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CAN EUROPEAN ECO-INNOVATION POLICIES ACCELERATE THE UPTAKE OF PRODUCT-SERVICE SYSTEMS?

Keywords:

product-service systems (PSS), eco-innovation, sustainable consumption and production, sustainability policy, innovation policy, sustainable business models.

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Can European eco- innovation policies accelerate the uptake of Product-Service Systems?

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Abstract:

Despite the apparent potential of product-service systems (PSS) as a more profitable, resource efficient and socially responsible form of eco-innovation, there has seemingly been limited uptake of this type of business model. A current gap in the literature is that most of the available academic work on PSS has focussed on design strategies, environmental potentials and uptake in industry, but few have explored the role and importance of public policy and policy intervention. Recent policy reports suggest a recent interest of policy makers in the identification of policy mixes that support new forms of eco-innovation. The European Union (EU) has a broad set of policies in place to support the adoption of sustainable development principles in businesses. In spite of the availability of a rich set of innovation and sustainability policies, the current focus of intervention is not directly targeting the promotion of PSS. Using narrative analysis of eighteen key policy papers and a number reports, the authors of this paper offer an exploratory analysis of European policy and its potential for supporting the market uptake of PSS. The outcome of this analytical effort presents work in progress aiming at identifying adequate mechanisms of support using the existing policy instruments in Europe. The main message unveiled by this explorative analysis is that only less than a handful of existing policy instruments in the EU have good potential to foster market uptake of PSS. Notwithstanding, about a dozen of instruments could potentially be modified to improve their potential to support PSS.

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1 Introduction

In the context of global warming and an increasing depletion of natural resources the promotion of eco-innovation has come to the forefront of theoretical and empirical research and of policymaking. It is over a decade now that the opportunities for sustainable solutions through product-service systems (PSS) caught the attention of businesses and policy makers (PSS) (Manzini and Vezzoli, 2002, Mont, 2002). PSS encompass service-oriented approaches that embrace a change of business focus from individual products to total integrated customer solutions (Tan et al., 2010). PSS have been considered as a business model that promotes more radical forms of eco-innovation (Jing and Jiang, 2013).

Despite the apparent potential of PSS as more profitable, resource efficient and socially responsible, there has seemingly been limited uptake of this type of business model. Policy makers around the globe have paid attention to the promotion of PSS (e.g. US EPA, 2009, COWI, 2008, Bartolomeo et al., 2003). Notwithstanding, (European) policymaking lacks adequate analytical and intervention frameworks, which could foster their market uptake.

The European Union (EU) has a broad set of policies in place to support the adoption of eco-innovation in businesses. It is often mentioned that systemic, radical eco-innovation ought to be encouraged. The main intervention framework that attempts to bring these policies together is the Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan and the introduction of Integrated Product Policy, extended producer responsibility (EPR) principle. Specific policies for the promotion of eco-innovation exist, such as the Eco-innovation Action Plan (EcoAP). But formally, none of the aforementioned policy approaches explicitly target PSS.

It is against this backdrop that the authors of this review paper provide an exploratory analysis of the field of policy intervention for PSS. The aim of this review paper is twofold. On the one hand this paper aims at the identification of existing policy instrument in the European policy environmental and innovation policy toolbox. In the other hand, it presents an exploratory enquiry about specific policies with the potential to foster the uptake of product service systems (PSS).

A review of the state of the art of the study of public policy and PSS/servitisation is presented. The literature review unveiled that most of the literature on PSS has focussed on design strategies, environmental potentials and uptake in industry, but few have explored the role and importance of public policy and policy intervention (Mont and Lindhqvist, 2003). The literature review also revealed that no academic study has explicitly focused on the positive connection between environmental and innovation policies for the promotion of PSS.

Building on widely acknowledged contributions from the field of environmental policy intervention, this paper uses concepts of market and system failure in relation to the promotion of new forms of eco-innovation (Kemp, 2011), such as PSS. The analysis of the information presented in this paper is based on qualitative methods for data collection and analysis. Given the lack of focus of

PSS literature on the effects of policy intervention, it was important to obtain empirical evidence on the role that different policies could have in fostering the uptake of PSS in Europe. Based on narrative analysis of a series of key EU policy documents in the period 2003-2013 and publicly-funded studies funded in the period 2009-2011, the authors of this paper identified and cross-checked important policy areas linked to PSS and make initial propositions of their potential to help the promotion of this type of business model.

The main outcome of this paper is an exploratory analysis of European policy (and its potential) to suggest a policy action framework for PSS to support policy makers in their efforts to achieve sustainable development and to promote eco-innovation uptake in Europe and other World regions. The final version of such a framework is currently under development.

The remainder of this paper is organised as follows. Section 2 presents a literature review on environmental and innovation policy, with a special focus on the development of a policy intervention rationale for the uptake of PSS. Section 3 presents the research methods guiding this review paper. Section 4 presents the results of a narrative analysis of selected policy instruments with the potential to influence the uptake of PSS. Finally, in section 5 the authors of this paper present some preliminary conclusions, in particular how new business models for resource efficient, more sustainable product-services are influenced by policy action.

2 Literature review

This section presents an introduction to the topic of PSS, sustainable business models and the rationale for policy intervention, mostly framed within market failure logic. Understanding the history of policy developments and current state of the art is important before performing any exploratory analysis about the potential of selected policy instruments, which could help promoting the uptake of PSS. The subsequent sections present a brief historical account of the main policy developments in Europe related to PSS. This is followed by two additional sections discussing the relation of PSS with sustainability and innovation policies, respectively.¹

2.1 PSS as a sustainable business model for eco-innovation

Product service systems (PSS) can be defined as service-oriented approaches that embrace a change of business focus from individual products to total integrated customer solutions (Tan et al., 2010). Eight types of PSS can be identified (Tukker, 2004): product related, advice and consultancy, product lease, product renting/sharing, product pooling, activity management, pay per service unit, and functional result. Examples of the above include energy saving companies, chemical management services, and design, build, finance and operate projects. PSS have been acknowledged in number of recent reports as a form of sustainable or eco-innovation (e.g. Beltramello et al., 2013).²

The use of policies to promote PSS has attracted some academic interest over the past decade (Mont, 2002, Manzini and Vezzoli, 2002). But within the policy sphere it still remains an elusive concept. On one side, although the potential business, consumer and environmental benefits seem to be promising, it is not a given that PSS are in actual fact a more resource efficient and sustainable approach to production and consumption (Tukker and Tischner, 2006). On the other, it is not clear what is the role of policy in fostering the uptake of PSS in the market (Mont and Lindhqvist, 2003). Recent publicly-funded studies have been commissioned in order to understand what policy intervention are needed in order to influence eco-innovation in green business models (e.g. Bisgaard et al., 2012). But it is not yet clear how different policy mixes will operate and how effective these will be.

