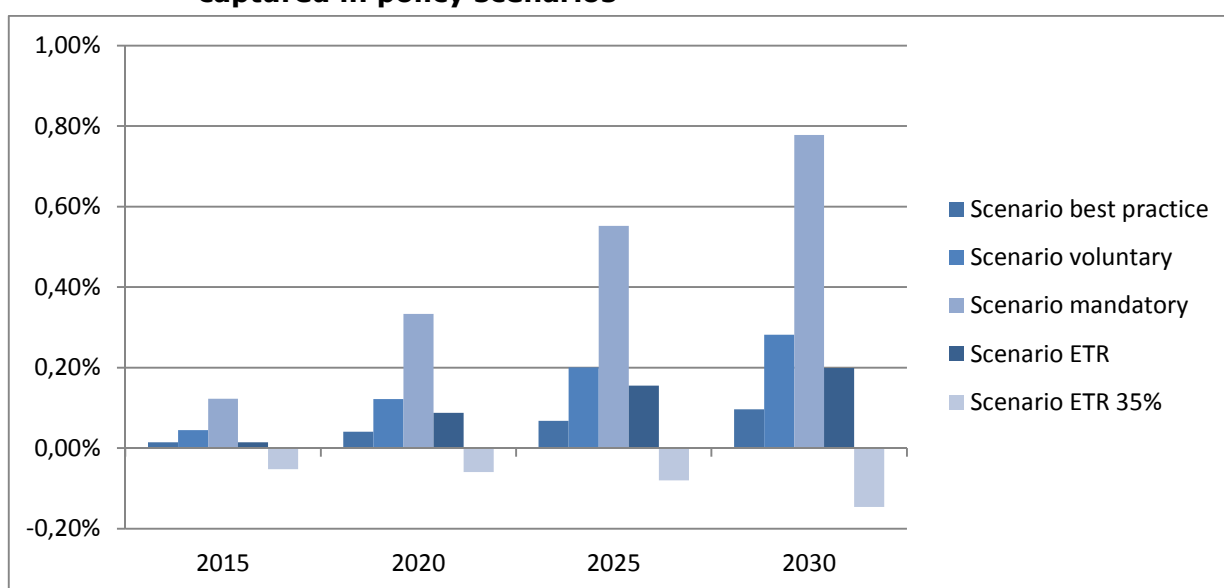
Report	Geographic scope	Economic Value	Jobs
MOSUS project (Raymenta et al. 2009)	EU	2.8% to 4% of GDP	
EMF (EMF 2012)	EU	520 000 to 630 000 million EUR worth of material savings/year	400 000
Club of Rome (Wijkman and Skånberg 2015)	Sweden	1% to 3% of trade surplus	5 000 to 100 000
TNO (TNO 2013)	Netherlands	7 300 million EUR/year	54 000

As described above, the process of job creation is one of the logical results from an increase in value creation. European jobs are likely to be created if businesses, regardless of the location of their main office worldwide, increase their value-added in the territory of the EU—especially non-tradable services that need to be provided locally. The studies displayed in Table 8 have estimated the job creation potential stemming from specific products. In general, the findings of these studies can be summarized as one job created for every 10 000 to 60 000 EUR increase in valued-added, depending on the particular Member State. A job value of 40 000 EUR would translate to almost 200 000 jobs.

A few studies have reported the effects of a longer lifetime of specific products. One example is a study of the Japanese car industry. This sector would be significantly prone to suffer from loss of sales if economic lifetime for automotive products were increased. However, the study reports that a +1.0 year (12 months) longer lifetime of a car contributed to a GDP growth that amounted to approximately +2 billion yen (corresponding to 150 million EUR) (Kagawa et al. 2005).

A bottom-up analysis of individual innovations in the build environment, many of which aim at a longer lifetime for products, is assessed in Ivanova et al. (2014). Figure 1 shows results from that study. Scenarios in this study are based on the uptake of best practices, voluntary and mandatory measures and Environmental Tax Reform (including a revolutionary scenario of 35% tax in physical imports) The order of magnitude of growth percentages are used in calculation of positive economic effects of 7.9 billion EUR as discussed in section §2.4.1.

Figure 1: Economic gain from scenarios anticipating longer product lifetimes, captured in policy scenarios



Source: Ivanova et al. (2014).

4.1.2. Change in trade balance

The EU is, from a global perspective, relatively dependant on imports. The three main sources of demand and usage of products in an economy are intermediate goods for use between businesses, final goods for consumption of households and government, and capital-good formation. These goods have their share of imports in the European economy as illustrated in Table 9. The highest impact of longer product lifetimes will be on consumer demand for final products. This is due to the fact that the increase of value-added is valorized in the B2C relationship in the marketplace, as shown in Table 9. For most products, the largest proportion of imports coming to Europe are for final consumption or capital formation. These shares are shown in the two last columns of Table 9. Apart from energy carriers, electric and electronic equipment, textiles, transport equipment and furniture rank high on consumption from imports. This means that a longer lifetime of these products is most likely to influence the trade balance because fewer imports will be required to maintain the current level of B2B and B2C stock in the European market.

Table 9: Illustration of Current Trade Balance (EU-27 Aggregates, 2011, Basic Prices)

Products (CPA 2-digit)	Share of intermediate use (B2B) from imports	Share of final consumption (B2C) from imports	Share of annual capital formation from imports
Mining and quarrying	11%	62%	13%
Computer, electronic and optical products	4%	54%	3%
Textiles, wearing apparel and leather products	24%	44%	N/A
Other transport equipment	68%	35%	22%
Furniture and other manufactured goods	7%	29%	N/A
Basic pharmaceutical products and pharm.	28%	28%	33%
Fish and other fishing products; aquaculture products	9%	26%	3%
Electrical equipment	8%	23%	N/A
Air transport services	1%	18%	N/A
Rubber and plastic products	23%	17%	13%
Machinery and equipment	18%	16%	12%
Chemicals and chemical products	30%	15%	N/A
Products of agriculture, hunting and related services	11%	14%	12%
Coke and refined petroleum products	6%	14%	8%
Fabricated metal products, except machinery and	20%	12%	15%
Motor vehicles, trailers and semi-trailers	7%	12%	7%
Basic metals	55%	N/A	N/A
Wood and of products of wood and cork, except	23%	10%	23%
Other non-metallic mineral products	21%	9%	16%
Paper and paper products	10%	7%	13%
Food products, beverages and tobacco products	27%	6%	43%
Other services (private or public sector)	11%	mostly <2%	0-30%

Source: TNO elaboration, with Eurostat data.

Another potential source of improvement in the European trade balance is likely to be realized by an increase in demand for EU production in non-EU intermediate use or non-EU final consumption. The improvement of the trade balance could be realized by both primary as well as secondary (used) goods. If European manufacturing has to adhere to more stringent legislation on product lifetimes, an improvement in exports in the order of magnitude of several percentage points is within the range of reported results. The most important finding

is that, despite the presence of many price-regulation mechanisms for relevant products, increasing standards can actually increase a manufacturer's profits (Lacourbe 2015).

4.1.3. Change in labour market

The majority of jobs created by implementing measures resulting in longer product lifetimes will be linked to jobs that enable this through enhanced maintenance and repair activities (TNO 2013). It is precisely these types of jobs that have suffered over the last decades of strong economic growth, due to the increased complexity, miniaturization and fashion sensitivity of products, prohibitive wages and a lack of fiscal incentives. The organization RReuse (a European platform representing national/regional networks of social enterprises active in reuse, repair and recycling activities) studied the decline in jobs in the repair sector and recently presented an overview of some long-term time series in employment in the repair sectors (RREUSE 2015):

- In the Netherlands, over 10 years, the number of specialized firms in electronics repair went down from 4 500 to 2 500.³
- In Germany, in one year, 13% of radio and TV repair shops closed down (Ask and Ax 1997).
- In Poland, between 2008 and 2010, the number of repair enterprises active in the repair and maintenance of consumer and household goods decreased from 16 793 to 14 070, a decrease of 16% in two years. The number of employees dropped in this period from almost 28 000 to about 21 000 (Central Statistics Office of Poland 2012).
- In the US, shoe-repair shops decreased from 60 000 in 1995 to some 7 000 today.
- In the US in 1963, some 110 000 people were employed as radio/TV repairmen. In 1982 there were 80 000, and in 2006, only 40 000. This is despite the doubling of TV ownership per household.

4.2. Social benefits, being inclusive

Of the three key guiding principles of the European 2020 strategy, social benefits are the least discussed, researched and quantified. Yet, from a political point of view, they seem to be a key aspect to legitimizing governmental action on longer product lifetimes.

Social benefits are related to the many potential quality-of-life and well-being gains that could result from being employed (feeling productive, having social interactions, providing routines and structure, having pride in one's community, etc.) and from having increased opportunities for employment and a reduction in barriers to achieving one's chosen career. These intangible benefits can be measured, quantified and monetized through survey data in studies that measure the value of well-being (Mallender et al. 2015). Two aspects are important to be highlighted regarding social benefits: these are the distribution of skills that enable inclusive growth and the associated competitive advantages for Europe deriving from the uplift and renewal of qualifications in low- and medium-skilled jobs.

4.2.1. Distribution of skills (social capital) to enable inclusive growth

Many studies predict an increase in demand for low- and medium-skilled jobs, related to policies aimed at a longer lifetime for products (e.g., COM 2014a; DEFRA 2011; TNO 2013; Umfenbach 2014). This positive impact could become a reality if the availability of low- and medium-skilled labour in the EU is combined with the required skills to increase the lifetime of a product. In other words, the unemployed segment of the labour force needs to be

³ Statline.cbs.nl.

productive, making a longer lifetime for products a real prospect: in other words, jobs related to retail, for instance, wholesale, repair and rental and leasing services that should (and can) be paid at or above minimum wage. When considering embedding skills in the labour population, these are, in many cases, services that require some tacit knowledge, which, as opposed to formal, codified or explicit knowledge, is the kind of knowledge that is difficult to transfer to another person by means of writing it down or verbalizing it. This kind of knowledge can be built up over extensive periods of time, even generations. Moreover, it can provide long-lasting advantages to the utility of the consumer.

There is also usually a social cost involved because unemployment is very often related to health issues and social problems like exclusion, affecting not only the unemployed person, but also his/her family and even the wider community (Wijkman Skånberg 2015). There are positive externality effects associated with skill development, which yields greater benefits to society at large than to individual employers, especially in areas and sectors where labour is mobile (Raymenta et al. 2009).

4.2.2. Competitive advantages for the EU as a whole

A simple way to express the competitiveness of the EU is to look at the trade balance (see §4.1.2) Longer product lifetimes reduce dependency on non-EU imports to meet European demand. Moreover, if lifetime-extending services require a certain economy of scale, the single market of the EU can further justify its presence.

Services enabling longer product lifetimes are capable of increasing the utility for consumers, because customers are willing to pay more for that particular product. One of the manifestations of the warm-glow effect is reported in the case where EU consumers feel that they directly support enterprises with a social element (e.g., repair services from physically challenged local young people) (Nicoli 2015).

Policies aimed at a longer lifetime for products will also result in increased standardization of repaired or refurbished goods and secondary raw materials. This is a common indicator for global competitiveness, which would imply that a longer lifetime would increase the attractiveness of EU goods (Tukker and Tischner 2006). These policies are discussed in Chapter 5.

Greater consumer preference for EU products would be a positive effect. However in many cases, the origin of a product is not known to the consumer. The fact that a product adheres to EU regulations is better known (Natural Scotland 2013). This means that trust in European governance is likely to be increased by a longer lifetime for products just as much, or even more, than confidence in a particular manufacturer.

Market access is likely to be improved by longer product lifetimes. In general, it is clear that, as the different competitive stages evolve, different players learn the rules of the game. They accumulate knowledge and skills until a significant number of players level the field (Montalvo 2014). Specifically, the services to supply consumers with lifetime-extending economic activities are suitable for widespread knowledge development and, subsequently, entrepreneurship.

4.3. Environmental benefits, being sustainable

Of the three elements of the European 2020 strategy, the environmental benefits of longer product lifetimes are the least questioned. They relate to technical or natural sciences, rather than social sciences. This provides both a perceived basis of absolute truth as well as a sense of alienation of many non-experts from the actual content of studies assessing environmental effects. There is an overwhelming volume of scientific publications on the quantification of

environmental benefits as a result of cleaner production processes, better designs, improved reparability and recyclability (COM 2013b).

The following environmental issues are the most common for assessing the effects of economic processes on our planet: raw material equivalent,⁴ “blue”/“green”/“grey”⁵ water use, metal depletion, fossil depletion, abiotic depletion, acidification, eutrophication, global warming potential (GWP100⁶), ozone layer depletion, human toxicity, marine aquatic and freshwater aquatic eco-toxicity, terrestrial eco-toxicity, photochemical oxidation and land use.

4.3.1. Quantifying selected environmental impacts

For decades, the practice of life-cycle assessment (LCA) has provided product-specific assessments of environmental impact, regularly taking a specific lifetime into account. This means that the body of work on the environmental impact of longer product lifetimes is sizable.

For instance, changing the toaster market by extending the lifetime by 10% would net a savings of around 4 000 tonnes of CO₂ equivalent and prevent around 60 tonnes of waste per annum. The greatest benefits to be gained for global warming potential (GWP) from a longer lifetime would be through a 10% change in the market for the T-shirt, which would result in a reduction of circa 100 000 tonnes of CO₂ equivalent per annum (DEFRA 2011).

A common justification for the continued consumption of primary goods is based on the increased energy efficiency of these products. Two sources have taken the challenge to explore and quantify the trade-off between energy-efficient use and a longer product lifetime (Cooper and Gutowski 2015). There are indications that studies to quantify this research are influenced by the possibility that these results might encourage consumers to purchase new products to replace inefficient old ones, which would have a disproportionately large environmental impact in itself (Scheepens et al. 2015).

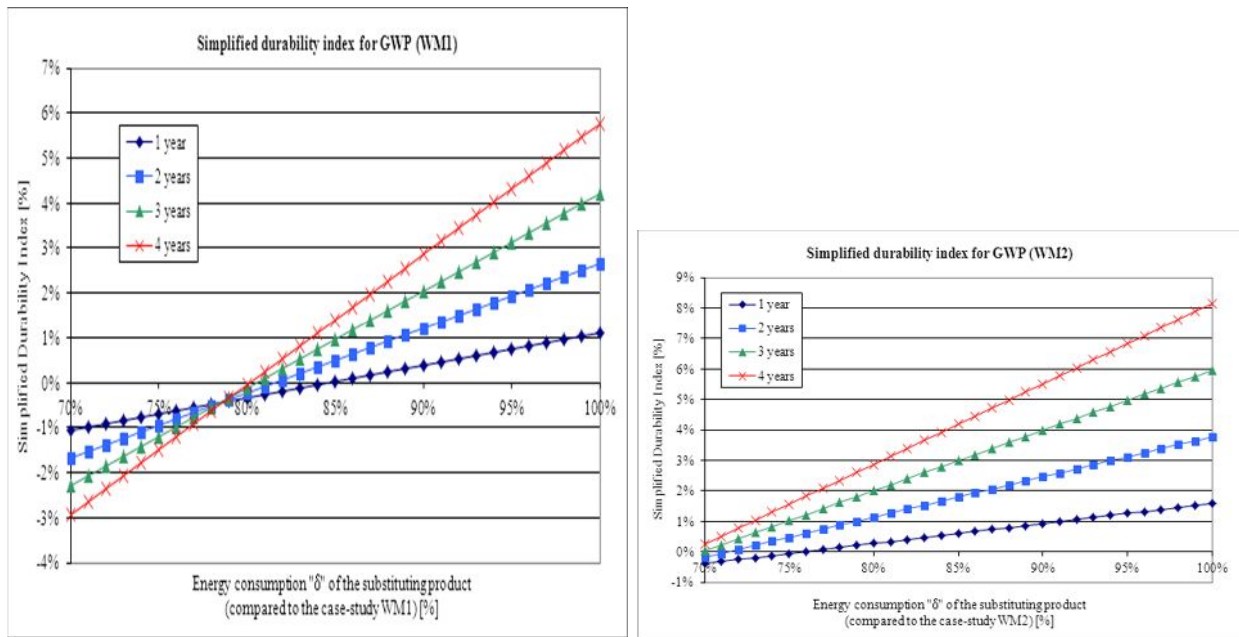
Figure 2 displays the energy consumption of two types of washing machine (WM1 being a product of average quality, WM2 being a product of high quality). The unit of measurement is the emission of GHG, expressed in global warming potential (GWP). A value of 80% on the x-axis means that, relative to the GWP impact, the extension of the lifetime of the WM1 or WM2 from one to four years is environmentally comparable to the replacement of the old product with a new one, which has to be 20% more efficient to be equal in environmental benefit.