Traditionally, approaches to minimising environmental impact of companies have focused on the life cycle stages of production and supply, through pollution control (so-called end-of-pipe approaches), and cleaner production technologies (Manzini & Vezzoli 2002). This later expanded to also focus on cleaner products throughout their entire life cycles. Stahel's (1997) approach to sustainability included the consumption and demand of products. He identified four main strategies that contribute to more sustainable solutions:

- Sufficiency solutions (demand side).

¹ Please note that in this paper we use an interchangeable use of the terms 'sustainability policies', 'sustainable consumption and production policies' and 'environmental policies'. The reason for this is that the authors of this paper mainly focus on European SCP-related policies (see section 2.2), which include both environmental and consumer-oriented interventions. In this paper the authors use the generic term 'innovation policies' for addressing the whole set of 'science, technology, and innovation' and 'innovation and competitiveness' policies.

² In this paper the authors use the term eco-innovation to denote innovations with both economic and environmental benefits. See Ekins (2010) and Kemp (2010) for review of the topic.

- Systems solutions – reducing volume and speed of resource flow (supply and demand side efficiency).
- More intensive use of goods reducing the speed of the resource flow (supply and demand side efficiency).
- Longer use of goods reducing the speed of the resource flow (supply and demand side efficiency).

Environmental effects of products occur in all of a product's life phases (Wenzel et al., 1997), but traditionally manufacturing companies are responsible for the production of their products, but only involved to a limited degree in the use phases. For many (especially energy consuming) products, the largest environmental effects occur during the use phase.

The World Business Council for Sustainable Development (WBCSD) acknowledged that a total life cycle perspective must be considered, and identified four areas where companies could combine economic and environmental performance (WBCSD, 2001):

- Dematerialisation by developing ways of substituting material flows with knowledge flows.
- Closing production loops by ensuring outputs and waste that can be used as resources in the same or other production systems.
- Service extension by developing customised responses to customer needs through leasing.
- Functional extension by manufacturing products with new and enhanced functionality and selling services to enhance the functional value of those products.

PSS attempts to incorporate all of the areas above as it provides companies with the possibility to respond to customer needs efficiently and sufficiently. In many cases, it is not the product and its technology that is the problem, but the (mis)use and (over)consumption patterns which emerge when the product is subject to users in practice.

The concept of sustainable business model refers to key company dimensions of successful market introduction of eco-innovations: it specifies how a firm is able to earn money from providing products and services. This includes not only the value proposition to customers, but also the value creating constellation in which the firm connects to suppliers and acquires resources in a profitable manner. It also includes the financial model (Boons and Lüdeke-Freund, 2013). One of the best known models for business models is the Canvas model (Osterawlder and Pigneur, 2010), including elements such as growth strategy, key partners, resources, value proposition, cost structure, comparative strategy, etc.

A study performed for the European Commission (COWI, 2008) identified PSS to be the most promising type of business model with potential economic and environmental benefits. Similar messages were identified by a recent study commissioned by the Nordic Council of Ministers. The COWI study listed three key factors for success for PSS:

- The PSS provider can capitalise the full capability of their product and know-how to improve their business case and reduce prices at the same time
- Creating new incentives for all partners to bring down resource use and operating costs by splitting the savings among the partners

- The ability to manage and mitigate risk when offering PSS.

The same study mentioned a number of barriers to the diffusion of PSS. Among these barriers we found lack of knowledge, inertia in ways of working, difficulties in communicating how new business models work as well as companies' unwillingness to invest in change when facing uncertain future of policies (COWI 2008).

Now it is turn to briefly discuss why Governments need to intervene in order to support the uptake of PSS. The rationale for policy intervention is rooted in varying visions on society, science politics and markets (e.g. Brickmann and Jasanoff, 1985; Jasanoff, 2005). A dominant discourse is that in principle a free market is the best means to promote optimal societal welfare. Part of the reason for slow uptake of PSS is attributable to market failures, such as the absence of externalities in resource (e.g. materials, energy and water) and product prices, asymmetric information (Morey, 2003), obsolescence as part of the business model (Mont, 2002), consumers may not be aware or able to use the products that they buy correctly and efficiently, etc. Additional barriers to eco-innovation in PSS can also be mentioned, i.e. lack of trust between customer and supplier, new risks, need of a common vision, inertia, transaction costs, uncertain incentives, lack of knowledge and the need of new infrastructure (COWI, 2008). In addition to identified market failures and barriers, the study suggested that policy-makers could support the development of PSS models by means of:

- Using business models as a means to achieve environmental and innovation policy goals
- Encouraging businesses to deliver 'outcomes' (rather than products) through regulation of public and private purchases.
- Facilitating access for companies to existing local networks and infrastructures to make their business model operational.

A study for the US Environmental Protection Agency (2009) emphasised the importance of letting the market decide what the best business models and value propositions are based on clear performance based criteria. According to their report, policy invention is justified based on:

- Levelling the playing field by, e.g., reducing information asymmetries, internalising environmental costs, and/or offsetting the advantage that externalised environmental costs may confer on traditional business models
- Reducing entry barriers by, e.g. raising awareness and providing customers and companies with information and knowledge of these new types of business models, supporting access to financing
- Setting formal and informal standards to ensure that business models and value propositions can be compared so that the most cost effective and eco-efficient delivery system can be easily identified

There is growing evidence of the presence of system failures in the innovation system for services (Rubalcaba et al., 2009), which could make us think of additional factors leading to a slower market uptake of service-related innovations, including PSS. Therefore, it may seem that policy intervention at the system level is also necessary in order to ensure that PSS are also eco-efficient and more sustainable value propositions than conventional product-oriented business models.

2.2 PSS in European environmental policy

At the global level, the concept of Product/Service-Systems (PSS) can be traced back to prior environmental concerns of how the world's economy is currently coupled with material and energy consumption. The possibility that economic growth could still be achieved without compromising the Earth's natural environment was widely recognised under the term sustainable development in the 1987 Brundtland report (Brundtland 1987). One of the strategies to decouple material and energy consumption with economic growth is to substitute a material product with an immaterial way of fulfilling the same need or function, i.e. a service. This approach is called 'dematerialisation', where the aim is to fulfil a need by consuming significantly less material and energy. Stahel and Reday (1976) were among the first to consider the potential to develop a more labour-intensive and less energy-intensive economy through product-life extension. Compared with manufacturing, this constitutes a substitution of manpower for energy, and decentralised workshops instead of centralised factories. Stahel (1997) uses both the terms 'service economy' and 'functional economy' synonymously to describe this approach to sustainability. During the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, sustainable production and consumption emerged as a key issue on the sustainable development agenda (UNCED, 1992).

A cornerstone for creating more sustainable products in Europe is Integrated Product Policy (IPP) and the extended producer responsibility principle (EPR). The IPP framework emerged as a key element of the EU's 6th Environmental Action Programme. This framework represents the life cycle approach of modern environmental policy. IPP follows five basic principles: life-cycle thinking, working with the market, wide involvement of stakeholders, continuous improvement of products, and co-ordinated use of policy instruments (EC, 2003a). IPP is also seen as a complement to traditional environmental policy that looks at fostering greener products that combine lower environmental impacts with enhanced competitiveness via a market driven approach. For achieving its purposes the IPP communication envisaged a careful and pertinent selection of instruments and a timely combination of them (EC, 2003a). No ready-made combination of environmental product policies or instrument mixes exists. The set of policy instruments that can be applied has broadened considerably over time, and the coordination of policy instruments is therefore a critical aspect of this policy. IPP does not address PSS.

In Europe, the European Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) action plan aims at improving the environmental performance of products and increase the demand for environmentally improved goods and production technologies. The SCP/SIP Action Plan covers both mandatory and voluntary instruments, which address production, products and consumption – all the elements of PSS, but without an overarching approach to encourage the development of PSS. Related to the SCP/SIP action plan that has a very strong product focus, shows the broad range of policy instruments that address products from both the supply and the demand side.

2.3 PSS and sustainable consumption and production policy (SCP)

Mont was among the first to question what sustainability-related policies are needed for PSS (Mont 2002).³ This author suggested that it was probably not economically efficient to develop policies directly for PSS, but rather focus on general policies that would optimise and minimise environmental impacts associated with the entire product life cycles as PSS is just one approach to optimising products' life cycles. Mont proposed a framework for classifying policy principles (e.g. polluter pays principle); policies, strategies and concepts (e.g. integrated product policy, dematerialisation, circular economy, etc.); policy instruments (e.g. regulatory, economic, informative); and, policy tools (e.g. standards, indicators), mainly from the area of sustainable consumption and production (SCP) (see Table 1).

Table 1 Categorisation of SCP policy instruments

Policy instruments	Mandatory instruments	Voluntary instruments
Administrative	Bans, licenses, requirement on EHS information, EPR, recycling and recovery quotas, material and quality requirements, emission levels, chemicals regulation	Responsible Care and similar initiatives, Product-oriented environmental management systems (POEMS), application of product standards, product panels, EMS, functionality panels, agreements between government and industry
Economic	Deposit-refund systems, taxes and charges, liability rules	Green public procurement, technology procurement, R&D investments
Informative	Requirement on EHS information, emission registers, material and quality requirements, chemicals regulation on information for professional and private users, energy labelling, marketing regulations	Eco-labelling ISO type I, EPDs, green claims, energy labelling, organic labelling of food, certification schemes of e.g. hotels, consumer advice, consumer campaigns, education

Source: (Mont and Dalhammar, 2006)

One of main barriers to the implementation of eco-efficient PSS - and eco-innovation in general – is that the costs of environmental damage are not adequately included in market prices. It is believed that if the price of these so-called externalities were more properly reflected in market prices, companies and consumers would automatically use resources such as materials and energy more efficiently and find ways to reduce pollution and waste (Ceshin and Vezzoli 2006). At present there is not sufficient economic motivation to optimise the use of products, e.g. it is typically more profitable and less risky to produce and sell as many products as possible, than to ensure that the products sold are used correctly and actually satisfy the actual need. In this case, companies that offer the use of products in a more resource efficient manner as PSS are often placed at a disadvantage compared to companies that sell products in a conventional manner. Policies that aim to optimise and minimise environmental impacts associated with the entire product life cycles should ensure a level playing field for both types of business models to allow fair competition. Take for example the case of price competition between incontinence pads instead on the price of incontinence care per person. Incontinence products (i.e. diapers and pads) are typically sold per unit. Differences in quality and features of disposable pads together with correct usage determine how many units are needed to satisfy the daily needs of an

³ Mont uses the term 'functional sales' which is synonymous with PSS

incontinent person. As manufacturers do not have to take into account the costs of changing pads and disposing of them, it is in the interest of some manufacturers to encourage consumers to buy and use as many pads as possible. A manufacturer that offers higher quality pads with associated services (e.g. training and support) that results in fewer leakages and minimises the consumption of pads per person, will be perceived as too costly when measured in terms of price per pad.

In addition to internalising the use and end-of-life costs of products, Mont also pointed to facilitating the development of durable products by using modular designs, where products can be easily repaired refurbished or updated, and encouraging more reuse, remanufacturing and other schemes of reverse logistics. Mont identified three policy principles to guide SCP policies to encourage PSS: (i) the polluter pays principle, (ii) the Extended Producer Responsibility principle; and (iii) the closed loop / circular economy principle. What is interesting is that all three principles are already applied in EU environmental policy, and in particular in SCP policies. Mont then listed public procurement, consumer information (such as Eco labels and environmental product declarations), economic instruments (e.g. environmental taxes on energy and resources, tax write-offs for consumer products that remain a company's capital assets) as relevant policy instruments for PSS. Furthermore standards, indicators and product panels were mentioned as concrete policy tools that could be implemented to support the deployment of PSS.

Ceshin and Vezzoli (2010) acknowledged the role of governments to create the right economic conditions for PSS and raising consumer awareness to inform consumers of the benefits of eco-efficient PSS, but also highlighted the importance of supporting information and knowledge dissemination of successful implementation of PSS to companies. Using the automotive industry as an example, they classified instruments as “general policy measures indirectly addressing PSS” and “specific PSS-oriented policy measures”. The first type of policy measures are similar to what Mont has proposed in that the policies should address the environmental impacts of products in general, but not necessarily pointing to PSS directly. The second type of policy measures are however contrary to what Mont proposed. Ceshin and Vezzoli argued for a set of policy measures that directly stimulated the introduction and diffusion of eco-efficient PSS. These include Green Public Procurement focused on PSS; information programmes to promote PSS in businesses; training and education of professionals capable of designing, implementing and managing PSS; and, supporting demonstrative pilot projects with a network of actors such as local authorities, companies, universities and research centres.

A report from the Ellen MacArthur Foundation (2012) also pointed to better alignment of economic incentives, such as increasing taxes on materials and waste compared to labour. Furthermore, regulation in the areas of customer and corporate responsibility, accounting, certification, and standardisation can help to quickly reach scale. The same report highlights that financial interventions are needed in order overcome market failures such as risk aversion. This is caused by informational asymmetries and high transaction costs, which must also be supported by the education system with integration into university curricula and outreach programs to increase awareness in the general public and business, science, and engineering communities. Another issue related to finances is the obsolescence of products. For example, when

the owner of a product is a corporation, products may be retired for accounting or legal liability reasons. Firms typically retire computers, for example, when the warranty expires.