⁴ The raw material equivalent of a product indicates how much extraction of material was needed over the whole production chain to manufacture a specific product, irrespective of whether those raw materials were extracted from the domestic environment or the rest of the world.

⁵ The blue water footprint measures the volume of ground- and surface water consumed (i.e., withdrawn and then evaporated). The green water footprint measures which part of the total evaporative flow is actually appropriated for human purposes. The grey water footprint measures the volume of water flow in aquifers and rivers polluted by humans.

⁶ GWP is relative measure of heat trapped by GHG, harmonizing all GHG in the atmosphere.

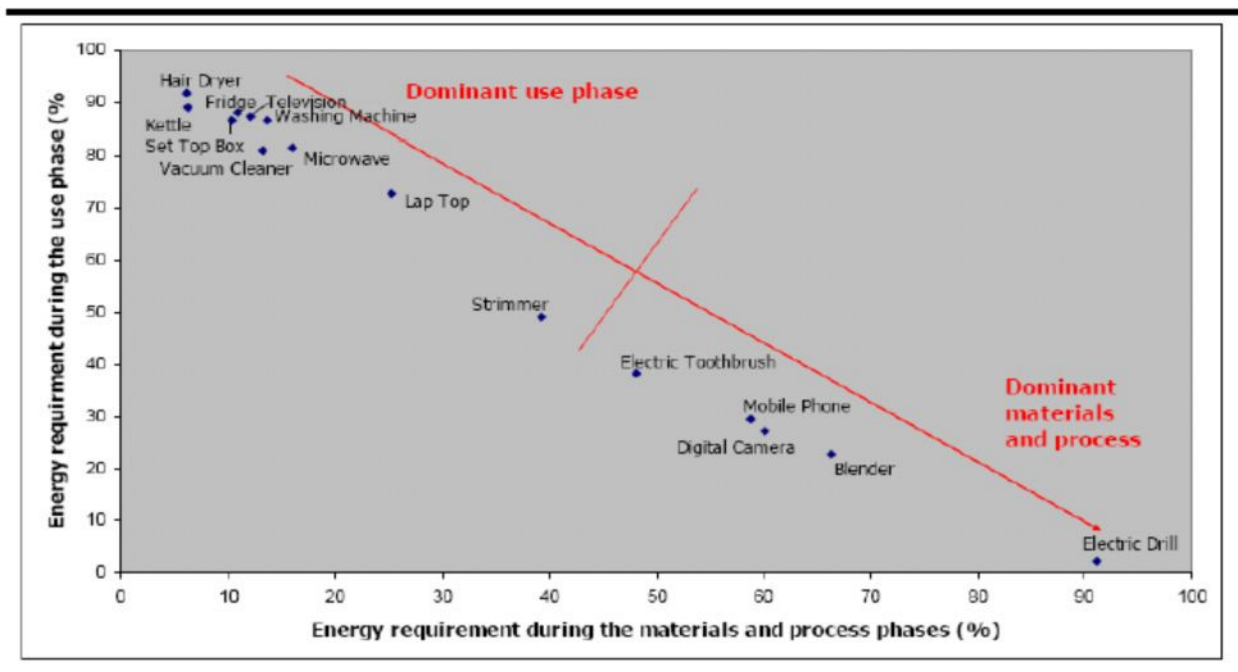
Figure 2: Tipping point analysis of energy-using products in trade-off between longer lifetime versus improved new product



Source: Ardente and Mathieux (2014).

Another source exploring the trade-off between energy use during the production versus the use phase is shown below in Figure 3.

Figure 3: Distribution of energy requirements between process phase and use phase



Source: WRAP (2010).

More evidence is offered from a longer automobile lifetime. An increase of one year in the lifetime of cars in Japan results in a reduction of 200 Kton of automotive products in the waste landfill over five years (Kagawa et al. 2005).

During the project “Assessment of Scenarios and Options towards a Resource Efficient Europe,” options for extending the lifetime of specific products were assessed (Ivanova et al. 2014). Some of these results are detailed below (Table 10).

Table 10: Reported Environmental Gains from a Longer Product Lifetime

Options related to a longer product lifetime	Change in total raw material consumption
Change from adhesive to tactile fixing of flooring	-0.003%
Flooring: Increase typical durability from 5 to 7 years	-0.001%
Paint: Increase typical durability from 5 to 6 years	-0.005%
Recycle asphalt back into roads instead of land-filling	-0.014%
Recycle PVC at end of life instead of landfill or energy recovery	-0.008%
Recycle carpet at end of life instead of land-filling	-0.005%

Source: Ivanova et al. (2014).

The order of magnitude of changes in material consumption may seem very small. This results from the definition of the options that were assessed. They represent detailed products (six out of around four thousand product groups); moreover, the options represent in some cases only partial longer life-times, not complete substitution. This illustrates that there is no solution originating from a longer lifetime of products that by itself delivers significant gains. It is the summated effect of many products and initiatives that results in benefits for consumers and companies.

Remarkably, various studies have indicated that there is no change in environmental impact by substituting bio-based materials for raw material inputs (Mudgal et al. 2013b). This can be readily verified in various LCA modelling exercises.

5. CURRENT EU REGULATORY AND LEGISLATIVE FRAMEWORK

KEY FINDINGS

- For the most part, the concept of longer product lifetimes is currently not explicitly present in policy and regulations in the EU. Thus, the current policy framework does not provide sufficient mechanisms to guide and regulate the extension of product lifetime.
- Initiatives promoting eco-design, eco-innovation and the circular economy indicate an ambition to promote product redesign and to consider and label the durability of products, but the selection of pilot products is still on the horizon.
- The circular economy initiative makes explicit linkages with mainstream innovation policies, which opens the opportunity to capitalize on existing policy instruments that support extending product lifetimes. Given the fast pace of innovation, this also creates an awareness of the implicit clash of current innovation policies and any policy package promoting a longer life for products. A delicate balance must be stricken between policies enabling fast innovation that brings to the market better and more efficient products (in resources and energy) and new initiatives aiming to optimise in the long term the embedded capital stock of products currently in use.
- Legislation related to the Ecodesign Directive presents no barriers, but initiatives to standardize design norms in some sectors have already demonstrated that changes in norms and their transposition in the single market, can take decades when faced with split incentives and ill-defined performance indicators.

In this chapter we present a review that searched for European policies that might affect—directly and indirectly—the promotion of extended product life among companies and consumers. A preliminary policy list was derived from an extensive policy review and elicited in talks and interviews with experts in product design and policy, environmental policy, energy policy and consumer protection policy at the European level. Europe has a broad, robust regulatory framework on product design and related lifecycle issues; arguably among the most developed in the world. This is also the case for environmental regulation and consumer protection. Early consultation work on environmental performance of products conducted on behalf of the European Commission DG Environment in 2004 indicated some challenges in setting environmental performance targets for products (Willems et al. 2006). Consumer-protection legislation is also part of the work programme, indicating the Commission's commitment to better regulation. Subsequently, this is an important part of the Commission's regulatory fitness programme, which seeks to cut red tape and remove regulatory burdens. The fitness checks from the work programme are a good reference for the existing legal framework in the EU (COM 2014d).

The role of policy and regulation moderating the environmental behaviour of companies has been widely studied and discussed in public forums and research (POLFREE⁷), and arguments for and against its effects on the competitiveness of companies abound (Jaffe et al. 1995; Montalvo 2007). Recent studies indicate that there is a positive relationship between the level of innovative activity at the firm level and regulation intensity (Montalvo et al. 2011). The

⁷ See www.polfree.eu.

overall idea of regulations and standards at the European level, is that businesses do not have to navigate through multiple national regulations when launching their products on the market, an approach they regularly ask for.

A wide review of policies that might either directly or indirectly affect the promotion of longer product lifetimes in companies was conducted on the portfolio of consumer protection in the single-market, thematic and horizontal environmental policies. Policies and directives that were considered for a more detailed review are listed in Table 11.

Table 11: EU Regulatory Framework

Climate
<ul style="list-style-type: none"> • Emission Trading System (EU ETS) • European Economic Recovery Programme • Sustainable Industry Low Carbon (SILC) programmes
Energy
<ul style="list-style-type: none"> • Energy Labelling Directive • Energy Efficiency Directive • Energy Taxation Directive • EU Energy Labelling Directive 2010/30 • Directive 2009/28/Ec On The Promotion Of The Use Of Energy From Renewable Sources • Strategic Energy Technology Plan
Circular economy
<ul style="list-style-type: none"> • Zero Waste Programme • Waste Framework Directive • End of Life Vehicles Directive (2000/53/EC) • EU action plan for the circular economy
Policies addressing pollution (air, water, soil, noise)
<ul style="list-style-type: none"> • Environmental Noise Directive • Discharges Directive • Air Quality Directive • Air Quality Framework Directive • Water Framework Directive (WFD) • Regulation EC 595/2009 on type approval of motor vehicles and engines • Directive on Waste of Electrical and Electronic Equipment (WEEE) 2012/19
Consumer protection
<ul style="list-style-type: none"> • EU Consumer Rights Directive (2011/83/EC) • Directive on batteries and accumulators 2006/66 • Consumer Sales Directive • Common European Sales Law • Unfair Commercial Practices Directive • Product Safety Law • Regulation EC 595/2009 on type approval of motor vehicles and engines

Table 11: Continued**Horizontal policies**

- The Environmental and Technologies Action Plan
- Eco-innovation Action Plan
- Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment
- Ecodesign Directive 19/125
- Regulation 461/2010 vertical agreements in the vehicle sector
- EU Ecolabel
- Integrated Product Policy (IPP)
- Green Action Plan (GAP) for SMEs
- Green Employment Initiative
- Product Environmental Footprint (PEF)
- EU Eco-Management and Audit Scheme (EMAS)
- Harmonized standards for Ecodesign and Energy Labelling

Source: TNO Elaboration.

In general, the policy framework provided by the policies, directives and regulations reviewed do not provide mechanisms to guide and regulate product usage and lifetime. Policies that, in principle, are directly related to the notion of a longer product lifetime contain objectives and aims that address other aspects of environmental and consumer protection. Most of those reviewed offer the potential of a framework that could be modified to include features that support longer product lifetimes. The concept is not explicitly present in current policies and directives. The policy areas surveyed include Climate, Energy, Circular Economy, Pollution, Consumer Protection, Product Safety, Single Market and other Environmental Horizontal Policies.

The policies and directives described below provide selected examples of existing policy platforms that could be extended to include considerations that promote a longer life for products. In the following, we describe the main objectives of a number of policies such as Zero Waste, waste of electrical and electronic equipment (WEEE), Ecodesign, Eco-labelling, consumer protection, consumer rights, etc.

5.1. **Producer support and regulation**

5.1.1. **Directive on Waste of Electrical and Electronic Equipment (WEEE)**

The primary objective of this directive is the prevention of WEEE and, in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce their disposal and to contribute to the efficient use of resources and the retrieval of valuable secondary raw materials. It also seeks to improve the environmental performance of all operators involved in the life cycle of electrical and electronic equipment, e.g., producers, distributors and consumers, and, in particular, those operators directly involved in the collection and treatment of WEEE.

In addition to its primary objectives, the WEEE Directive includes guidelines that aim to promote the repair and preparation for reuse of products through their design. As the directive is put into effect in Member States, both objectives could potentially extend the lifetime of EEE products.

There are two aspects crucial for reuse and repair: the first is the design of the product (see Art. 4 of the directive) and the second refers to the information provided by the manufacturer to WEEE treatment operators, including reuse and repair centres (Art. 15).

These two aspects are directly addressed in two articles of the directive:

- Article 4: Producers must ensure that they do not prevent (through specific design features or manufacturing processes) WEEE from being reused, unless such specific design features or manufacturing processes present overriding advantages, for example, with regard to the protection of the environment and/or safety requirements.
- Article 15: Gives clear guidelines concerning the information that manufacturers should be providing independent operators (e.g., garages, repair centres, etc.) that provide services that enable the reuse and repair of products: "Member States shall take the necessary measures to ensure that producers provide information free of charge about preparation for re-use and treatment in respect of each type of new EEE placed for the first time on the Union market within one year after the equipment is placed on the market."

This implies that longer product lifetimes will be facilitated when manufacturers transfer and make available relevant information to reuse and repair centres; however, the challenge is in the implementation and transposition of the regulation by individual Member States. In principle, such information should be made available to independent operators within one year of the product coming onto the market. Because most durable products in Europe are covered by a two-year guarantee provided by the brand, in principle, for most products with such guarantees, the period stipulated in the WEEE regulation would be appropriate.

5.1.2. Integrated Product Policy

As part of the Sustainable Production and Consumption Policy, the Integrated Product Policy⁸ (IPP) was intended to minimize the environmental degradation caused by a product during all phases of its life-cycle (manufacturing, use and disposal). The aim was to look at all these phases—whether the design, assembly or even distribution—and attempt to improve their environmental performance (COM 2001).⁹ Many actors were involved in these different steps, from industries to marketing people to consumers, and all products were included in the IPP. Consequently, there is not just one policy measure that covers everything but a variety of tools, both mandatory and voluntary, such as economic instruments, substance bans, voluntary agreements, environmental labelling and product design guidelines.

The IPP provided a framework in which Member States, local authorities, businesses and non-governmental organizations (NGOs) can adopt green product policies. It can also lead to specific EU-wide policy initiatives designed to foster green consumerism. The IPP has had an effect on consumers, manufacturers, retailers and NGOs. According to the Commission, for initiatives at the level of Member States, the IPP was "a major building block as they allow a practice-oriented, bottom-up approach" (COM, 2009). However, to some extent, this experience indicated that the main drivers behind the growth of green consumerism will be market forces in the form of levers such as price reductions and better consumer information. The Commission indicated the need for the price of products to reflect their full cost, including environmental impact.

⁸ http://ec.europa.eu/environment/ipp/index_en.htm.

⁹ The green paper on integrated product policy was adopted by the European Parliament in 2001 (COM 2001).

In general, the IPP initiative could now be seen as an intermediate policy step leading to the Eco-design and Zero Waste initiatives, which subsequently evolved into the current Circular Economy Package (summarized further below).

5.1.3. EU Ecodesign Directive 2009/125/EC

The Ecodesign of Energy-Related Products Directive 2009/125/EC is a framework directive that primarily focuses on the energy used by products, an aspect that has been expanded. A further study (the “Material-efficiency Ecodesign Report and Module to the Methodology for the Ecodesign of Energy-related Products”) was completed in 2013. The methodology of this study was designed to take material-related aspects (particularly critical materials) into account. See also Table 13.

Table 12: Categories of Products in Ecodesign Directive

Minimum requirements for certain energy-consuming products related to the following categories

Products that have a volume of sales that exceeds 200 000 units per year throughout the internal European market (a cumulative total and not one calculated on the basis of an individual producer)

Products that have a significant environmental impact within the internal market

Products that present significant potential for improvement in environmental impact without incurring excessive costs

Note that transport is not included in the scope of the directive.

The objective is to reduce greenhouse-gas emissions and other adverse environmental impact throughout the life-cycle of a product with emphasis placed on its design and development stages with a view to improving its energy efficiency.

The Ecodesign Directive provides consistent EU-wide rules for improving the environmental performance of energy-related products through ecodesign. It prevents disparate national legislation on the environmental performance of these products from becoming obstacles to intra-EU trade, which should benefit both businesses and consumers by enhancing product quality and environmental protection and by facilitating free movement of goods across the EU.

Energy-related products (the use of which has an impact on energy consumption) account for a large proportion of the energy consumption in the EU and include the following:

- Energy-using products, which use, generate, transfer or measure energy (electricity, gas, fossil fuel), such as boilers, computers, televisions, transformers, industrial fans, industrial furnaces, etc.
- Other energy-related products, which do not use energy but have an impact on energy and can therefore contribute to saving energy, such as windows, insulation material, shower heads, taps, etc.