2.4 PSS and eco-innovation policy

In the context of the enlarged attention for fostering innovation and competitiveness (i.e. via the Lisbon Agenda and the European 2020 strategy), the promotion of eco-innovation has been firmly embraced by the OECD (1997, 2011), the European Commission (2003b, 2010a), and several national governments (i.e. Sweden, Finland, etc.). The field of science, technology innovation policies is rooted within the innovation systems approach (Edquist, 2005), which is interested in understanding development and diffusion of innovation.⁴ This approach argues that the right mix of knowledge infrastructure, entrepreneurship, risk capital, launch markets etc. must be in place (Coenen and Díaz López, 2010).

Innovation policies are focused on the identification and removal of both market and system level failures (Klein Woolthuis et al., 2005) (see table below). The rationale for intervention is basically twofold: a problem must exist and relevant government agencies must be able and have the capacity to solve it (Edquist, 2005). Examples of policy instruments are: funding and support for R&D, instruments supporting testing and demonstration, support for early stage business development, regulatory and market based instruments, etc. Target groups for innovation policies are often firms and entrepreneurs, but it also reaches universities, R&D centres, service providers and intermediaries, etc. (Coenen and Díaz López, 2010).

Table 2 Market and system failures to eco-innovation

Market failure	System failure
Public good nature of knowledge gives rise to problems of appropriating the benefits from innovation (e.g., risk of imitation)	Inadequacies in the technology/knowledge infrastructure
Uncertainty and incomplete information about costs and benefits of innovation	Old and rigid technological capabilities within companies causing transition failures to new knowledge bases
Market power	Insufficient entrepreneurship
Entry barriers	Not enough risk capital and high capital costs
Network externalities causing a lock-out	Regulations acting as barriers to innovation
Price gap for environmental innovations at the beginning of the learning curve	Unfamiliarity with and social resistance to certain innovations
	Actors not being able to coordinate joint action

Source: Kemp (2011)

One of the areas where traditionally more innovation support has been provided is investment in basic and long term research, which is believed has the potential to overcome specific market failures associated with green innovation, notably those linked to the dominance of existing technologies, systems and incumbent firms. Additional policies in this area include:

- Support for private investment in innovation,
- Support for general-purpose technologies

⁴ See Coenen and Diaz Lopez (2010) and Ekins (2010) for an overview and comparison of innovation policies for sustainability.

- Fostering the growth of new entrepreneurial firms.
- Facilitating the transition to green growth in small and medium sized enterprises (SMEs).
- Foster diffusion and take-up of green innovations in the market place, via strengthening markets for green innovation and changing consumer behaviour
- Demand side/performance standards, green labels and certificates & public procurement and consumer subsidies
- Support for network and partnerships – particularly when provision of enabling infrastructure is needed policy making lacks adequate analytical and intervention frameworks, which could foster the uptake in the market.

There is a consensus among eco-innovation experts that eco-innovation diffusion requires a mix of policies. Ekins observes that it is increasingly common to seek to deploy policy instruments in optimal policy ‘mixes’ or ‘packages’, in order to enhance their effectiveness across the pillars of sustainable development (Ekins, 2010). According to Kemp (2011), eco-innovation policies should (1) be based on identified barriers (and failures), (2) prevent windfall profits, (3) consider and weight specific versus general support, (4) ensure adequate balance and timing of policy mixes and measures, (5) provide targeted spending in areas where innovation is really needed, (6) promote missions for system innovation, (7) be supported by strategic intelligence, (8) ensure the availability and support of a wide innovation portfolio, (9) enable policy learning and experimentation and (10) ensure policy coordination and public-private interactions. Whilst the need for policy mixes is well-understood, the precise nature of them has to be determined on a case by case basis, raising difficult questions about the coordination and timing across the innovation cycle (Coenen and Díaz López, 2010).

One of the pillars of the European innovation agenda for the promotion of green innovations is the Eco-innovation Action Plan (EcoAP) (EC, 2011). This initiative aims at improving the market conditions for the uptake of eco-innovations. Seven actions are included in this plan: (1) environmental policy and regulation, (2) demonstration projects, (3) standards setting, (4) funding and support to small and medium companies, (5) international cooperation with emerging and developing economies, (6) new skills and knowledge for green jobs, and (7) innovation public-private partnerships. Some of the messages identified by Ekins (2010) and Kemp (2011) are included in the EcoAP, but in spite of the fact that the actions of this plan include products and services, but no specific mention is made to PSS.

Two recent studies from Nordic innovation and the OECD pointed out at the need to support green business models innovation in order to facilitate a major shift towards sustainability and green growth (Bisgaard et al., 2012, Beltramello et al., 2013). Under the label of ‘incentive models’ for green innovation, some of the identified policy measures included: encouraging an efficient public sector green procurement, increase flexibility in long term contracts, the introduction of standards and smart financial schemes. In addition, the establishment of clear and stable market signals and pricing mechanisms, active support of regional or local government and municipalities, and the creation of room for new firms (the prevalence of dominant designs, technologies and systems in energy and transport markets) were encouraged.

3 Methodological approach

The authors performed an exploratory content analysis of 18 European policy documents. The objective of this exploratory analysis was to enquire if terms associated to product-service systems were present in policy discussion. A 10 year time frame for the selection of key policy documents corresponded was set, including the period 2003-2013.

A literature review was subsequently performed based on PSS and eco-innovation literature (including green/sustainable business models). The authors searched for terms related to 'policy', 'legal' legislation' and 'regulation'/regulatory'. The list of documents also included key contributions to resource efficiency (BIO Intelligence Service et al. 2011); a study on policies to encourage sustainable consumption (BIO Intelligence Service et al. 2012); the mid-term evaluation of the IPP (Ecorys et al. 2011); the study on the Future Application of IPP instruments in Europe (Tukker, Diaz Lopez, et al. 2013); etc.

Table 3 Documents analysed

List of EU policy documents used by the authors for exploratory content analysis, period 2003-2013

Integrated Product Policy (2003)
Thematic Strategy on the sustainable use of natural resources (2005)
Thematic Strategy on the Urban Environment (2006)
Action Plan for Energy Efficiency: Realising the Potential (2006)
A lead market initiative in Europe (2007)
Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan (2008)
An integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Front Stage (2010)
Thematic Strategy on the prevention and recycling of waste (2010)
Roadmap for a resource efficient Europe (2011) (including two annexes).
A resource-efficient Europe – flagship initiative under the Europe 2020 strategy (2011)
Low-carbon economy 2050 roadmap (2011)
Energy Efficiency Plan (2011)
White Paper on the future of transport (2011)
Innovation for a sustainable Future - The Eco-innovation Action Plan (Eco-AP) (2011)
White Paper on the future of transport (2011)
Making raw materials available for Europe's future well-being (2012)

From the literature review hitherto provided it is possible to identify at least five policy principles which could provide policy guidance to the support of PSS. These areas include: i) polluter pays principle, focusing on environmental compliance; (ii) Extended Producer Responsibility – internalising externalities; related to greening products, waste avoidance and life cycle thinking (iii) circular economy, related to sustainable production; (iv) redefinition of policy to focus on outcomes and performance rather than products, related to product use and behavioural aspects of consumption, and; (v) knowledge and innovation via public private collaboration / networks and partnerships, related to the promotion of innovation and R&D. These areas can be used to narrow down the scope of policy analysis in this paper, using a more focused number of sustainability and innovation policy intervention areas (see table 3, policy focus).

The authors of this paper used the definition and classification of environmental policy instruments (Mont and Dalhammar, 2006) as a basic framework for the classification of selected PSS-related economic, administrative and informative European policy instruments. A mapping exercise and further analysis of a number of European policies that are potentially linked to PSS was subsequently performed. This qualitative exercise allowed the identification of three policy areas and twenty policy instruments relevant to PSS, which were further analysed using narrative techniques (Stanley and Temple, 2008). The list of instruments included fourteen tools from environmental policies, four from consumer policies and four from innovation policies (see Table 3).

Table 4 Framework for analysis of EU policies

Policy area	Policy focus	Policy instrument
Environment	Product policies	Eco design Directive
		Eco label
		Energy labelling
		Green Public Procurement
	Production policies	Environmental Liability Directive
		Industrial Emissions Directive
		Restriction of the use of certain hazardous substances
		REACH directive
		Eco-management and Audit Scheme
	Waste policies (incl. Extended Producer Responsibility)	Waste Framework Directive
		WEEE
		Packaging
		End-of-life Vehicles
		Batteries
Consumer, energy	Consumption/Use policies	Energy Efficiency Directive
		Energy Performance of Buildings Directive
		Unfair Commercial Practices Directive
Science, technology & innovation	Innovation policies	Lead Market Initiatives
		CIP Eco-innovation market replication program
		Innovation vouchers

4 Survey of EU policies and their potential to promote PSS

As noted in the precedent section, the first step of our analysis included an exploratory content analysis of 18 policy documents in the period 2003-2013. The results of this analysis identified only 1 mention to PSS in the entire set of policy documents. The reference was in the technical Annex 2 of the Resource efficient Flagship initiative. The section of 'improving products and changing consumption patterns' of this document mentioned PSS in regards to the existence of barriers to the introduction of new business models, which are facing slow introduction. Hence, our initial argument that no specific mention to PSS is currently available in European policy document is supported. A manual inspection of policy documents allowed the identification of 12 specific policy instruments with potential to be supportive of the market uptake of PSS (Table 2). The main outcome of our narrative analysis is presented below.

4.1 Survey of product policies

Eco design Directive (mandatory)

The Eco design Directive 2009/125/EC provides consistent EU-wide rules for improving the environmental performance of energy-related products through Eco design. Its scope has been extended from energy-using (e.g. boilers, televisions, refrigerators, etc.) to energy-related products (e.g. windows, water-using products, etc.). The Directive provides a legal framework for setting requirements for product environmental performance (e.g. minimum energy performance standard), so that products with poor environmental performance cannot be put on the EU market. The Directive can also establish specific information requirements related to environmental aspects of the product (e.g. expected life time). The Eco design Directive is directed at manufacturers and importers and legally imposes them to ensure that any of their products placed on the EU market comply with any Eco design requirements. This essential prevents the worst performing products from entering the market and is meant to direct product development towards better environmental performance (manufacturers are given a clear plan for when stricter requirements will come in force in the future).

In relation to supporting PSS, the Eco design Directive is product focused. It ensures that products put on the market have a certain level of environmental performance. At present this is mostly related to energy efficiency, but it can potentially include material and water requirements in the future. The Directive does not directly address how the products are used, although requirements can be set for certain product features that influence use such as standby power consumption. A shortcoming of the Directive is that it only addresses new products that are sold on the market and does not include products already in use and/or already installed. Furthermore, the Directive does not take into consideration that services could provide the same functional unit as products more efficiently.

The European Commission is currently investigating the possibility of setting material efficiency requirements under the Eco design Directive such as improving the reusability, recyclability, recoverability of products as well as

making it easier to track the use of priority resources such as critical raw materials. This could potentially be key to supporting PSS as this could lead to standards for reusability and modular design and increasing minimum guaranteed life times. Standardisation of products and components (e.g. refillable cartridges, power supply units, etc.) could help encourage circular economies in that multiple producers can share the same collection and take-back system. This provides economies of scale that benefit consumers, producers and local infrastructure. All producers share a common platform for certain parts of products and in that way can repair/refurbish/reuse each other's products and components.

Eco label (voluntary)

The EU Eco label (EC/66/2010) is a consumer communication tool first established in 1992 to promote products and services that have the potential to reduce negative environmental impacts, as compared with similar products and services. The idea is that label in essence ensures consumers that the product is among the top performers in its class with regard to the most relevant environmental aspects.⁵ The EU Eco label is, like other Eco labels, a marketing instrument for producers. It allows consumers to easily identify the products and services on the market with the best environmental performance. Producers that make the effort to comply to strict environmental criteria are awarded with the EU Eco label and are in turn rewarded by enjoying special status on the market. The EU Energy Star Programme is a similar labelling scheme for office equipment established in collaboration with the United States of America.

Even though the uptake of the EU Eco label is relatively low, it demonstrates that it is possible to get industry to agree on setting high environmental criteria that should be considered when purchasing products and services. The scope of the EU Eco label allows environmental criteria to be developed for both products and services, but it treats products and services as two different entities as does not let customers choose between the best delivery mechanism for them (e.g. the criteria for wooden furniture is based on product ownership, renting or leasing furniture is not included).

Energy Labelling Directive (mandatory)

The main aim of the Energy Label (Directive 2010/30/EU) is to make energy use of domestic appliances and electronic products transparent to the public. It does so by requiring manufacturers and retailers to display the energy (in some cases water and noise also) performance of a product in a specific category. Energy performance is based on the size of the product (e.g. a large fridge can achieve a high energy efficiency rating even though it consumes more energy than a small fridge with a lower rating). On the label the energy efficiency rating is clearly highlighted by different classes (e.g. A, B, C, etc.), but the expected annual energy consumption is also listed.