According to Article 16, working plans should determine the list of products for which a preparatory study is to be conducted during a given period and when implementation measures will eventually be adopted.¹⁰ The ecodesign working plan for 2015-2017 will be

¹⁰ <http://www.ecodesign-wp3.eu/>.

tailored to the Circular Economy Package, which, again, contains an aspect on critical materials. Developing a convincing classification of product groups according to circular business models (repair, durable design, etc.) is a main objective. Some studies have concluded that expansion of product design directives (e.g., minimum requirements on "durability") is desirable (Mudgal 2013b).

As a first step, and under the framework of the Ecodesign Directive, the Commission has developed and will shortly propose mandatory product design and marking requirements to Member States to make it easier and safer to dismantle, reuse and recycle electronic displays (COM 2015: 614). Ecodesign offers, in theory, a great opportunity to address the issue of improved durability of products. The issue of product durability, as an environmental performance standard, is a feature that, in principle, affects a large variety of durable consumer goods. In practice, the selection of specific products has proven to be extremely difficult in specific industries.

5.1.4. Eco-innovation Action Plan (EIAP)

Efforts to promote environmental technologies with the Environmental Technologies Action Plan (ETAP 2004) continued with the new Eco-innovation¹¹ Action Plan (EcoAP), which also complements other Europe 2020 Flagship Initiatives. A major building block for the transition towards a green economy is the "Resource Efficient Europe"¹² Flagship and its roadmap,¹³ creating and reinforcing demand for eco-innovation and related investment. The "Industrial Policy for a Globalized Era"¹⁴ places EcoAP as one tool to identify and implement measures for the deployment of key environmental technologies, to enhance coordination and cooperation between the EU and Member States and to generate awareness of the potential of new technologies. The Agenda for New Skills and Jobs¹⁵ calls for EcoAP to support competencies for sustainable development, to promote appropriate skill development and to tackle skill mismatches.

The EcoAP focus is on boosting innovation that results in or aims at reducing pressures on the environment, and on bridging the gap between innovation and the market. It will, inter alia, take further some actions identified in the Resource Efficiency Roadmap. The Commission currently conducts a number of actions to support market uptake of eco-innovations by means of the following:

- using environmental policy and legislation as a driver to promote eco-innovation (Action 1);
- supporting demonstration projects and partnering to bring promising, smart and ambitious operational technologies that have been suffering from low uptake to the market (Action 2);
- developing new standards to boost eco-innovation (Action 3);
- mobilizing financial instruments and support services for SMEs (Action 4);
- promoting international cooperation (Action 5);

¹¹ Eco-innovation refers to any form of innovation resulting in or aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impact on the environment, enhancing resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources.

¹² COM(2011c) 21: Communication from the Commission: "A resource-efficient Europe – Flagship Initiative under the Europe 2020 Strategy".

¹³ COM(2011) 571 final.

¹⁴ COM(2010) 614: Communication from the Commission: "An integrated industrial policy for the globalisation era: Putting competitiveness and sustainability at centre stage".

¹⁵ COM(2010) 682 final: An Agenda for new skills and jobs: "A European contribution towards full employment".

- supporting the development of emerging skills and jobs and related training programmes to match labour-market needs (Action 6);
- promoting eco-innovation through the European Innovation Partnerships foreseen under the Innovation Union (Action 7).

The action plan does not address issues of product lifetime extension, but actions oriented to boosting new standards and eco-design might offer possibilities that could be complemented with guidelines for producers to consider product life extension.

5.1.5. Directive on batteries and accumulators 2006/66

The durability of batteries that cannot be removed/replaced easily from consumer goods often dictates the lifespan of a product. In general, the life of a battery is often considerably shorter than that of an equivalent appliance that has a removable and replaceable battery (Schischke 2011). The recent amendment to Directive 2013/56/EU of the batteries directive states that: "Member States shall ensure that manufacturers design appliances in such a way that waste batteries and accumulators can be readily removed. Where they cannot be readily removed by the end-user, Member States shall ensure that manufacturers design appliances in such a way that waste batteries and accumulators can be readily removed by qualified professionals that are independent of the manufacturer. Appliances in which batteries and accumulators are incorporated shall be accompanied by instructions on how those batteries and accumulators can be safely removed by either the end-user or by independent qualified professionals. Where appropriate, the instructions shall also inform the end-user of the types of battery or accumulator incorporated into the appliance."

The application and transposition of this amendment is dependent on the transfer and availability of information in manuals to independent operators as well as the cost of spare parts and repair services. This also requires the appropriate disposal/recycling of the old batteries.

5.1.6. Regulation (EC) No 595/2009 on type-approval of motor vehicles and engines

This regulation primarily depends on the automotive sector to facilitate its implementation and includes provisions for the transfer and facilitation of maintenance and repair information to independent operators. It contains two core requirements concerning the facilitation and access to services and repair information for automotive products:

- Manufacturers shall provide unrestricted access to maintenance and repair information as well as diagnostic equipment.
- Manufacturers shall provide a standardized, secure and remote facility to enable independent repairers to complete operations.

Concerning the two indications provided above the European Commission is to provide technical specifications regarding ways in which the information is to be provided and shall ensure the update of these specifications according to current information technology.

The regulation gives concrete definitions of the terms "repair and maintenance information"¹⁶

¹⁶ Vehicle repair and maintenance information means all information required for diagnosis, servicing, inspection, periodic monitoring, repair, re-programming or re-initialising, or the remote diagnostic support of the vehicle that the manufacturer provides for its authorised dealers and repairers, including all subsequent amendments and supplements to such information. This includes all information required for fitting parts or equipment onto vehicles.

and “independent operators,”¹⁷ which is crucial for the correct implementation of the requirements. Such requirements provide inspiration for the way other EU legislation could be adapted for electronic products and provides evidence that such provisions are possible and feasible to implement.

A gap in legislation is related to protecting the interests of enterprises offering repair services. The availability of spare parts in a timely manner is a reported problem. Moreover, upgradability and modularity are sometimes actively thwarted by OEMs (with a high air-pressure system destroying equipment when it is opened, for instance).

5.1.7. EU action plan for the circular economy (COM 2015: 614)

Building on the objectives and experiences of the Zero Waste Programme for Europe (COM 2014b), Resource efficiency (COM, 2011c), the Eco-design Directive (COM 2009) and the IPP (COM 2001), the new action plan for the circular economy includes long-term targets to reduce landfills and to increase preparation for reuse and recycling of key waste streams such as municipal and packaging waste. The targets should lead Member States to gradually converge on best-practice levels and encourage the requisite investment in waste management.

Further measures are proposed to make implementation clear and simple, promote economic incentives and improve extended producer responsibility schemes. By stimulating sustainable activity in key sectors and new business opportunities, the plan will help to unlock the growth and job potential of the circular economy. It includes comprehensive commitments on eco-design, the development of strategic approaches on plastics and chemicals, a major initiative to fund innovative projects under the umbrella of the EU’s Horizon 2020 research programme, and targeted action in areas such as plastics, food waste, construction, critical raw materials, industrial and mining waste, consumption and public procurement. Other key legislative proposals on fertilizers and water reuse will follow. Finally, horizontal enabling measures in areas such as innovation and investment are included to stimulate the transition to a circular economy. The proposed actions support the circular economy in each step of the value chain—from production to consumption, repair and remanufacturing, waste management, and secondary raw materials that are fed back into the economy.

As the actions proposed are to be taken forward with the principles of Better Regulation, this initiative requires coordination with the single market regulation. To date, eco-design requirements have mainly targeted energy efficiency; in the future, issues such as reparability, durability, upgradability, recyclability, or the identification of certain materials or substances will be systematically examined. The program has six topics where priority is given to provide the framework conditions for a shift from previous practices regarding the conceptualization of material and product life cycles.

¹⁷ Independent operator means enterprises other than authorised dealers and repairers, which are directly or indirectly involved in the repair and maintenance of motor vehicles, in particular, repairers, manufacturers or distributors of repair equipment, tools or spare parts, publishers of technical information, automobile clubs, roadside-assistance providers, operators offering inspection and testing services, operators offering training for installers, manufacturers and repairers of equipment for alternative fuel vehicles.

Table 13: Topics and Priorities of the Action Plan for the Circular Economy**Production**

Actions in product design. The commission will:

- consider proportionate requirements on durability and the availability of repair information and spare parts in its work on Ecodesign, as well as durability information in future Energy Labelling measures;
- propose new rules in the revised waste proposals, which will encourage reuse activities;
- work towards better enforcement of the guarantees on tangible products, examine possible options for improvement, and tackle false green claims;
- prepare an independent testing programme under Horizon 2020 to help the identification of issues related to possible planned obsolescence, which work would involve relevant stakeholders as appropriate;
- take action on green public procurement (GPP), by emphasizing aspects of the circular economy in new or revised criteria, supporting higher uptake of GPP and leading by example in its own procurement and in EU funding.

Actions in production processes. The commission will:

- include guidance on best practices for waste management and resource efficiency in industrial sectors in best available techniques reference documents and will issue guidance and promote best practices on mining waste;
- propose (in the revised legislative proposals on waste) to clarify rules on by-products to facilitate industrial symbiosis and help create a level playing field across the EU.

Consumption

Actions supporting sustainable consumption. The commission will:

- consider proportionate requirements on durability and the availability of repair information and spare parts in its work on Ecodesign, as well as durability information in future energy labelling measures;
- in the revised waste proposals, propose new rules that will encourage reuse activities;
- work towards better enforcement of the guarantees on tangible products, examine possible options for improvement, and tackle false green claims;
- prepare an independent testing programme under Horizon 2020 to help the identification of issues related to possible planned obsolescence;
- take action on GPP by emphasizing circular economy aspects in new or revised criteria, supporting higher uptake of GPP and leading by example in its own procurement and in EU funding.

Waste management

The Commission is adopting, together with this action plan, revised legislative proposals on waste comprising, in particular:

- long-term recycling targets for municipal waste and packaging waste, and reducing landfill;
- provisions to promote greater use of economic instruments;
- general requirements for extended producer responsibility schemes;
- simplification and harmonization of definitions and calculation methods;
- stepping up its work with Member States to improve waste management on the ground, including avoiding over-capacity in residual waste treatment;
- assisting Member States and regions to ensure that Cohesion Policy investments in the waste sector contribute to supporting the objectives of the EU waste legislation and are guided by the EU waste hierarchy.

From waste to resources:

Change in the conceptualization of waste to resources.

- This aims at boosting the market for secondary raw materials and water reuse. The vision is for materials that can be recycled to be injected back into the economy as new raw materials, thus increasing the security of supply. These "secondary raw materials" are to be traded and shipped just like primary raw materials from traditional extractive resources.

Priority areas

A large number of sectors face specific challenges in the context of the circular economy.

- Because of the specificities of their products or value chains, their environmental footprint or dependence on material from outside Europe, a number of sectors were given priority. This includes Plastics, Food waste, Critical raw materials, Construction and demolition, Biomass and bio-based products. These sectors will be addressed in a targeted way, to ensure that the interactions between the various phases of the cycle are fully taken into account along the whole value chain.

Production Innovation, investment

The transition to a circular economy is a systemic change. In addition to targeted actions affecting each phase of the value chain and key sectors, it is necessary to create the conditions under which a circular economy can flourish and resources can be mobilized. Innovation will play a key part in this systemic change. Actions programmed to support innovation towards the circular economy are, in particular:

- the Horizon 2020 Work Programme for 2016-2017, which includes a major initiative on "Industry 2020 in the circular economy," with funding of over €650 million;
- a pilot approach for "innovation deals" to identify and address potential regulatory obstacles for innovators;
- stepping up action to mobilize stakeholders on the circular economy, particularly for the implementation of this action plan; also targeted outreach to help the development of circular economy projects for various sources of EU funding, particularly Cohesion Policy Funds.

5.2. Consumer protection

5.2.1. The Consumer Sales Directive (1999/44/EC)

The Consumer Sales Directive (CSD) covers specific aspects of the sale of consumer goods and associated guarantees and aims to harmonize those parts of contract law on consumer sales that concern legal guarantees (warranties) and, to a lesser extent, commercial guarantees.

EU countries can require consumers to inform the seller of a lack of conformity within two months after its discovery. A commercial guarantee must be clearly drafted and indicate what rights it gives on top of a consumer's legal guarantees.¹⁸

The CSD is the main source of specific definitions of products, guarantees, obligations, etc., for both producers/sellers and consumers (if they want to retain their consumer rights). It introduces the two-year guarantee period as a standard, but national implementation offers opportunities for sellers to avoid liability (for instance, by obliging consumers to examine the goods prior to signing the contract). The directive also offers obligations for repair. Most Member States require the seller to remediate a situation in reasonable time (CHAFEA 2015). The CSD has recently been examined for consistency with the Ecodesign Directive,

¹⁸ Source: http://ec.europa.eu/consumers/consumer_rights/rights-contracts/sales-guarantee/index_en.htm.

questioning the feasibility of the two-year guarantee period. As the Ecodesign Directive requires minimum lifetime standards for specific goods if they are to be placed on the market, consumers must be entitled (according to the Ecodesign Directive) to claim nonconformity during the entire minimum lifetime period. Consequently, the CSD's general two-year cut-off rule for claims for lack of conformity as from the date of delivery of the goods appears incompatible with product-specific ecodesign requirements (Schmitz 2015).

5.2.2. EU Consumer Rights Directive (2011/83/EC)

The objectives of Consumer Rights Directive (CRD) that are relevant to a longer product lifetime include, among others, harmonizing and clarifying parts of the consumer protection regime, with regard to pre-contractual information requirements, cancellation rights and responsibilities, delivery responsibilities, consent around additional payments and telephone costs where consumers are trying to exercise their consumer rights, reduction of compliance costs for businesses that export or wish to export in the EU (Department of Business Skills & Innovation UK 2013).

As with other European Directives that do not directly address the issue of product lifetime, this could also be improved through legislation on consumer rights. Having a minimum guarantee on products can motivate manufacturers to produce goods with a longer lifespan in order to avoid economic losses. Consumers must be aware of the expected longevity of the products that they purchase, and competition must be stimulated among manufacturers to produce durable, easily repairable parts on long-lasting products, especially in regard to the provision of spare parts.

Under the CRD, the seller is liable for a product for a period of two years; however, after the first six months, the burden of proof for a defect existing at the time the product was delivered lies with the consumer. While this aspect of the directive has been transposed in various ways among the Member States, Portugal has set a good example by extending the length of the rebuttable presumption from six months to two years. A general modification of the law to extend the right to a two-year guarantee to all Member States could motivate producers to make sure their products will not fail in a short period of time.

The majority of provisions contained in the CRD are full harmonization measures, minimizing the degree of deviations that Member States can introduce when transposing the regulations into national legislation. Implementation must be through regulation, and options regarding implementation are limited (Department of Business Skills & Innovation UK 2013).

5.2.3. Green Paper on consumer rights preceding the CRD (COM 1993)

This paper is an essential milestone in consumer protection as it marks a crossroad in guarantee standards and "normal" expectations for product performance. Despite the numerous references to the normal lifespan of a product, a normal lifetime is not defined in a quantitative way. The Green Paper's analysis of problems relating to after-sales services in the strict sense concentrates exclusively on the type of after-sales services more likely to have implications for the smooth working of the Common (Internal) Market, namely the question as to the availability of spare parts necessary for the operation, maintenance or repair of goods over their normal lifespan.

The paper is based on legislative examples from Germany, the Netherlands, Denmark, Portugal and Greece, France and Ireland. For example, commercial guarantees on cars: these were often limited to one year, but certain manufacturers offered three-year guarantees. Indeed, sometimes there may be major differences in the duration of a guarantee even within a given industry. Guarantee periods were harmonized as a result. Two conditions would be imposed on economic operators if they wished their commercial guarantees to be considered as "European": first, the application of standard guarantee conditions in all the Member

States for the same type of goods of the same brand; second, the real possibility of implementing the guarantee in all Member States, no matter where the goods were purchased.