The Energy Label provides producers with incentives to be 'best in class' and consumers to buy the product with the best energy performance. It has proved to be very effective in many Member States by transforming the market to more energy efficient products. By providing clear information on the product performance, consumers opted for the most efficient products even though they

⁵ See for all relevant information on the EU Eco label the following EU website: http://ec.europa.eu/environment/ecolabel/about_ecolabel/what_is_ecolabel_en.htm (Accessed 5 January 2012)

often were priced higher than less energy efficient products. The Tyre Labelling Regulation is a similar policy for tyres.

The Energy Label complements the Eco design Directive as it encourages manufacturers to continuously develop more energy efficient products (at least until the highest energy rating is reached), but similarly it focuses only on products and does not allow the energy consumption to be compared between a product and providing the same functional unit as a service. A drawback of the Energy Label Directive is that it does not take in to consideration the users actual needs in that larger (and more energy consuming) products can obtain the same energy efficiency rating as a smaller product that might suit users' needs and consume less energy.

In relation to PSS, the Energy Label provides some good lessons on the effectiveness of providing clear information to consumers of the environmental performance and expected annual costs of products. Labelling requirements that allow a comparison of the same benefit of products and services measured in terms of environmental performance and costs based on annual resource (energy, water and material) consumption, could boost the market for PSS. The European Commission is considering providing more information on the environmental performance of products (the so-called Product Environmental Footprint), but it is unclear whether this will allow a comparison of products and services that provide the same functional unit.

Guidelines on Green Public Procurement (voluntary)

The purpose of the EU Green Public Procurement (GPP) policy is to use the purchasing power of Governments to stimulate the markets for goods and services with lower impacts on the environment. The EU developed GPP guidelines that aim to help authorities to include environmental performance criteria in their procurement procedures.⁶ The existing EU procurement directives⁷ explicitly allow contracting authorities to choose between specifications based on technical standards or on performance or functional requirements.⁸ Performance or functional specifications allow procurers to describe the desired result and which outputs (for example in terms of quality, quantity, and reliability) are expected, including how they will be measured. In this way it allows product-oriented and service-orientated solutions to compete on equal terms. Furthermore the Guidelines recommend that life cycle costing (LCC) is used at the award stage of the procurement procedure. LCC can include the costs related to purchasing, delivery, installation, operating, supplies, maintenance and end-of-life management, but also the cost of externalities such as GHG emissions. Although many of the existing criteria are product-oriented, GPP does have a good potential to be able to stimulate the market for PSS in the EU.

GPP is however only a voluntary instrument at present. It is still up to public authorities in Member States to decide how to set procurement specifications and criteria. There are several barriers to performance-based contracting such as fear of change, lack of understanding of the concept, unknown risks, fear that it takes more time, and procurement budgets and processes are based on product-oriented contracts (Mahon, 2007).

⁶ http://ec.europa.eu/environment/gpp/index_en.htm (Accessed 5 January 2012)

⁷ Article 23 of Directive 2004/18/EC and Article 34 of Directive 2004/17/EC

⁸ <http://ec.europa.eu/environment/gpp/pdf/handbook.pdf>

4.2 Survey of production policies

Environmental Liability Directive (mandatory)

The Directive on Environmental Liability (ELD) (2006/21/EC) establishes a framework at EU level based on the polluter pays principle. The aim of the Directive is to ensure that economic operators are liable and need to financially compensate and/or remediate environmental damage they cause. The ELD is primarily focused on the production stage, but could come to play with regard to defective products that cause environmental damage when used (if the operator was aware that the product was defective and did not take preventive action). In the context of PSS, one could imagine the concept of environmental liability be expended to cover environmental impacts caused during the use phase, but it is difficult to determine liability when the impacts may be caused by user behaviour. On the contrary, even though companies retain the ownership of products in PSS, any liability legislation should not discourage operators from taking greater responsibility of their products compared to traditional product-oriented business models, where ownership and product liability are linked.

Industrial Emissions Directive (mandatory)

The Industrial Emission Directive (2010/75/EC) aims to set emission limits of industrial processes. The Industrial Emissions Directive (IED) is a recast of the Integrated Pollution Prevention and Control (IPPC) Directive and other pieces of legislation. The IED only addresses industrial sites such as factories and waste treatment facilities of a certain size. Although, the IED does improve the general environmental performance of industrial processes, it does not directly contribute to PSS as there is no direct relation to the use of products.

RoHS Directive (mandatory)

The Directive (2011/65/EU) on the Restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment (EEE) prohibits the use of certain hazardous substances in domestically produced or imported EEE. The objective of this Directive is to protect humans and the environment against the release of these substances and to facilitate recycling and recovery of materials from waste electrical and electronic equipment (WEEE).

The RoHS Directive improves the general environmental performance (particularly related to toxicity and Eco toxicity) of products and indirectly supports PSS in that it facilitate recycling and recovery of materials from WEEE, but otherwise does not seem to have any further potential to support the development of PSS.

REACH Directive (mandatory)

The Registration, Evaluation, Authorisation and Restriction of Chemicals REACH regulation is an instrument which obliges companies to provide information on how they manage the risks that chemicals can pose to human health and the environment. It has the following elements: registration of chemicals with a production volume of 1 tonne/year and more; evaluation of registration dossiers and substances; authorisation of chemicals which are of very high concern; restriction of chemicals of very high concern as a safety net; and establishment of the European Chemicals Agency to manage the whole system (ECHA). REACH does not directly support the development of PSS, but provides an example for how product information can be gathered and shared

across the supply chain. Interestingly, PSS that include recovery operations can be a way for companies to be exempted from REACH.

Eco-management and Audit Scheme (voluntary)

The EU Eco-Management and Audit Scheme (EMAS) aims to provide a framework for the effective management of environmental impacts and for continuous improvement in the environmental performance of all organisations. This instrument was designed to help organisations improve their environmental performance while simultaneously enhancing their competitiveness, e.g. through a more efficient use of resources. An EMAS registration allows organisations to demonstrate to stakeholders such as customers, regulators, and citizens that they evaluate, manage and reduce the environmental impact of their activities. In relation to PSS, EMAS and other environmental management systems are important tools to ensure that the environmental performance of a company's activities is monitored to ensure continuous improvement, but in itself it does not directly promote the development of PSS. Albeit product-oriented management systems (POEMS), could potentially foster some degree of market uptake, since it is an eco-design based approach which in principle deals with business model transformation. However, no evidence was found on the impact of POEMS on servitisation of business models and management systems, more general.