The overall situation was created along an average existing length of guarantees. An exception was made for the Dutch situation, where "normal" guarantee standards from many products exceeded the two-year mark, with many products assumed to last between five and 10 years by court rulings. The law in the Netherlands uses a definition of "normal" lifetime in a qualitative way. This definition is inevitably culturally defined, depending on issues ranging from the way a product is typically used to meteorological conditions. The five key aspects taken into account by Dutch courts are (1) price, (2) type of product, (3) type of retail channel, (4) information provided by the legal salesperson and (5) written information provided by the OEM. For Dutch consumers, the Consumer Rights Directive meant a deterioration of consumer rights as it marginalized the option for consumers to claim guarantees in a legal dispute rather than following the standards as set by the CRD.

On several occasions, the European Parliament also emphasized the need for Community (Union) action in the domain of guarantees and after-sales services. The Commission called to "review the laws of the various Member States on guarantee schemes and to propose schemes that will ensure a minimum European standard, but to retain contractual guarantees that go further than this as a special form of competition and not to regulate them in European laws."

5.2.4. European Ecolabel initiative

The objectives of this policy are to assign an ecolabel, which is a voluntary environmental performance certificate that is awarded to products and services. These products and services have to meet specific, identified criteria (depending on the product groups), which reduce overall environmental impact. The EU Ecolabel fits the International Organization for Standardization definition for a Type 1 Ecolabel. This means the EU Ecolabel is voluntary, based on multiple criteria, where a third party awards the use of the label to indicate overall environmental preference within a particular product category based on life-cycle assessment.

Launched in 1992, the EU Ecolabel scheme promotes the production and consumption of products that have a reduced environmental impact in comparison to existing products on the market. Because the scheme works on a European level, it goes beyond the pre-existing national ecolabels that are often only known within national borders.

The European Commission manages the scheme at the EU level to ensure that the Ecolabel Regulation is implemented correctly. Even if the development or revision of EU Ecolabel criteria can be initiated and lead by parties other than the European Commission (States, Competent Bodies and other stakeholders), the Commission is in any case responsible for preparing the final draft of the criteria documents that have to take into account the comments from the European Union Eco-Labeling Board. The Commission adopts EU Ecolabel criteria for each product group as "Commission decisions" after the Ecolabel Regulatory Committee supports the criteria by a qualified majority.

Every four years, on average, the criteria are revised to reflect technical innovations such as evolution of materials or production processes, as well as factors like emission reduction and changes in the market. Because of this, you can be sure that the EU Ecolabel continues to stand for the highest environmental performance

The results expected from this initiative are the following:

- Greater voluntary use of the EU Ecolabel, awarded based on accurate, non-deceptive and scientific environmental information
- Increased interest in optimizing production and environmental management processes
- Increased awareness of the environmental impact of products and production processes
- Increased availability to organizations of reference information on how to improve, measure and benchmark their environmental performance
- A market for buying and selling products with reduced environmental impact
- Reduced environmental impact from consumption and production

5.3. **Other regulations or legislation**

Of the 10 million tons of WEEE in 2012, an estimated 1.3 million tons departed the EU in undocumented exports. The used electronic and electrical equipment exported typically has a considerable remaining lifespan and, thus, reuse value (Huisman et al. 2015). A significant share of the recycling of WEEE under non-compliant conditions in Europe is also related to cross-border transport.

Proper ecodesign would limit the environmental impact of WEEE over its total lifecycle and would keep the functionality demand intact. Furthermore, the prevailing “collective” character of the collection stream (products do not come back nicely sorted by producer) results in a limited role for design for recycling (Huisman et al. 2006).

The legal state-of-play of social enterprises offers a wide variety of situations. The 2016 Optimity report (Liger 2016) identifies three ways a social enterprise is acknowledged by a national government: explicit recognition of social enterprises and their special nature and needs; recognition of these organizations’ capacity and freedom to act in any area of social and economic activity; or recognition of their role as providers of services of general interest, viewing them as co-decision makers and co-executors of the policies. It is generally assumed that social enterprises have the potential to offer services that used to be regarded as government responsibilities. Member States that have developed legislation on social enterprises are Romania, Poland, Lithuania, Italy, Slovenia, Finland, the UK, Spain and France. Some of these countries seem to want to expand in terms of the number of social enterprises. In other Member States, the cooperative organization is embedded in a long-standing practice. The development of a Statute for a European Cooperative Society aims to regulate the competitiveness among social enterprises in the internal market, which seems relevant for design services, refurbishment and recycling. Transport costs and other transaction costs make it unlikely that repair services are subject to cross-border competition.

5.4. **Potential synergies of EU policy aimed at business and consumer behaviour**

5.4.1. **Circular economy initiative and European innovation policy**

The circular economy package reflects lessons learned in several streams of policymaking and implementation, amongst others from the recent IPP Package (COM 2001), the Zero Waste initiative (COM 2014b) and ongoing initiatives like Eco-design (COM 2009) and Resource Efficiency (COM 2011c). The circular economy initiative calls for systemic and transformative innovation and links its aims and actions to mainstream innovation policy in Europe (e.g., with the Horizon 2020 and Eco-innovation Action Plan). This has the potential

to create great positive synergies and renewal of business models but, at the same time, holds intrinsic contraction, given that current rapid innovation cycles tend to shorten the life of consumer goods. On the positive side, the fact that there are unexploited opportunities for the widespread adoption of new technologies and products arising, for example, from the Multi-KETs and Future and Emerging Technology Programmes could potentially spark transformative innovation. This will require the committed engagement of diverse stakeholders promoting longer life for products. (See, for example, the paper on new business models on new pilot lines arising from multi-KETs [Montalvo et al. 2014].) Such synergy facilitates further lessons and the application of instruments currently available for the promotion of change and innovation oriented towards longer life of products (e.g., access to finance, new skills, public-private partnerships and public procurement). The above implies the need to achieve a balance between policies enabling fast innovation that brings to the market better and more efficient products (in resources and energy) and the promotion of new initiatives aiming to optimise in the long term the embedded capital stock (in natural resources and economic terms) of products currently in use.

5.4.2. Green Public Procurement

Although GPP is a voluntary instrument, it has a key role to play in the EU's efforts to become a more resource-efficient economy. GPP has been endorsed in a number of EU policies and strategies, reflecting its potential to encourage a more sustainable use of natural resources, to establish behavioural changes for sustainable consumption and production, and to drive innovation (COM 2011a). To gain an overview of lifetime environmental impact, relevant GPP criteria are put in place. For specific products (e.g., vehicles), a common LCA methodology for total operational costs is provided. An update of GPP criteria is due for 2016, which is part of a continuing effort to facilitate the inclusion of green requirements in public-tender documents in a feasible way for purchasers throughout the EU. Executed by an expert group, technical reports¹⁹ are published bi-annually, on average, with a different sector subject to criteria updates for every report. The expert group consists of the European Association of Craft, Small and Medium-sized Enterprises; the European Environment Bureau/the European Consumer Organisation; and the International Council for Local Environmental Initiatives.

5.4.3. 7th Environmental Action Programme

The need for a revised, balanced and controlled set of information tools to influence consumer (enterprises or households) behaviour is clearly stated in the 7th Environmental Action Programme. There is also a description of the type of measures that are suitable at the EU level. Such policy instruments include economic incentives, market-based instruments and information requirements as well as voluntary tools and measures to complement legislative frameworks and to engage stakeholders at different levels (EU 2013). However, for clear examples and evaluations of instruments and information provision, one remains dependant on targeted reports and sources. These are discussed in Chapter 6. The evaluation of the 6th Environmental Programme is regrettably less informative regarding explicit policy measures (Pallemaerts and Geeraerts 2007).

5.4.4. SOLVIT

In 2002, the initiative was taken to encourage cross-border trade offering a wide variety of benefits. SOLVIT centres have been made available in each Member State to monitor and help resolve observed problems. The most common problems experienced are unjustified requests for extra tests or national testing certificates, requirements for a specific type of labelling, classification of products and applicable rules. These issues are especially

¹⁹ http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm.

detrimental in regard to refurbished goods or cross-border repair services, as these products are more vulnerable to different interpretations in terms of origin, manufacturer, legal obligations, etc. Marking products with certain eco-labels is another example (COM 2011b). The number of cases relevant to a longer product lifetime (LCA, guarantee periods, parts used) have increased, but whether the SOLVIT initiative has encouraged consumers to increase their cross-border trade, given the presence of an agency able to solve these problems, remains inconclusive. Evaluations of SOLVIT and the Entrepreneurship and Innovation Programme were both carried out by the Centre for Strategy and Evaluation Services in 2011, which indicated that awareness among users of the centres and among businesses was lacking (COM 2011b).

5.4.5. Information action tools and consumer behaviour

Recent research on the effectiveness of consumer information tools shows that there is little first-order innovation in tools for sustainable consumption and influencing consumer behaviour through policy (Scholl et al. 2010). Faced with a profusion of labels or environmental claims, EU consumers often find it difficult to differentiate between products and to trust the information available (COM 2015b). The social dimension of consumption and influencing consumer behaviour has been acknowledged. Not only does “peer pressure” matter, but public policy is also important: a public body needs to drive the debate. At the same time, given the difficulty to either establish or track the preferences of individual consumers, policy needs to be constantly monitored in terms of wording, focus, and accurate information. Social media can be instrumental in this.

Similarly, research on pricing policies has shown that information about lowering up-front costs for electric vehicles could have a greater effect on the consumer decision-making process because consumers put more emphasis on the up-front price than on variable costs (Gass et al. 2012).

Furthermore, research on policies on labelling the durability of a product on its packaging and how they change consumer behaviour shows that the impact of durability labelling on willingness to buy depends on the temporal orientation of consumers and their social background. Most remarkably, durability labelling has a positive impact on the perceived quality of low-priced products (Swaen et al. 2014).

5.4.6. Flagship initiative: Resource-efficient Europe

This flagship initiative²⁰ creates synergies with three core elements. First is the need to take coordinated action in a wide range of policy areas (notably political visibility and support). The second is to act according to the expected long investment lead-times: benefits for the EU economy should be anticipated for decades to come. Third is the empowerment of consumers (businesses and households) to move to resource-efficient consumption. This last element is linked to and creates synergies with policy measures to place greater emphasis on “getting prices right” and making them transparent to consumers. The introduction of shadow prices (i.e., the cost of negative externalities) to consumers, for instance using RFID tags, QR/bar codes, etc. These innovations have a clear synergy with the opportunities and barriers as described in the Digital Single Market Agenda. Another aspect of the Resource-efficient Europe initiative is to increase sustainability in EU trade, opening up new export markets by reinforcing the consumption of more sustainable products.

²⁰ <http://ec.europa.eu/resource-efficient-europe/>.

5.5. Synergies resulting from initiatives discussed in this chapter

Despite the efforts mentioned above, obstructions of the single-market rules are still reported. National regulations and practices continue to create barriers. National authorities often require specific proof of lawful marketing or simply refuse access to their national market. Economic operators are often required to produce specific documentation or carry out additional tests for their products (COM 2015a). A synergy is observed, however, through the existing operation of product contact points, where companies can check which legislation applies to them.

As announced in the Single Market Strategy, the European Commission will also develop a European agenda for the collaborative economy (COM 2015a). This is possibly the strongest example of synergy between the internal market and a longer lifetime for products, effectively opening opportunities for product service systems where ownership is exchanged for the use of a service.

Conditions are improving for EU-wide consumption of services by companies (albeit only around 25% of intra-EU trade). An evaluation of the Services Directive (COM 2015a), indicates that, for every service sector, barriers are diminishing. However, retail enterprises of all sizes and legal services are still confronted with the largest number of barriers, and the directive still suffers from incomplete implementation. As discussed in Chapter 2, these sectors might not be key sectors in pursuing longer product lifetimes, but they do thwart potential innovation related to take-back systems or reuse/shared-use systems.

Further evidence of consumer behaviour and the role of information campaigns comes from a study commissioned by the European Economic and Social Committee, which evaluated behavioural changes in the purchase of a product when its lifetime is indicated. The results of the study show that lifespan labelling has an influence on purchasing decisions in favour of products with longer lifespans. On average, sales of products with a label showing a longer lifespan increased by 13.8% over competing products. Varying effects and influences on purchasing decisions depending on the product was confirmed in eight of nine product categories tested: suitcase (+ 23.7%), printer (+ 20.1%), trousers (+ 15.9%), sport shoes (+ 15%), coffee maker (+ 14.4%), washing machine (+ 12.9%), vacuum cleaner (+ 12.3%) and smartphone (+ 11.4%). Lifespan labelling influences purchasing decisions, regardless of the product's price (+ 13.8%). The report cautiously posits that there is a price effect. As the amount that people are willing to pay for a product increases, the importance of lifespan also increases. In other words, it seems that lifespan labelling has more influence on purchasing decisions relating to high-end products (+ 15.3%) than low-end products (+ 14.1%) (Jahnich et al. 2016).

A concluding remark is about a stifling element in policies aimed at changing consumer behaviour: the "rebound effect." Even if consumption behaviour is changed, it can simply result in an increase of consumption of the same or other products that defeats the original purpose of the behavioural change. There is considerable empirical evidence that these effects occur (see, for instance Ayres 2009; Ivanova 2014; Maxwell 2011).

6. POTENTIAL EU INITIATIVES AIMED AT A LONGER LIFETIME FOR PRODUCTS

KEY FINDINGS

- The EU internal market could anticipate an increase of product service systems (PSS), which would require a new set of legislative tools. PSS do not, by definition, facilitate improved consumer-protection tools for governments.
- Development of key enabling technologies in the field of ICT (RFID tagging, internet of things and big data) have positively changed the prospects of product life-time policy dramatically, and will continue to do so in the coming years. While ICT applications offer opportunities for deployment of a longer lifetime for products, new technologies bring new challenges related to labour-force re-skilling, privacy and protection for both producers and consumers (i.e., industrial secrecy and protection of consumer privacy).
- Innovation is critical for competitiveness and jobs, but innovation cycles are potentially at odds with the longer product lifetimes. While offering better products and technologies, it often means discarding products that could still function for longer periods. Striking a balance between durability and bringing better and more efficient products in faster cycles remains a challenge for the time being.
- Currently, public procurement in Europe amounts to 14% of European GDP. This level of demand of final consumption within the EU underlines the purchasing power of public authorities and their leverage in dictating norms and standards for producers to consider in regard to product lifetime. Information on the benefits to producers and consumers is a necessary but not sufficient condition for the acceptance of longer product lifetimes for both groups. Potential policies aimed at increasing the provision of information are not expected to alter the low impact on behavioural change that has characterized current and past policies. Enabling programmes with incentives and supporting platforms are required.
- Potential EU policies with a greater likelihood of success are related to investment in green public procurement, education and public R&D&I.
- A redefinition of the term “planned obsolescence” is required, describing the phenomenon in a more general way and avoiding any impression of deliberate consumer deception.

This chapter presents a review of trends and issues that hold implications for longer product lifespans. These trends and issues pertain to the areas of business, consumers and government. The review includes issues arising from the deployment of new internet applications as well as information gathering and information flows in these areas. It provides a foundation for the measures described in the following chapter. The key findings of this chapter are related to §1.2, where the fundamental interaction between materials, products and services is laid out. The growth of product service systems is, in that context, the logical progression of a century-long trend in advanced economies relying more on services (combined with goods) rather than goods alone to provide the maximum utility to consumers.

6.1. Exogenous developments directing initiatives

6.1.1. Internet of things

The Internet has enabled the pooling of large amounts of information, and it is expected to pool information about equipment as well. For instance, this could be realized by an unobtrusive network of RFID tags being deployed on almost every type of consumer or durable goods. These tiny, traceable chips, which can be scanned wirelessly, are being produced in the billions and are capable of being connected to the Internet in an instant (Kranenburg 2007). These traceable chips enable the tracking of the good (its origin and material composition) as well as its usage (i.e., user behaviour). Whatever the eventual application of RFID, consumer protection will be challenged by this and other ICT developments (Consumer Reports 2011). The organization and management of information throughout the value chain and use phase is also referred to as “industry 4.0” or the fourth industrial revolution.

6.1.2. Privacy needs

Many opportunities for policy related to extended producer responsibility, total cost of ownership (TCO), chain transparency, etc., are related to the greater availability of information. This has potential conflicts with the Data Protection Directive.²¹ Tailored attempts to use consumer information constitute an infringement on the protection of privacy when it involves tracking individuals (through cookies, profiling and geolocation, etc.) (Valant 2015).

The advent of new big data technologies and data markets will play a major role in both technical opportunities as well as societal acceptance of a longer product lifetime, and touches upon virtually all aspects of a longer lifetime for products. To name some examples: smarter design from direct user feedback, lower transaction costs for shared use, improved repair from optimized provision of spare parts based on number and location of products in use, lower waste-treatment costs from optimized product discarding. The recurrent question is what information about the use of a product the consumer is willing to share and how “sharing” this relates to privacy.

6.1.3. Need for inclusive growth

Inequality is on the political agenda in many Western countries and is a key EU policy priority, with the debate ranging from inequality in income, skills, wealth, culture, etc. Inequality is observed between social groups in terms of educational attainment, geographic spread, generations, gender, ethnicity, faith and cultural background. The support and protection of the ability of all EU citizens to earn a living and reach their full potential remains a cornerstone of the Union (COM 2008).

6.1.4. Research, development and innovation

The dynamics of R&D&I are currently a core component of the Strategy 2020 and, in general, a cornerstone of international competitiveness. Innovation cycles are potentially at odds with longer product lifetimes because the notion of innovation leading growth is underpinned by the notion of creative destruction. This refers to the replacement of the old by the new, and currently the cycles of replacement are accelerating, often bringing better products and technologies but often discarding products that could still function for longer periods. Striking

²¹ Directive 95/46/EC on the protection of individuals with regard to the processing of personal data and the free movement of such data.

a balance between durability and bringing better and more efficient products in faster cycles will remain a challenge for the time being.

6.2. Initiatives to provide information for producers

6.2.1. Technical information on product design and standards

To facilitate an optimal lifetime for products produced and/or consumed within the EU, producers have the same need for information as consumers. Reaching professionals within companies is, or should be, part of policy efforts to provide information.

Various models on total cost of ownership (TCO) are available for companies, calculating the cost of using certain goods over their entire lifetime. The issue is not availability, but the accessibility, consistency and acceptability of the information from these systems. Standardization of TCO accounting rules could greatly increase producers' use of TCO models in decision making related to product lifetimes. Such a standard should be incorporated in current standards and regulations concerning the most economically advantageous tender in public procurement as well as the life-cycle costing standard of the International Reference Life Cycle Data System handbook, as provided by the European Commission Joint Research Centre (JRC).

A possible continued development related to reducing B2B transaction costs is suggested by the European Directive on Guaranties and Direct Producers Liability (COM 1985; COM 2007). To set up negotiated or mandatory enterprise resource planning, the producer might also choose to delegate this responsibility to a third party, a so-called producer responsibility organization, which is paid by the producer for used-product management. Expansion of mandatory enterprise resource planning schemes is generally objected to by current major OEMs (DG Environment 2015). An approach attempting to implement mandatory enterprise resource planning in Europe could well prove suboptimal. A more fruitful strategy would be to offer incentives and highlight the benefits longer product lifetime for OEMs (or other enterprises) willing to voluntarily meet any further enterprise resource planning requirements.

Trade with non-EU countries needs to anticipate initiatives aimed at longer product lifetimes. The companies within the EU that fully engage in global value chains could benefit from EU efforts to harmonize product standards in international trade regulations. In particular, the third countries should adhere to the same standards as EU Member States; the need for proper transposition is self-evident. Consumer protection could be at stake in the anticipated transatlantic trade agreement; the "mutual recognition" of US/EU standards, in particular, could open the backdoor to imports that do not meet EU standards (Phelan 2014). The introduction of product lifetime considerations could also be expanded in the existing General Agreement on Tariffs and Trade, with the World Trade Organization supervising the enforcement of legislation.

The conclusion of recent research on branch-specific remanufacturing companies in the south of the Netherlands interestingly observed that the development of new products requires the same set of R&D&I skills as innovation at the end of the first life phase (Mare Advies 2013), which makes all efforts aimed at overcoming R&D&I challenges applicable to a longer lifetime for products.

6.2.2. Initiatives to incorporate product lifespan in business decision making

The PSS, which is effectively a transition from ownership of a good to consumption of a service, is a key development for businesses. The EU Circular Economy package makes an explicit reference to the creation of greener products in the single market and to supporting recovery and recycling schemes.

The PSS sheds a different light on future ecodesign policy measures that explore setting a minimum guaranteed lifetime, setting a minimum availability time for spare parts, and promoting the modularity, upgradeability and reparability of products (EC 2009). PSS puts the discussion of lifetime guarantees in a different perspective, as it relates to guarantees on the functionality of a service rather than guarantees relating to a good. For an in-depth overview of PSS concepts, see also Fischer et al. (2012).

The possible burden of enterprise resource planning could be relieved by offering public financing schemes to cover business activities. The best example is the waste-treatment premium that is part of the consumer price in many EU states (hidden taxation) when a new product is purchased. These premiums are nevertheless often underused by companies who don't know how to access these funds and to benefit from this financial support (Gombault 2015).

Innovation could also come from a new type of data, the type a producer needs in a collaborative, shared-use system. In the event that data on the use of products by consumers would be voluntarily made available to manufacturers, a bonus-malus system could be introduced. In insurance, it is common practice to let the size of the premium be dependent on the individual's claim history. This system is also called a no-claim discount or no-claim (Lemaire 1995). For final consumers sharing information about their "reliability as users," a discount for prudent users would be a similar pricing option. The fact that businesses are developing and exchanging information (for instance, between insurance companies) to track the reliability of a consumer might create possible conflicts with the personal data regulations of EU citizens (Kotterink et al. 2013).

6.3. Initiatives to provide information to consumers

Information is assumed to help consumers make better decisions and to benefit society as a whole. However, increasing consumer information does not necessarily increase consumer protection (Council of Europe 2009). If providing information is done in order to make the receiver more responsible for the outcomes of resulting decisions ("transferring guilt"), it can't be considered as consumer protection.

6.3.1. Initiatives to incorporate product lifetime in decision making (labelling)

The following measures are generally regarded as possible ways to inform consumers about the characteristics and durability of their purchase: figures, grades, scaling systems, aggregated indicators, best-in-class label, shelf tag, package, bar code, QR code, etc. Below are some examples of measures gathered by BIO IS (2012) in a previous study of the literature and consumer tests:

- General terms for the indicators and simple units of measurement using an easy-to-understand rating system are preferred over technical descriptions (e.g., "climate change" is preferred over "CO₂ equivalent").
- Absolute values by themselves are not sufficient to communicate multi-criteria environmental information to consumers. An ordinal scale (e.g., between 1 and 10) should be used.
- Using smartphone (i.e., mobile-device) technology to communicate environmental information could allow consumers to access detailed product information when making their purchasing decision.
- Consumers express a desire for environmental information, but only about half look for it. The information therefore needs to be obvious (difficult to miss) and explicit (easy to understand).

The volume of consumer information (labels, advertising, promotion, etc.) is enormous, but there is a trend to make the information easier to understand. Also identified is the need to protect consumers from false and misleading information, although it is very hard to prove from a legal point of view.

Information can support consumer decisions in both acquiring a product and discarding it. The reasons for premature disposal of products were shown to be as much emotional and social as to do with a product's design and functionality, although the two are often interwoven (Beagan et al. 2010; Park 2010 cited in Cox 2013; Schifferstein et al. 2004), which illustrates potential room for consumer information.

This also relates to planned obsolescence, which is a strategy used by companies that consists of designing products so that they become unfashionable or no longer functional after a period that is shorter than the product's technical requirements and properties would allow. The core business model of product lifecycles over time is a business standard. To directly provide information on the most recent demonstrated functional lifetimes of products would reduce the appeal of this practice. The wording "planned" implies intent, and some indications suggest that such intent might exist in the case of particular products, but one can argue at length whether this is indeed the case. Whether obsolescence has been built into a product deliberately or not could play an important role in the level of public outrage (Brönneke 2015).

The most flagrant cases of planned obsolescence could, if dealt with, improve confidence in European businesses (EESC 2013). An independent testing programme is recommended to be included in the Circular Economy action plan in order to detect such practices and ways to address them (COM 2015b).

6.3.2. Initiatives to maximize product utility

The ability of consumers to retain the functionality (i.e., utility) of a product can evidently contribute to its longer lifetime.

A very significant development in recent years includes the repair cafés or "hack spaces," which represent a broad range of initiatives that can vary in size, visibility, business arrangements and level of technical expertise. They share one attribute: they offer repair and refurbishing services to people. The repair cafés do not often adhere to legislation related to workspaces for employees, but describe themselves as "still a place where rigorous research and experimentation occurs,"²² offering value by extending the time one can utilize a product or even increasing the value of utilization. For example, a useful ICT tool of such initiatives to maximize the life of products is embedded in the internet portal Ifixit.com, a source of information enabling service for various products.

Suggestions for better information for consumers about the costs of repair and parts (as opposed to obscurity in markets: e.g., replacement of car parts) point at the Digital Single Market once more. Access to information comparing sales channels is widely available, but often difficult to find and use.

Related to services to repair products, inputs to operate the repair service are also required. User manuals are legally provided by OEMs, but the quality and lucidity of the manuals varies and is not a priority, although writing manuals is reported to be a significant cost for manufacturers. The gap can be filled by people posting instructive videos, for instance, on streaming services like YouTube. Policies could be developed to allow social enterprises to provide this service.

²² www.socialvsocialaluelab.org.

Information for consumers about purchasing used products could play a role supporting longer product lifetimes. The image of remanufactured products still seems poor, and companies that provide remanufactured products report many cases of superior business cases being rejected because of this (Yalabik et al. 2013). Empirical research has demonstrated that many respondents see remanufactured products as being of inferior quality or status compared to newly manufactured equivalents (Guidata et al. 2015).

6.3.3. Consumer protection and information flow

An often proposed approach to translate TCO data into comprehensible information is to express all of a product's utility in a pay-per-functional-unit system (EMF 2015b). With such a system, a customer could directly assess how many hours of operation, number of operations, distance, etc., that a piece of equipment would deliver. Using price as incentive, this would deliver a clear measure describing the cost of all functionality provided throughout the lifetime (i.e., use phase) of a product.

Consumer confidence relies on the proven accuracy of such information. Violation of reliability could either harm the product (and the corresponding producer) or the authority responsible for enforcing regulation. This demonstrates the difference between types of consumer confidence. Given the division of marketplaces and public authorities that are common throughout the EU, a focus in consumer protection could be one of confidence in law enforcement rather than confidence in products consumed within the EU, regardless of origin (Govier 2012).

Information seems unlikely to make consumers more aware of "planetary" problems. Given that environmental concerns are rarely the primary driver for changes in social behaviour, it is likely to be more effective to build pro-environmental behaviours through the use of complementary drivers for action like social justice, health, or children's well-being rather than only environmental concerns (Natural Scotland 2013). Cultural and/or behavioural aspects of consumption seem therefore dominant. Vendor "lock-in" is a common phenomenon. It concerns virtually the whole spectrum of products used in households, from cosmetics through electronic and electrical equipment and building materials. (The benign twin of this effect is called "customer intimacy," which can be seen in, for example, the tendency of consumers to buy what their parents did.) For product lifetime, the most relevant examples are obsolescence of a part of the "whole" product, although each of the parts could otherwise be general-purpose. For instance a computing device that, due to deliberate restrictions, can only run a specific operating system, which only allows playback of files from a specific source. Possible new repercussions for consumers of PSS from vendor lock-in are conceivable. Yet these business models should enable a consumer to shift from using/consuming a certain product relatively easily where they "only" pay for the service and not the ownership.

Policy proposals that help deliver other policymakers' primary concerns (for instance health or jobs) through longer product lifetimes are likely to be seen more favourably by the general public (COM 2013a). This also relates to the involvement of retail, among the biggest private sectors in terms of jobs in the EU. Retaining productivity, i.e., keeping people employed in retail, could be targeted in policy. The involvement of retail organizations (including the not-for-profit retail sector) could be targeted in policy. Customer rewards at a retailer as a result of "customer loyalty" and take-back systems could provide a boost to creating jobs. The retailing sector could also play a vital role in take-back systems. The empirical results of advanced return fee systems (or take-back deposits) show positive results in the Netherlands and in Switzerland (for SENS and WECycling, respectively). A good way for OEMs to extend their transactions with customers are competitive swap-outs. On the other hand, recent

empirical evidence gathered among OEMs showed that 80% of manufacturers would not like to see its products returned after their economic lifetime (Stevens 2012).

6.4. Initiatives relating to government responsibilities

6.4.1. Public procurement

On average, public procurement in Europe amounts to 14% of European GDP (Cernat and Kutlina-Dimitrova 2015). This level of final-consumption demand within the EU underlines the purchasing power of public authorities and its leverage to dictate norms and standards for producers to consider designing their products with longer lifespans. It suggests that policy instruments targeting institutional arrangements might be useful in changing consumption patterns (Umpfenbach et al. 2014). There could be an overlap between procurement and research in the standards and units that can be used to make transparent and quantified decisions. For example, the Ellen MacArthur Foundation proposes an actual average number of functional units achieved during the use phase of a product (EMF 2015b). This would allow a product's lifetime to be evaluated on the basis of the service it provides to the owner, allowing for a better estimation of utility than purchasing price. It is vital that, for major product groups, lifetimes are determined on their actual performance rather than estimations. These concepts could be used in new Eco-Directive standards, enabling producers to express performance in a way that is closer to the reality perceived by consumers.

6.4.2. Education and research

The Horizon 2020 Programme, the 8th Framework programme of the EU, is bound to be the largest public research and innovation program ever. The Circular Economy Package urges Horizon 2020 programmes and tools, with corresponding funding from the European Investment Bank (European Fund for Strategic Investments), to focus not only on waste treatment. In terms of funding, 650 million EUR and 5.5 billion EUR could be used from the Horizon 2020 and structural funds at the national level, respectively. The advised focus from the Package relates, for example to LIFE, COSME and tools like IPCEI from the European Investment Bank. It has been observed that clarity of criteria is not sufficient to assess the potential impact of research in this context, jeopardizing the perceived efficiency and efficacy of these programmes. Opportunities for a transition towards a circular economy featuring a longer lifetime for products (basically all elements of a circular economy apart from recycling) could be left unexplored. The European Investment Bank is allowed to develop criteria putting an emphasis on design, shared use and reparability of products, so it could be engaged to do so.

For the economic effects of a longer product lifetime, further quantified modelling is advisable, especially to describe the indirect and often offsetting rebound effects along the chain from a change in demand or supply resulting from longer product lifetimes. The development and/or application of computable general equilibrium tools, however far from perfect (Bergman 2005), is an essential scientific research development. The analytical power of these types of analyses lies in the accounting aspect of "saved" and therefore shifted expenses from economic agents. In other words, "What will they do with the money they save as a result of a longer lifetime for products?" An example of such research is the paper by Kagawa et al. (2009) that contributes to modelling a simple social accounting method with cumulative product lifetime distributions and argues how longer product lifetimes affects income flow throughout the entire economic system.

Sound accounting, including defining new accounting rules, is another form of research worth extending. The "ProSUM" project, commencing in 2016 as a Horizon 2020 project, will estimate the "urban mine" (the stock of products, used or not, present in households,

companies and other (mostly public) buildings) in the EU to a degree of accuracy that has never been provided before. This will give conclusive evidence, given current processes and technologies, supporting the use of current and outdated stock for remanufacturing or recycling.

6.4.3. Active labour-market policies

Fighting unemployment could be complemented with the use of programmes aimed at a longer lifetime for products.

The repair and refurbishment aspect of longer product lifetimes has potential synergies with labour-market policies. Parliamentary studies provide overviews of the policy measures in place to encourage and support the employment of people with disabilities: for example, sheltered workshops, reasonable accommodations, alternative labour-market policies and universal design (also known as “design for all”) (Mallender et al. 2015). These policies are interesting because they provide opportunities for producers to deploy people and, by doing so, making them productive, which could not be accomplished at the value level of the minimum wage in that specific Member State. From a societal point of view, these policies relate to such areas as guidance and counselling, training and education and job placement. From a business point of view, it simply means productive, qualified labour at a below-minimum-wage rate.

The development of skills and knowledge related to design, coordination of shared use of products, repair, refurbishment and waste collection and treatment could be enforced using European Regional Cohesion Fund. The aim of the fund is, among other things, to reduce economic and social disparities and to promote sustainable development. Several initiatives to create and maintain social capital have been part of the Cohesion programme over recent decades and are part of future investments by the fund.