4.3 Survey of waste policies

Waste Framework Directive (mandatory)

The Waste Framework Directive (2008/98/EC) is an important piece of EU legislation as it establishes many concepts and principles relevant for PSS. Based on the 'polluter-pays principle', it introduces the concept of 'extended producer responsibility' (EPR). In the Waste Framework Directive, this meant that manufacturers had the (financial) responsibility to take-back products at their end-of-life as well as the subsequent waste management. The idea was that this would encourage the "development, production and marketing of products that are suitable for multiple use, that are technically durable and that are, after having become waste, suitable for proper and safe recovery and environmentally compatible disposal". The Waste Framework Directive also established a priority for waste management policy and legislation using the hierarchy: 1) prevention, 2) preparing for re-use, 3) recycling, 4) other recovery such as energy recovery and 5) disposal. The hierarchy was based on which waste management option had the least life cycle environmental impacts. Furthermore, the Waste Framework Directive also set re-use, recycling and recovery targets for certain waste streams. This was thought to guide measures in Member States to encourage the establishment and support of re-use and repair networks.

All these three measures: EPR, waste management hierarchy and targets directly support PSS, but despite their intent the actual policy implementation did not lead to encouraging PSS. As we will see under the specific waste directives, manufacturers chose to delegate their responsibilities to independent waste management organisations and missed out on the opportunity for changing to more service-oriented business models. The targets did not specify the difference between the rate of re-use and recycling, so often products were just recycled instead of reused as this was the easiest option.

The European Commission is currently exploring the possibilities of further developing and widening the scope of EPR as well as setting specific targets for waste prevention and reuse. In the context of PSS, EPR could be 'extended' even further to include all of a product's life cycle (both upstream and downstream) and not only be focused on end-of-life and waste management. EPR could potentially approach the scope of Corporate Social Responsibility, where a company takes greater environmental and social responsibility of its actions through all its activities and interactions on stakeholders – including suppliers and customers. Producers could be required to ensure that their suppliers comply with certain environmental criteria (similar to GPP), take back products and packaging or manage their own products and supplies (e.g. Chemical Management Services). One could imagine that producers could be obliged to provide certain information and services together with their products, e.g. fair advice on procurement and the life cycle costs, documentation of product defaults and take back, training for proper and sustainable use of the product, performance monitoring and optimisation, maintenance / repair/ refurbish / upgrade options, etc.

WEEE Directive (mandatory)

The Waste Electrical and Electronic Equipment Directive (2012/19/EU) aims at ensuring the prevention of waste electrical and electronic equipment (WEEE) and, where this is not possible, to reuse, recycle and use other forms of recovery of such wastes in order to reduce the disposal of waste and to reduce the negative environmental impacts of WEEE through proper treatment of collected WEEE. The WEEE Directive does so by introducing mandatory targets for recycling and re-use.

The WEEE Directive compels local authorities and producers to provision for the collection of WEEE and ensure it is transported to authorised treatment facilities, where the best available treatment, recovery and recycling techniques should be applied. The WEEE Directive originally intended to encourage that the design and production of EEE (complementing the Eco design Directive) should take into full account and facilitate its repair, possible upgrading, re-use, disassembly and recycling. This would directly support PSS, but in practice as manufacturers opted for a business model where they 'outsourced' the collection and treatment of WEEE and paid a fixed amount per unit. This unfortunately eliminated the added incentive for producers to alter their product's design that would lower product reuse, disassembly and recycling costs (Savage 2006). Although the WEEE Directive attempted to encourage the development of PSS, the business model that industry finally chose, missed out on the PSS opportunities.

Packaging Directive (mandatory)

The objective of Directive on packaging and packaging waste (94/62/EC) is to harmonize national measures concerning the management of packaging and packaging waste in order to prevent or reduce the impact on environment as well as to ensure the functioning of the internal market and to avoid obstacles to trade and restriction of competition. The Directive in essence sets minimum targets with regard to recycling and re-use of packaging waste, but also includes provisions for the prevention of the formation of packaging waste, return, collection and recovery systems, marking and identification systems, standardization and limits of concentration levels of heavy metals in packaging.

Similar to the WEEE Directive the Packaging Directive has the potential to support PSS, but also falls short in its implementation. In most cases, the collection and treatment of packaging waste (typically recycling, not reuse) is left to independent waste recovery organisations, which are not closed loop systems. Some deposit schemes (a type of PSS) do exist, but often these schemes were already in place in Member States before the EU Directive was implemented.

End of Life Vehicles Directive (mandatory)

The objective of Directive (2000/53/EC) on End-of-Life Vehicles (ELV) is to protect the environment and health by reducing the volume and hazardousness of waste from the ELV, specifically passenger cars and light goods vehicles. The Directive also aims to contribute to greater resource productivity through the reuse, recovery and recycling of vehicles. Similar to the WEEE and Packaging Directives, the Directive sets re-use and recovery targets and makes vehicle producers responsible for the costs of waste management of ELV. Different to WEEE and Packaging Directives, under the ELV Directive producers are responsible not only for vehicles to be put on the market, but also for those already on the market. In addition to the ELV Directive, a vehicle type approval Directive (2005/64/EC) requires producers to provide information (defined by a standard) on aspects related to the reusability, recyclability and recoverability of their vehicles. This was thought to force vehicle manufacturers to consider all these aspects in design and development. The required information, which also includes “a strategy to ensure dismantling, reuse of component parts, recycling and recovery of materials”, should be made available to the whole supply chain. Although the ELV and Vehicle Type Approval Directives have not led to an increase in PSS, the requirement on manufacturers to provide information vital for reuse, recycling and recovery is interesting for establishing PSS in practice.

Batteries Directive (mandatory)

The Directive (2006/66/EC) on batteries and accumulators and waste batteries and accumulators is similar to the other waste stream specific Directives in that it specifies waste targets, but only for collection and recycling and none for reuse. In the context of PSS, as many batteries are standardised products already, for some types of batteries there might be a possibility to encourage business models based on the leasing of rechargeable batteries and discourage the use of ‘disposable’ non-rechargeable batteries.

The Batteries Directive also includes measures that prohibit the use of some hazardous substances similar to the RoHS Directive.

4.4 Survey of Consumption/Use policies (energy, consumption)

Energy Efficiency Directive (mandatory)

The Energy Efficiency Directive (2012/27/EU) establishes a common framework of measures for the promotion of energy efficiency in the EU. The Energy Efficiency Directive repeals the Directive (2006/32/EC) on energy end-use efficiency and energy services, which aimed to promote companies that offer energy efficiency improvement measures, the so-called energy service companies (ESCOs). ESCOs are essential a type of PSS in that the “payment

for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria.” The Directive compelled Member States to ensure that there are sufficient incentives, equal competition and level playing fields for ESCOs in relation to traditional energy providers. This is the best example of how EU policy has attempted to directly promote PSS.