6.4.4. Taxation

In general, shifts in taxation are among the most frequently debated governmental options, and a longer lifetime for products is no exception. The Commission’s persistence and continuous emphasis through the European Semester on the importance of shifting taxes away from labour has shaped the tax policy agendas of a growing number of Member States. Ample evidence of the impact of the Commission’s emphasis on the tax shift can be found in the reform programmes prepared by Member States as part of the European Semester cycle.²³ See the body of taxation papers for more in-depth analysis, for instance Taxation Paper No 1 (2004).

²³ Member States’ national reform programs for the period 2010-2015 are published online on the website of the European Commission on Europe 2020.

7. POTENTIAL MEASURES FOR SMART, SUSTAINABLE AND INCLUSIVE GROWTH

KEY FINDINGS

- The monetary value of a product—the price—is by far the most important piece of information for consumers of all types to act upon.
- From the perspective of consumer protection, potential measures to support longer product lifetimes include public debate concerning the benefits of longer product lifetimes, empowering product repair and servicing initiatives, communication with consumers, and extending and harmonizing consumer rights across Member States.
- Potential measures from the perspective of the single market include promoting new business models based on ownership substitution and individualization, and capitalizing on social enterprises.
- Synergies between measures related to the Digital Single Market and longer product life are strong and should be developed further. Activities of the European Data Protection Supervisor (EDPS) should be integrated into this analysis. The set-up of the analysis of policy synergy should, however, not be overly ambitious. The current market systems and corresponding technology, legislation and culture related to longer product lifetimes represent a complex and intricate system. An analysis of policy synergy that is either executed too quickly or based on a scope that is too extensive, could be flawed, given the complexity of the system.

In this chapter, we discuss the review conducted in the previous chapter in more detail and link its insights to potential measures (in regard to the single market and consumer protection) that could support a longer lifetime for products, taking both legislative and non-legislative measures into account.

Despite the irrational aspects of market pricing, in the context of policy measures, market prices are by far the strongest incentive for human behavioural change (Simon 1959). This leads to the general recommendation, based on the literature and interviews, that pricing mechanisms provide one of the most effective bases of societal impact. Moreover, consumer protection will benefit from information directly related to shadow prices hidden in the total cost of ownership.

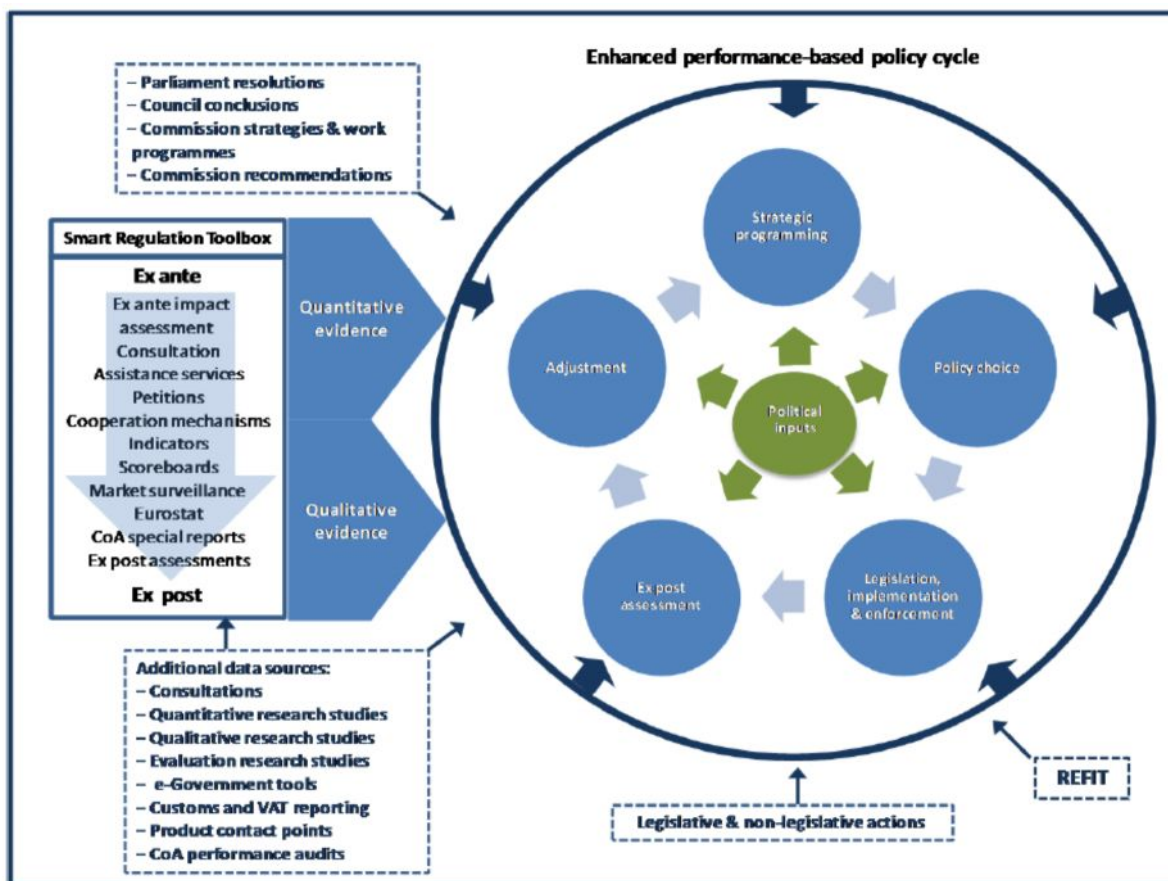
Non-legislative measures refer to and primarily target, the promotion of changes in consumer behaviour, and support systemic eco-innovation in companies. Overall, the non-legislative measures suggested are related to activities where the European Commission and the European Parliament have prior experience and where there are already platforms to support the measures proposed. An advantage of the suggested set of measures is that all of them support innovation and competitiveness. Such a position is strongly linked to policies like the circular economy, but also well beyond the environmental realm, including, for example, Innovation Union, support to SMEs, and the Digital Single Market (DSM).

Legislative or regulatory measures should be translated into Member States' laws using the normal procedures of parliament and the commission. Assessment and active monitoring of any legal measure is a necessary requirement. Policy synergies, be they positive or negative, are especially relevant for situations where private expenditures on R&D&I are diminished as a result of protective or descriptive legislation. This would be the case when policy invokes

protectionism, unbalanced legal obligations (i.e., only applying to EU businesses) or undesirable lock-in effects (creating path dependency with subsequent market failure).

During the review of the literature and consultation with experts, a range of promising non-legislative options arose,²⁴ and these have been organized into a set of topics (Table 14) that serve as a framework to present and propose potential measures. All measures proposed in this chapter are categorized based on the system for smart single market regulation developed by (Muller et al. 2015), which provides a framework that explicitly enables the use of performance-based policy cycle as a basis for classification (Figure 4).

Figure 4: Recommendations presented in diagram form; position based on policy cost, societal benefit and feasibility of implementation



Source: Muller et al. 2015.

This framework includes categories like location of the measure proposed in the policy cycle (“Dominant cycle phase – measure type”), the aim of the proposed measure, if there any alternatives to the measure proposed (“Alternative options”), and indications of relevant approaches that could fit the measure (adopted from the “smart regulation toolbox”). Table 14 displays each category and its internal logic.

²⁴ For a good introductory overview of potential measures, see also PSI (2014).

Table 14: Structure of Potential Measures, Based on System for Smart Regulation

Dominant cycle phase & type of measure	Definition of objectives	Alternative options available	Relevant items from smart regulation Toolbox
<ul style="list-style-type: none"> • Council conclusion • COM programmes • Parliament resolutions • COM recommendations • legislative & non-legislative actions • REFIT 	How can measures be assigned with SMART objectives?	Are alternative measures identified in other policy documents?	<ul style="list-style-type: none"> • Ex ante impact assessment • Consultation • Assistance services • Petitions • Cooperation mechanisms • Indicators • Market surveillance • Eurostat • Court of Auditors (CoA) special reports • Ex post assessment

Source: Müller et al. 2015.

In Table 15, an analysis of the trends and drivers described in the previous chapter is presented, showing the classification of measures according to their topic. Each topic is further elaborated in the rest of the chapter. This analysis connects longer product lifetimes to consumer protection and competitiveness in the single market. It should be noted that continued improvement of implementation is not considered an isolated measure. Current implementation is very important, but should be scrutinized through a meticulous ex post legal evaluation and is therefore out of the scope of this chapter.

Table 15: Main Topics of Potential Measures Related to a Longer Lifetime for Products

Dominant responsibility of IMCO committee	Topic
Consumer protection	Public debate concerning the benefits of a longer lifetime for products
	Empowering repair initiatives
	Communication towards consumers
	Extension and harmonization of consumer rights
Internal market	New business models, based on ownership substitution
	New business models, based on individualization
	Capitalizing upon social enterprises
	Autonomous growth of digital services
	Communication of environmental risk

7.1. Measures related to consumers and consumer protection

7.1.1. Public debate about longer product lifetimes

Awareness of environmental sustainability is increasingly gathering momentum among both producers and consumers. Widespread and international public debate on the pros and cons of a generalized extended lifetime for products is likely to be beneficial in the promotion of this topic. In addition, consumers increasingly look for sustained utility in their products. Note that utility does not automatically mean a longer product lifespan; it is actually mostly related to an extension of the service provided by the product and/or retailer. The Grech report (COM 2008) makes a clear statement about this: consider the major role consumer associations play in circulating information to consumers about their rights, supporting consumers in consumer disputes and promoting consumer interests in the construction of the internal market.

The European Bureau Européen des Unions de Consommateurs (BEUC) or, as they prefer to be called, The European Consumer Organisation is active in Transatlantic consumer dialogue and would be a possible partner in expanding the dialogue. Recent studies report that widespread public debate is a precedent for the creation of institutions advocating specific social issues that affect investment in new technologies and new business models. This is supported by Montalvo and Leijten (2015) in patenting and investment in new renewable energies worldwide, and Vallejo (2015) reports on actions taken by the automotive industry following customer preferences for more environmentally friendly cars. These innovations are examples of a positive relationship between consumer information and a longer lifetime for products, which is exemplified by the widespread public debate driven by the climate-change agenda: i.e., the close relationship between investments and subsequent availability of renewable energy technologies supporting CO₂ emissions.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> Strategic programming & COM Programmes Parliamentary resolutions 	Could be expressed related to media attention and synergies with NGOs	No	<ul style="list-style-type: none"> Consultation Assistance services Petitions Mechanisms for cooperation

7.1.2. Empowering repair initiatives

The development of repair cafés, social-value labs, hack spaces, etc., appears to be strong and consistent. Disagreements and disputes between the citizens engaged in such social initiatives and OEMs are also likely to grow. There seems to be a clear role for the EU to draw the boundaries between practices that empower and benefit EU society and practices that violate intellectual property rights (IPR) and other business interests of the OEMs.

For commercial repair services in general, the improvement of regulations concerning the availability of comprehensive repair manuals and spare parts listings is crucial for the growth of these types of companies. This relates to the already existing market (termed “aftermarket”) for new and used spare parts for durable goods. Provision of information to garages and independent repair companies that provide support to regulation EC595/2009 concerning the reparability of motorized vehicles is a relevant example of this.

Tax reductions for repair and remanufacturing/refurbishment activities represent a feasible financial measure, and current quantified studies should prove them to be beneficial to

society. Such measures should, of course, preferably be harmonized within the EU. It should also be borne in mind that all such repair-service companies are very likely to be situated near consumer markets and therefore will create higher skill jobs regionally, even though the product might have been produced in a third country.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> Legislation, implementation and enforcement & (non-)legislative action REFIT 	Could be expressed as number of reported disputes and tax yields	Refraining from tax reductions is a valid and accepted alternative	<ul style="list-style-type: none"> Ex ante impact assessment Market surveillance Petitions CoA special reports Ex post assessment

7.1.3. Communication with consumers

The development of both standardized information (at least at the EU level) about a product's TCO and shadow price (e.g., monetized life-cycle analysis on social and environmental impact) is a challenging task. At the same time, a huge body of knowledge and information is available within the EU and third countries. If government institutions supply this information, it could create an incentive for businesses to customize and improve the body of knowledge and available information.

Various schemes to introduce this basic information could be developed over time (possibly many years), both to maintain credibility and not to overburden the organizations likely to supply this kind of information. The literature suggests that introducing this kind of information along with the conventional market price (for instance using QR codes) would influence the consumer behaviour that takes all effects of product consumption into account, as it is so closely linked to the prime decision factor of any purchase: the true market price.

Continued efforts to improve the provision of information on product durability and cleaner production could be made. Promotion of a new culture of consumption has proven difficult so far, but even so, it has delivered results.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
Policy choice & COM recommendation	Could be expressed in share of purchases in retail featuring on-line data use	Deploy resources on informing producers and professional purchasers	<ul style="list-style-type: none"> Ex ante impact assessment Petitions Consultation Assistance services Indicators

7.1.4. Further extension and harmonization of consumer rights

Arguably the most debated field related to a longer product lifetime is the possible regulatory extension of guarantee periods. As discussed earlier, the average expected lifetime of products is by no means a quantified or standardized entity; differences in consumer usage can, for some products, result in significant variation. The highest standards, as investigated by the Green Paper on consumer goods (COM 1993) could be reconsidered as standards to

be applied throughout the EU. Promoting collaboration between insurance companies and OEMs is a possible avenue to explore.

The increased harmonization of consumer rights proposed under the Consumer Rights Directives has led to an increase in trade between consumers and businesses across all EU Member States by reducing non-tariff barriers such as transaction costs and differences in pre- and post-sales obligations facing retailers. In addition to the benefits to business currently exporting across the EU, the Consumer Rights Directives should reduce the reluctance of firms to export abroad (Department of Business, Innovation & Skills UK 2013). A clear potential policy programme would be to extend the reduction of transaction costs incurred by companies in order to offer specialized life-extending services. This could be done by adopting standards about the quality of repaired and refurbished goods, currently developed and used by service-providing companies.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> • Adjustment & Parliamentary resolutions • (Non-)legislative action 	<ul style="list-style-type: none"> • Could be based on macro-economic transport and trade margins • Lifetimes do not offer much consistent information 	Save policy costs on enforcement	<ul style="list-style-type: none"> • Petitions • CoA special reports • Ex post assessment

7.2. Measures related to strengthening the internal market

7.2.1. New business models, based on substitution from ownership to use

Enabling the expansion of the product service system (PSS), i.e. the collaborative economy, sharing economy, “servitization,” etc.), could be the single most important set of measures discussed in this report. Reliable information for businesses (general characteristics of user, specific type of use of their product, payment security) is a key factor in the development of business models based on PSS. This involves the use of personal data, which means that, for the EU and Parliament, legislation should anticipate PSS expansion—in situations where personal information from consumers is guaranteed by law as well as guarantees in performance of products. It is not self-evident that the benefits of PSS schemes will spread evenly over all size classes of business (in terms of people employed).

Moreover, new business models can create new market failures from consumers unaware of being locked in to a certain consumption pattern. Extended monitoring of abusive practices, focused on business in a collaborative economy, is possible within the current enforcement structure. Existing business models, mostly related to leasing, are available for developing appropriate monitoring operations.

Further consideration needs to be given to the implications for EU citizens with regards to individual who are fully dependent under a wide range of PSS contracts. This could be fine for people who are fully employed and earning, but very challenging if they become unemployed, disabled, retired, start a family, etc., and their income drops. If such scenarios become widespread, then Member States could face a significant challenge in social support.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> • Strategic programming & Council conclusion • COM programmes 	Could be expressed in share of rental and leasing activities in EU economy	Continue to extend producer responsibility based on existing market model pursuing ownership	<ul style="list-style-type: none"> • Ex ante impact assessment • Consultation • Cooperation mechanisms • Market surveillance • Eurostat

7.2.2. New business models, based on individualization

The notion of new business models underpinned by new products, functions, services and practices has received much attention over the last five years (Boons et al. 2013; Schaltegger et al. 2015). The advent of new design, manufacturing and information technologies applied to the way companies run their manufacturing operations offers great potential to the benefits of longer product lifetimes. Currently companies are experimenting with new ways of manufacturing, making the series of production of “one” fully customized product a reality. This offers a new dimension for consumption patterns moving from depersonalized products/services to full bespoke customer intimacy with new products that imply far more loyalty and attachment for the longer term towards specific products that follow the design, expected lifespan and quality requested by clients.

This new product scenario opens a completely different way of consuming and of keeping consumer goods for a longer time. New ways of manufacturing, such as 3D printing—additive manufacturing (AM)—offer the possibility of enhancing the reparability/availability of spare parts for new and vintage products.²⁵ But the option of supporting new business models requires new policy approaches, which have, at the moment, not been developed in sufficient detail. The availability of instruments like Horizon 2020 is currently enabling experimentation with new pilot lines for smart manufacturing as well as new business models for the circular economy. Major challenges in this new type of business model are to create one-of-a-kind, bespoke, products that comply with product standards, certification and safety.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> • Legislation • Implementation and enforcement & COM recommendation • REFIT 	Needs decentralized monitoring, given disruptive and unpredictable nature of AM	No	<ul style="list-style-type: none"> • Consultation • Cooperation mechanisms • Market surveillance

²⁵ See www.smartindustry.nl and www.industry4.0.de.

7.2.3. Capitalizing upon social enterprises

There are a number of current governmental tasks in EU Member States that could be transferred to social enterprises to fulfil some of the responsibilities of the EU. For instance, the collection of certain products that are at the end of their economic lifetime, training and educating the unemployed (young and old), disabled and retired. This would allow the option of experimenting with certain policies and would embrace the virtues of trial and error within predefined constraints in terms of time and geographical scope.

Recent case studies and legislation in France and Spain show the potential of equipping employers with tools to provide funding for employees to take a financial stake in the company, even taking over the full production site. These examples of legislation on the level of a Member State show the credible legal status of social enterprises, making them more suitable for undertaking a specific public service for the benefit of all.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> • Adjustment & Council conclusion • (Non-) legislative action 	Could be expressed as share of private sectors that is community owned	Adhere to strict rules of enterprise operations in order to increase legal compliance and tax yields	<ul style="list-style-type: none"> • Assistance services • Petitions • Cooperation mechanisms • CoA special reports

7.2.4. Autonomous growth of digital services

The widespread adoption of information and communications technology (ICT) by the manufacturing industry and traditional production operations is increasingly blurring the boundaries between the real and the virtual world in what are known as cyber physical production systems (CPPS). CPPS not only network machines with each other, they also create a smart network of machines, properties, ICT systems, smart products and individuals across the entire value chain and the full product life cycle. Sensors and control elements enable machines to be linked to plants, fleets, networks and human beings. These developments could be highly disruptive to the manufacturing labour market in the medium and long term. The EU should prepare scenarios for further centralization of skills and knowledge in manufacturing industries, focusing on retaining the productivity of the EU labour force. This is directly related to being able, for both companies and households, as well as repair services, to “understand” the product they use and to be able to make optimal decisions about their own utility, as a company using products for their economic activities, when acquiring and using a product.

This topic is indirectly related to trade regulation. Increasingly, EU households and companies are in direct contact with non-EU (third country) organizations. EU consumers are in need of protection if they are accustomed to more stringent standards from EU legislation and the supply of a product is not clearly attributable to an EU company. At the same time, if EU customers grow accustomed to higher (voluntary or mandatory) product standards in imports, their confidence in EU industry and government will diminish. For this reason, it is essential to monitor the differences among product standards and to react quickly when EU standards are found to be lower.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> Strategic programming & COM programmes Parliamentary resolutions 	Could be expressed in satisfactory ICT-based transactions and corresponding consumer-satisfaction surveys	Anticipating (i.e., waiting on) market developments to emerge and provide evidence	<ul style="list-style-type: none"> Cooperation mechanisms Market surveillance CoA special reports

7.2.5. Environmental risk communication

The notion of environmental-risk perception and environmental behaviour has been reported to have a positive relationship with the adoption of cleaner technologies (Montalvo-Corral 2002; Montalvo 2008). The argument is that those producers and consumers that have a higher perception of risk are more prone to use cleaner technologies. This is directly related to the promotion of a new culture of products with extended lifespans that minimize environmental damage, thus minimizing environmental risks in the longer term. The promotion and awareness of time-discounting environmental effects would benefit an agenda for longer product lifetimes.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
Policy choice & Council conclusion	No suggestion	No	<ul style="list-style-type: none"> Consultation Assistance services Petitions

7.3. Measures related to synergies with other EU policies

7.3.1. Application of policy synergy models

The many aspects of the product lifetime debate are reflected in the number of topics discussed in this chapter. We echo the advice of Muller et al. (2013) to analyse synergy into in a detailed logic model or map. This model could show how the policy under consideration would yield the expected outputs and outcomes, how exogenous factors (other policies and socioeconomic factors) would also be likely to have an impact on the evolution of the selected outcome and output indicators, and how the policy under consideration would contribute to (or hinder) the achievement of the objectives of other policies. By itself, a longer product lifetime is a complex problem (Ashby et al. 1996). It seems hard enough to capture the essential features of the current market systems and corresponding technology, legislation and culture related to longer product lifetimes. To rely on demonstrable evidence of policy synergy would, in that sense, raise expectations too high. This could thwart policies that could potential produce benefits individually, supported by a societal cost benefit analysis.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
Ex post assessment & COM recommendation	Based on synergy modelling exercise	Put emphasis on acceptance of common understanding of interdependencies among EU bodies	<ul style="list-style-type: none"> • Consultation • Ex post assessment

7.3.2. Autonomous expenditures of public R&D&I

The advent of the new wave of digitalization of industrial activities linking strong customer intimacy to production enables the flexibility of design approaches and the flexible control of supply and production chains. This is well understood by major manufacturers, who are taking this opportunity to reorganize their production systems. This new way of digitalization opens the door for new business models that explicitly consider an extended product life with the active participation of producers and consumers alike (Boons et al. 2013). New experiments in new manufacturing pilot lines that are embracing the digitalization of industry are already considering and including many environmental features such as energy and resource efficiency, for example. This is already happening in the context of initiatives like the European industrial renaissance (key enabling technologies, new value chains and pilot lines, etc.). An additional feature of extended product life would require the modification of business models to entice consumers to commit to longer stewardship of their consumer/capital goods (Montalvo 2014).

An analysis of policy synergy in the form of performance-based assessment has several possible advantages. It is especially worth considering given the intricate nature of product lifetimes. Moreover, it fosters the process of de-silo-ing European policy in EU directorates.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> • Policy choice & COM programmes • COM recommendation 	Based on improved data on R&D expenditures that are already reported in Eurostat	Direct financial support to encourage business expenditures on R&D	<ul style="list-style-type: none"> • Consultation • Indicators • Eurostat • CoA special reports

7.3.3. Digital single market

The continuous development of the digital single market (DSM) is likely to take down barriers to smart, economic and sustainable growth. Developments related to the transition towards a sharing economy will likely result in increased internal trade and innovation. More e-commerce generates tangible benefits for consumers, such as rapidly evolving new products, lower prices, more choice and better quality of goods and services, thanks to cross-border trade and easier comparison of offers (Bolognini and Legovini 2012). Using smartphone technology to communicate environmental information could allow consumers to access detailed product information when making their purchasing decision. This coincides with the need for safe, legal, secure and affordable digital transactions. This synergy is in the

developmental stage. For instance, the EU's Data Protection Directive has not yet covered significant common ground with the debate on longer product lifetimes, but this is a relationship that will likely materialize in the near future. The activities of the European Data Protection Supervisor should be synchronized.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
Policy choice & Parliamentary resolutions	Could be based on intra-EU cross-border trade volume	Emphasizing policy implementation on a national level	<ul style="list-style-type: none"> • Consultation • Assistance services • Indicators • Market surveillance

7.3.4. Circular Economy Package

The Circular Economy Package offers a list of possible initiatives related to a longer product lifetime. This demonstrates the significant overlap between the circular economy and longer product lifetimes, as discussed in §1.2. Here, we highlighted two measures that signify this.

First, extending producer responsibilities towards mandatory take-back systems for products is a possible measure. Like other options for extended producer responsibility, it should be treated with caution because OEMs in many sectors are still hesitant to become involved in these processes. Similarly, planned obsolescence is named and targeted in the package document. It is worth considering whether these efforts will have an effect, since the topic is highly contested by OEMs as well as ill-defined in legal terms.

A second interesting note on the proposed Circular Economy Package is the consideration of materials, notably the security of the supply of critical raw materials for Europe. Again, policy actions on longer product life and the effects on the security of the supply of critical raw materials are not well understood.

Largely missing from the Circular Economy Package are initiatives aimed at reducing energy use in the production or use phase. A CE should be run on low-carbon renewables, and again, such a transition will present significant challenges to material supply, especially critical raw materials.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> • Strategic planning & Council conclusion • Parliamentary resolutions 	Could be based on innovative value-creation model or classic material-flow accounting techniques	Provide clearer set of measures based on Circular Economy Package	<ul style="list-style-type: none"> • Ex ante impact assessment • Indicators

7.3.5. European Fund for Strategic Investments or Juncker plan

The financing schemes of the European Fund for Strategic Investments (EFSI)—or Juncker plan—related to the package will in every scenario contain over 300 billion EUR worth of

funds to support R&D&I for companies. There is a possible policy disconnect, however, because the criteria to which enterprises need to adhere in order to access the funds are virtually absent. A potential policy would be to set a clear set of rules on how to allocate these funds.

Criteria for the Juncker plan are not tailored to a longer product lifetime, or even the circular economy, which makes the resulting actions prone to policy disconnect. Although the 10 priorities of the plan are only indirectly linked to a longer product lifetime, it will be vital to explore possible contradictory elements or preferable synergies resulting from the investments. Given the scale (315 billion EUR) and scope of the plan, this action is urgent.

Dominant cycle phase & type of measure	Define objectives	Alternative options available	Relevant items from smart regulation toolbox
<ul style="list-style-type: none"> • Policy choice & COM programmes • Parliamentary resolutions • COM recommendation 	Based on policy targets	Relying on current supporting framework of plan	<ul style="list-style-type: none"> • Ex ante impact assessment • Consultation • Assistance services

8. CONCLUSIONS AND RECOMMENDATIONS

KEY FINDINGS

- Value of EU-level initiatives. The potential of exchanging ownership of products to the supply of services related to those products is huge. Enabling these PSS markets is the single most important conclusion of this study.
- Potential benefits for businesses, consumers and the environment. In general, economic benefits relate to EU competitiveness in terms of trade balance and to product utility for final consumers. Social benefits relate in general to the ability of all citizens to acquire skills, knowledge and employment and to provide for themselves. Environmental benefits generally relate to a reduction of negative external effects that reduce ecological capital without market price compensation.
- Sectors likely to gain from a longer product lifetime. Sectors providing services for specific product R&D, repair, maintenance, leasing and renting are most likely to benefit from longer product lifetimes. An indicative value creation of an annual 7.9 billion EUR is feasible within the EU after five years as a result of effective policy implementation.
- Communication to consumers. The bottleneck of consumer information is not the result of lack of availability. The challenge is in making the content acceptable for producers, wholesalers, retailers and final consumers, to support consumer decisions.
- Potential measures and recommendations. Measures on consumer protection relate mostly to institutional and consumer behaviour. Measures on strengthening the internal market aim to overcome the barrier of reduced sales as a result of longer product lifetimes. A list of 19 recommendations, organized in five policy mix sets is drawn up based on this study.

The conclusions of the study focus on key issues addressed in this report. The recommendations focus on the potential initiatives as discussed in Chapter 7. Focused conclusions are outlined in §8.1 to §8.5; recommendations are outlined in §8.6, in tables and in a diagram.

8.1. The value of initiatives at an EU level

Among the most significant conclusions in this report is the potential of exchanging ownership of products to the supply of services related to those products. This trend is put in perspective in Chapter 1 and is the key finding of Chapter 6. It is aided by expressing product lifetime in utility/functional units, thereby focusing on the service provided rather than the mere existence of a physical product. In this process, the EU market can anticipate an increase of product service systems (PSS) (i.e., collaborative economy, sharing economy, stewardship). This potential grossly exceeds the estimated 7.9 billion EUR value creation. Rather than trying to only “win the last war” (e.g., focusing solely on guarantee periods and extended producer responsibility), the value of policy at the level of the EU is to anticipate this fundamental shift in type of consumption.

The proportionality principle can be applied to many conclusions and subsequent recommendations. There is a considerable scope for action at the European level for initiatives on safeguarding privacy laws, hard laws on harmonization and extension of guarantee periods, and clarification of contract terms and conditions. Most significantly, the

legal outlines (potential business) and/or obstacles (existing business) in a marketplace dominated by PSS/collaborative economy should be mapped out.

The subsidiarity principle can be applied to a few recommendations. These are supported by the finding that 7.9 billion EUR is a conceivable annual increase of GDP as a result of a longer product lifetime. The principle applies to EU initiatives on testing and executing tax measures, supporting social enterprises or civil initiatives (e.g., hackspaces), engaging consumer associations, etc.

It is suggested by stakeholders that the single greatest potential negative effect of a longer lifetime for products needs to be clearly and concisely communicated. This is reduced sales of new products. Some companies in some sectors stand to lose value as a result of shifting demand for goods and services. For all companies, the transition will be challenging.

The funds of the ESFI (Juncker) plan, well over 300 billion EUR, need a concise but robust allocation mechanism to avoid a policy gap. The funds should be aimed at R&D&I on an SME level, realizing economic, social and environmental benefits.

This report echoes an important finding from Lacourbe (2015), that, despite the presence of many price-regulation mechanisms for relevant products, increasing standards can actually increase the profit ratio of an OEM. Potential EU policy that is less likely to meet resistance and which would therefore be attractive to businesses, jobs and growth is related to Green Public Procurement, education and public R&D&I investment.

Aiming EU policy to directly strengthen consumer confidence in products might be inefficient, as the EU is not the supplier of the products. Protecting consumers could instead be aimed at strengthening confidence in government interventions and law enforcement.

A redefinition of planned obsolescence should be crafted by policymakers and researchers. Describing the phenomenon in a more general and consistent way is a precondition for legal and non-legal measures that fight unnecessary obsolescence. It should avoid companies being accused of deliberately taking advantage of consumers.

8.2. What are the potential benefits for businesses, consumers and the environment?

The overall impact of a longer lifetime for products is part of the impact reported for an increase in circularity (circular economy). However, impact from a longer product lifetime is not, by definition, the same as maximizing valorization of (raw) materials.

The benefits of longer product lifetimes are best fitted in both the classic triple P (people, planet, profit) structure of the Brundtland report (Brundtland and World Commission on Environment and Development 1987) and the smart, inclusive and sustainable goals of Europe 2020. Benefits (and costs) could be expressed according to this structure.

When discussing economic benefits, the 7.9 net value creation (i.e., annual increase in GDP after five years) can be used as a yardstick. This number, albeit the result of a simple first-order calculation, provides an order of magnitude for preliminary discussions on costs and benefits.

Economic benefits relate in general to the competitiveness of the EU. Social benefits are generally related to the ability of all citizens to acquire skills, knowledge and employment and to provide for themselves. Environmental benefits generally relate to a reduction of negative external effects that reduce ecological capital without market price compensation.

The fact that costs and benefits accrue on different economic agents results in split incentives, which echoes the key finding: that agents incurring more costs than benefits resemble

barriers. They also make certain policy options undesirable and/or inefficient from a broad well-being perspective.

Rebound effects, the increase of consumption with more or less equal negative externalities, should be taken into account when designing policy. Only when consumption is shifted to a good (or more likely a service) with less negative environmental or societal impact can benefits be considered real.

8.3. **Who is benefitting from a longer lifetime for products?**

Sectors providing services for specific product R&D, repair, maintenance, leasing and renting are those most likely to benefit from longer product lifetimes. An indicative value creation of an annual 7.9 billion EUR is feasible within the EU after five years as a result of effective policy implementation.

The question of the distribution effects of European Policy initiatives is of primary importance for legitimization and acceptance. The most salient distribution effects on sectors arising from longer product lifetimes are in those sectors providing services for specific product R&D, repair, maintenance, leasing and renting. These are the sectors most likely to benefit from a longer lifetime for products.

Those sectors engaged in manufacturing goods are the most likely to be the target of extended product lifetimes. In their case there is the potential to either increase or decrease their value-added. All manufacturing sectors show the potential to suffer from an increase in product lifetimes, thereby representing barriers and certain outright undesirable scenarios, even from a broad well-being perspective.

The full spectrum of economic agents (households, SMEs, social enterprises, etc.) shows significant potential to benefit from a longer lifetime for products, with the agents with the weakest information base (household, social enterprises and SMEs) being the most likely to gain, in terms of both occurrence and volume.

Producers and processors of raw materials stand to gain the least, given current business models, but that could change if the business models change along the value chain. Examples would be if these non-energy extractive industries adopt activities related to reverse logistics and production of secondary materials.

8.4. **How can the benefits of a longer lifetime for products be better communicated to consumers?**

Household consumer behaviour is, to only a limited extent, influenced by the measures that are typically conceived as being feasible in terms of government policy directly aimed at changing behaviour patterns. This relates mainly to providing additional information, and it seems to have only a marginal effect. Households respond more to social pressure, but most of all to price incentives.

The bottleneck concerning product information is not the availability of the information, but making it acceptable/understandable for both producers/sellers and final consumers, so that consumers receive and act upon it.

A previous study (BIO Intelligence Service 2012), laid out in §6.2.1, explored a range of opportunities for communicating with consumers. Some key findings of this study are the following:

- General terms for the indicators and simple units of measurements using an easy-to-understand rating system are preferred over technical descriptions (e.g., "climate change" is preferred over "CO₂ equivalent").

- Absolute values by themselves are not sufficient to communicate multi-criteria environmental information to consumers. A simplified scale should be used.
- Using smartphone technology to communicate environmental information could allow consumers to access detailed product information when making their purchasing decisions. Consumers express a desire for environmental information, but only about half look for it. The information therefore needs to be obvious (difficult to miss) and explicit (easy to understand).
- However well designed the message, potential policies aimed at increasing the provision of information for consumers are not expected to change the low impact in behavioural change that has characterized current or past policies.

8.5. **Which non-legislative or legislative measures at the European level would be effective and proportionate? Are there existing gaps in legislation that could be closed?**

The EU has a broad regulatory framework for environmental and consumer protection and the functioning of the single market. To date, the review indicates the lack of a dedicated framework for a longer product lifetime. The experience of the EU in setting existing frameworks is the biggest asset that would enable the promotion of new schemes supporting longer product lifetimes.

The great impetus given to innovation in the current 2020 Strategy might be at odds with the notion of a longer lifetime for products, given the high rates of replacement of consumer products. A balance must be achieved in order to allow the improvement of products and the life extension of those already in use.

Behavioural change in consumers and companies has been studied from cultural, psychological and economics perspectives over decades, although theoretical and empirical guidance for policy design and policy implementation in practice has failed to live up to expectations.

Enterprises active in the internal market of the EU respond to EU policy reasonably well. Although many repair and refurbishment activities suffer from suboptimal supplies, the internal market is, in most cases, not the most prominent barrier.

Corporate and government consumers respond well to policy. As shown in Table 5, the Green Procurement policy is part of final government expenditure representing no less than 27% of total final consumption in the EU. This allows for more than merely demonstrating desirable consumer behaviour by governments; it allows direct and significant control of final consumption behaviour in the EU.

Initiatives promoting eco-design, eco-innovation and the circular economy indicate an ambition to promote the redesign of products and to consider and label the durability of products. Selection of pilot products remains on the horizon.

By making explicit linkages with mainstream innovation policy, the circular economy initiative opens synergies to capitalize on existing policy instruments that can support the extension of product lifetimes. Given the fast pace of product innovation, this also brings to the forefront a relative lack of coherence between current innovation policy and any policy package promoting a longer lifetime for products.

Innovation rates are likely to go up as a result of applying policies aimed at a longer lifetime for products. Discounting direct rewards for companies, studies (on innovative behaviour, for example) indicate that regulation and policy are the second most important underpinning innovation, particularly for environmental innovation. Policies that are unbalanced towards producer protection (as opposed to consumer protection) are found to frustrate innovation.

Actors in sectors related to repair, maintenance and refurbishment are developing standards on functionality, performance, lifetime, wear, etc., themselves. Adopting these market-developed standards as EU standards and processing them to eco-directives is not only efficient, but ensures a commitment from the private sector to adhere to them.

The strong and well-developed set of skills and knowledge from the field of marketing could be wielded for a longer product lifetime. This would require incentives from companies acknowledging the business value of a longer lifetime for them. EU policy, and corresponding messages to the general public, should be created according to the messages consumers receive from commercial promotional messages. Alignment of private marketing strategies and EU policymaking should be explored.

8.6. Recommendations

The EU has a broad regulatory framework that could well fit and take up initiatives promoting a longer product lifetime for consumer and durable goods. Many actors will have to be involved in the process of setting the new standards and regulations that are needed to make a longer lifetime for products possible.

For additional context, we suggest grouping recommendations into policy-mix sets (see Table 16). These sets group recommendations that are similar in nature, but can differ in terms of policy costs, estimated benefits and feasibility.

Table 16: Policy-Mix Options, Grouping Recommendations from Table 15

Policy mix #	Policy mix name	Description
1	Product service system mix	Focused on acceleration of ownership-service transition, performance economy, collaborative economy, servitization, etc.
2	Consumer information mix	Focused on TCO provision and direct support “during sale decisions”
3	Direct government control mix	Focused on direct government mandate and budgeting
4	Preparation for the future mix	Anticipating disruptive and/or ambitious developments
5	Pragmatism mix	Adopting current ideas and practices, based on stakeholder input from sectors likely to gain from longer product lifetimes

A number of recommended actions, listed below in Table 17, could contribute to a longer lifetime for products in Europe. All indicative scaling is based on a tentative expert judgement from various sources and interviews. The rating and ranking should be taken as indicative and is open to further discussion and further elaboration. The table is primarily sorted based on societal benefits: recommendations with the greatest benefits are placed on the top rows. The second ordering is based on policy costs: less expensive policies are placed above more expensive options. The column in the extreme right indicates that that specific measure already exists in practice in the case study (indicated by the “case number x”) presented in Chapter 3.

The societal benefits can be interpreted as part of the indicative annual increase of EU-28 GDP of 7.9 billion EUR, which could be the result of effective policies aimed at a longer lifetime for products after five years.

The scales are nominal, from least to most, as indicated by the following symbols:

- Policy costs: € (least costly) to €€€€€ (most costly);
- Total societal benefits: + (least beneficial) to +++++ (most beneficial);
- Legal/cultural/technical feasibility: (least feasible) to (most feasible).

Table 17: Recommendations to Capture Benefits of a Longer Lifetime for Products (Tailored to IMCO Responsibilities)

Recommended initiatives	Policy cost	Total societal benefits	Legal, cultural, technical feasibility	Mix #
Provide standardized TCO information. Provide information next to actual market price, expressed as TCO during average lifetime and shadow-prices. Teaming up with OEMs and their marketing power is an option in specific cases where public and private incentives are aligned (§6.2.1 and §6.3.1)	€€€€€	+++++	vV	2
Safeguard personal data related to consumer product. Anticipate legislation on PSS related to personal data. The Data Protection Directive should be amended based on experiences with current PSS business models (lease) (§6.1.2)	€€€€€	+++++	vV	1
Flag AM lock-in practices. Anticipate consumer protection needs related to Additive Manufacturing products, avoiding products i.e. materials to be supplied, used and repaired within the EU (§6.3.3 and §7.1.2)	€€	++++	v	4
Strict regulation on manuals and spare parts. Provide repair service providers with replacements and manuals. OEM's should be subject to enforcement of regulation, aimed at the provision of these materials (§6.2.2)	€€	++++	vVv	5
Monitor non-EU guarantee standards. Investigate and monitor difference between standards of EU and ex-EU products. EU business is not served by maintaining lower production standards than competition from outside the EU (§7.1.2)	€€	++++	vVv	3

Recommended initiatives	Policy cost	Total societal benefits	Legal, cultural, technical feasibility	Mix #
Create performance standards for PSS. Anticipate legislation on PSS related to performance standards. Consider the supporting role, and resulting business, that this activity could also mean for retail (§6.2.2 and §7.1.2)	€€€	++++	vW	1
Connect a longer lifetime for products to policy goals in Juncker plan. A longer lifetime for products and the circular economy are only implicitly part of the current Juncker plan. The efficiency and efficacy of investments will suffer from a lack clear criteria for assessing the potential impact of investments. Specifying goals will prevent this (§6.4.2 and §6.4.3 and §7.1.3)	€€€	++++	vW	3
Use consumer associations. Link lifetime research with initiatives from consumer associations (§7.1.1)	€	+++	vW	5
Flag PSS lock-in practices. Monitor abusive consumer PSS practices, with producers/sellers taking excessive advantage of shortcomings of consumer behaviour or acumen (§6.3.3 and §7.1.2)	€	+++	vW	1
Create assessment standards for GPP. Enable purchasers throughout the EU to support their procurement decisions on economic, social and environmental value. Use the frequent adaptations in GPP criteria to implement this (§6.4.1)	€€	+++	vW	3
Outsource public services to social enterprises. Allow social enterprises temporarily to take up public services For instance related to waste collection, enforcement of regulation etc. could be taken up by social enterprises (§6.3.2 and §6.4.3)	€€	+++	v	3
Standardize CSD definitions based on practice. Adopt repair and refurbish standards created by companies and incorporate them into ecodesign directives. (§6.3.2)	€€	+++	vW	5

Recommended initiatives	Policy cost	Total societal benefits	Legal, cultural, technical feasibility	Mix #
Tax reduction for circular services. Homogeneous tax reduction for repair and remanufacturing is always worth considering. Empirical evidence is available from similar initiatives in MS over the last years (§6.4.4)	€€€	+++	√	3
Support repair cafés. Provide repair cafés with legal support about IPR and reduce barriers for these organization to participate in public R&D&I (§7.1.1.)	€€€	+++	√√	4
Social enterprises as educational institutes. Support social enterprises to train or educate workforce. This initiatives should be aimed at repair and maintenance of both household products and capital stock used by SME's (§6.4.3)	€€€	+++	√	4
Extend guarantees in CSD. Extend and harmonize European standards on guarantees within the EU, updating the Consumer Sales and Guarantees Directive. The costs of extension are mainly based on the expected increased exposure of companies, not to policy costs or R&D expenditures (§7.1.1 and §7.1.2)	€€€€	+++	√	4
Extend consumer information available during sale. Increase quality and volume of consumer information in general (not TCO or shadow price), making it available during the purchase of a product. For instance using QR codes (§6.3.1 and §7.1.1)	€	++	√√	2
After-use responsibility shift. Explore further possibilities to shift after-use collection responsibility to OEM, focusing on information provision to producers to access funding schemes that have substantial funds available but are underused from information shortage. This recommendation (essentially EPR) assumes the current dominant business model based on ownership (§7.1.3)	€€€	+	√	4
Flag planned obsolescence. Monitor and flag practices of planned obsolescence based on standards from Consumer Sales Directive and Consumer Rights Directive (§6.3.1)	€€€€	+	√	4

For further illustration, the expert-judgement-based estimates of table 17 have been translated to a diagram in Figure 5. Please note that policy costs are considered negative and are therefore placed in a “negative” (left) direction.

A final context for the recommendations is provided by Table 18. It illustrates which case studies from Chapter 3 already realize the essence of the recommendations in their business operations.

Figure 5: Recommendations presented in diagram form, placing based on policy cost, benefits to society and feasibility of implementation

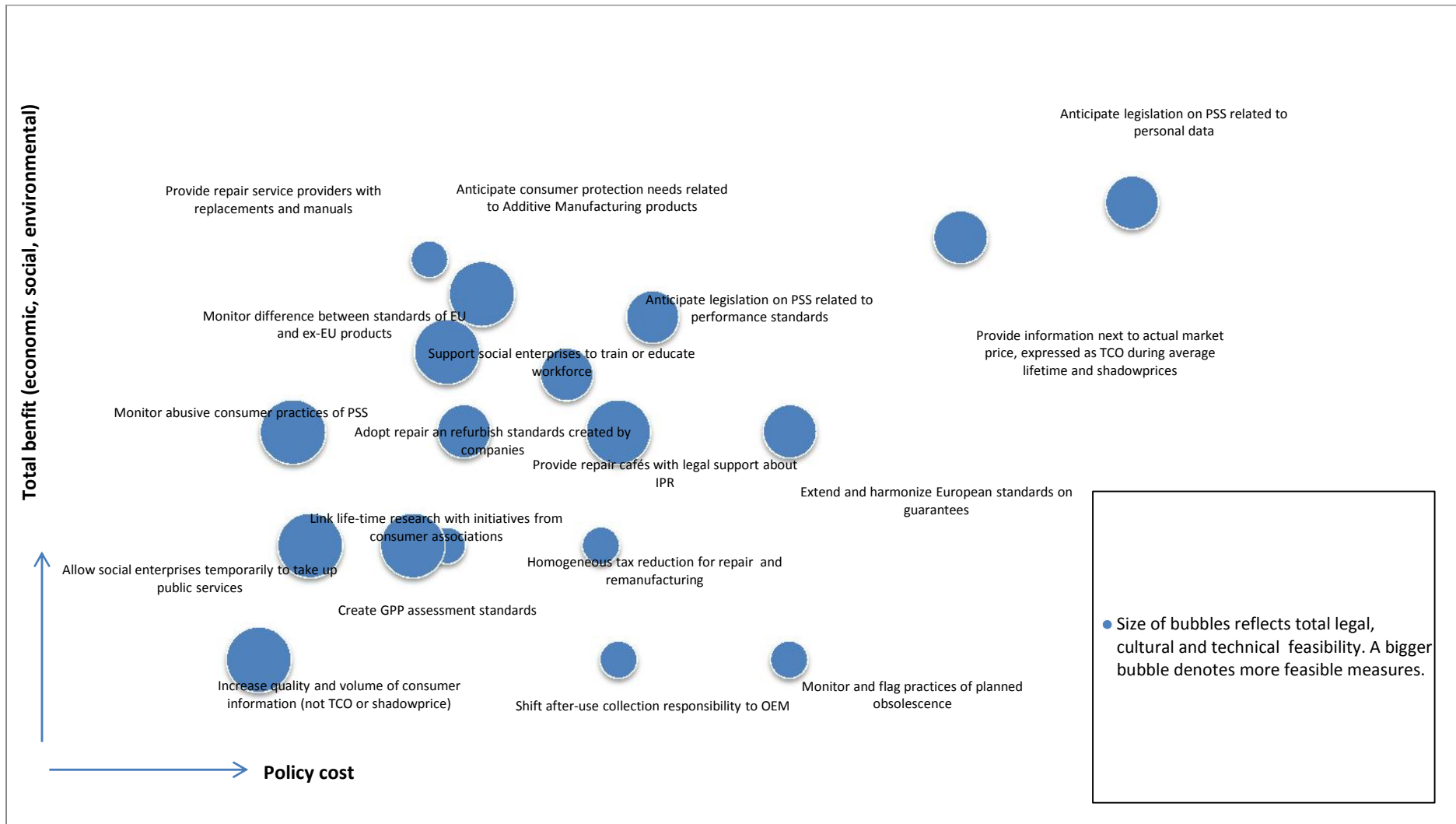


Table 18: Recommendations Linked to Case Studies

Case study	Recommendations relating to the case study
1. Malongo coffee machines	Extend consumer information (mainly environmental) and standardize CSD definitions based on practice (mainly extended durability)
2. Rapha	Anticipating PSS standards, extend durability and after-use responsibility shift
3. Project TARA	Social enterprises as educational institutes, outsource public services to social enterprises and strict regulation on manuals and spare-parts
4. Regeneris	Strict regulation on manuals and spare-parts, extend durability, support repair cafés, tax reduction for circular services and after-use responsibility shift
5. leapp Apple remanufacturers	Strict regulation on manuals and spare-parts, extend durability, tax reduction for circular services and after-use responsibility shift
6. Fairphone	Strict regulation on manuals and spare-parts, ex-EU guarantee standards monitor, flag planned obsolescence.
7. Tesla	Provide standardized TCO information, extend guarantees in CSD

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