The role of ESCOs is less prominent in the new Energy Efficiency Directive, but stipulates that Member States should promote the energy services market by providing information on how energy contracts should guarantee energy savings. Although ESCOs are identified as important to achieving the EU’s energy saving targets, transaction costs are too high for potential customers to easily assess the available service offer.⁹ It would seem that in market based instruments could be applicable to boost ESCOs.

Energy Performance of Buildings Directive (mandatory)

The main purpose of the EU Directive of Energy Performance of Buildings 2010/31/EU (recast of the Directive EC 2002/91) (EPBD) is to require Member States to set up and apply minimum requirements of energy efficiency of new and existing buildings. It aims to establish methodology for calculating the integrated energy performance of buildings; to set up minimum standards on the energy performance of new buildings and existing buildings that are subject to major renovation; to support systems for the energy certification of new and existing buildings and, for public buildings, prominent display of this certification and other relevant information – where certificates must be less than five years old; and to perform regular inspection of boilers and central air-conditioning systems in buildings and in addition an assessment of heating installations in which the boilers are more than 15 years old (EC, 2002, 2010b). This Directive is a follow-up to the EC measures on boilers (92/42/EEC), construction products (89/106/EEC) and SAVE programme provisions on buildings (EC, 2010).

Similar to the case of the Energy Efficiency directive, opportunities for PSS uptake could be identified in combination with contracting obligations in retrofitting and new project developments carried out by ESCOs, where energy performance obligations are set up-front.

Unfair Commercial Practices Directive (mandatory)

The main purpose of the Unfair Commercial Practices Directive (2005/29/EC) is to protect consumers and promote fair competition by laying down rules to ensure that claims made by companies are clear, accurate and substantiated and enable consumers to make informed and meaningful choices. In relation to PSS, the guidelines for the Directive provide guidance for national enforcers to legally challenge misleading environmental claims. Companies should not claim a product or a service is less damaging to the environment than competing products or services unless this is done in a specific, accurate and unambiguous manner with scientific evidence to back their claims. Although the Directive allows comparisons to be made between goods or services meeting the same needs or intended for the same purpose, this is usually interpreted that the comparison should refer to the same product category.¹⁰

⁹ http://ec.europa.eu/energy/efficiency/eed/doc/2011_directive/sec_2011_0779_impact_assessment.pdf

¹⁰ UCPD Guidelines http://ec.europa.eu/consumers/rights/docs/Guidance_UCP_Directive_en.pdf)

To further support PSS, the Directive could be developed to allow evidence based comparison of the life cycle environmental performance and costs of a traditional product compared to a PSS offering. It would require harmonised standards for determining the life cycle environmental impacts and life cycle costs for the consumer, if both traditional business models and PSS are to compete on equal terms. This is similar to the approach for performance based contracts as suggested for GPP.

Other EU policies could also be considered in relation to encouraging PSS. PSS tend to involve service contracts, which can be an obstacle for customers to switch providers.¹¹ Policy makers must ensure that there is a fair balance between consumer rights and obligations under PSS contracts. Another potential way to encourage PSS is to take measures that increase producer's liability of products through guarantees and support for repair and maintenance services (EC, 2012a). Leasing contracts are often designed in a way that the lease term does not exceed 75 % of the lifetime. Depending on whether it is financial or organisational leasing, the leasing periods of only one to three years are quite common, as the used goods and products must have a corresponding residual value at the end of their leasing period. Additionally, users of leased products often expect new equipment or machinery, whether in mobile phones, car sharing or photocopying machines. They may also show less care when they use rented or leased products, instead of a product that they own.

4.5 Survey of (eco-)innovation policies

CIP eco-innovation market replication programme (voluntary)

The EU's Competitiveness and Innovation Framework Program (CIP) Initiative on Eco-innovation was set up as a financial instrument of the Entrepreneurship and Competitiveness designed to provide seed and early market funding for SMEs in those areas where financial gaps have been identified.¹² The eco-innovation initiative (full official name: CIP Eco-innovation First Application and Market Replication Initiative) aims to bridge the gap between research and the market by helping to turn ideas for innovative products, services and processes that protect the environment become fully-fledged commercial prospects, ready for use by business and industry. It is in essence a subsidy scheme helping to develop and support market introduction of sustainable products developed by SMEs.

The CIP Eco-innovation program can in principle is applied for all kind of firms, producing all kinds of products, process-oriented technology and services. The generic category of "greening business" is open to services and organisational innovation - it does not exclude market ready projects where a combination of these forms of eco-innovation takes place. The CIP eco-innovation database includes 29 service-related projects, where a handful of them include terms related to servitisation and PSS. The results of the evaluation of this programme were expected in the second half of 2013, where more information could be obtained about the impact that this programme could have on PSS.

Lead Markets Initiative (voluntary)

¹¹ http://ec.europa.eu/consumers/strategy/docs/consumer_agenda_2012_en.pdf.

¹² http://ec.europa.eu/cip/eip/eco-innovation/index_en.htm (Accessed 5 January 2012)

The Lead Market Initiative (LMI) for Europe was launched by the European Commission following the EU's 2006 innovation strategy. It is a demand-side initiative aiming at lowering barriers to entry to market of new innovations (products and services). In the year 2005 the European Commission consulted the 34 European Technology Platforms boards and the 8 European INNOVA innovation panels to identify possible areas where a combination of supply and demand side policies could aid the creation of innovation friendly markets (EC, 2006b, EC, 2006a).¹³ As a result of the consultation process and analysis of relevant results, six potential lead markets were: e-health, protective textiles, sustainable construction, recycling, bio-based products and renewable energies. These (lead) markets are deemed as highly innovative, with potential to provide solution to address grand social challenges and have a strong technological and industrial base. The existence of a lead market supposes that the learning benefits for the innovator are supplemented by a reduction in risks in the up-front investment in innovation.¹⁴ Once the dominance of a particular product or technology is established in one market, the innovator can expect that other markets will follow while keeping such international dominance (Georghiou, 2007: 10).

The Lead market initiative can be classified as a policy mix than a single policy tool. It uses existing policy tools from other EU-policy areas, notably from energy, environmental and innovation areas. Four policy tools are used in combination across the above mentioned market areas: standardisation, labelling and certification, (ii) legislation, (iii) public procurement and (iv) complementary actions (often in some form of information exchange, communication, training and networking support mechanisms). A recent (interim and ex-post) evaluation of this policy instrument identified positive messages in relation to its effectiveness. Actions plans are the cornerstone of this initiative, and our narrative analysis of the six documents of each lead market area found no explicit mention to PSS, sustainable business models or servitisation. Notwithstanding, giving the strong focus of this policy instrument on standardisation, public procurement and legislation, it still gives room for thinking about its potential for supporting PSS. Clearly, the inclusion of new business models and a stronger focus on product-service combination in subsequent reviews of action plans would be required.

Innovation Vouchers (voluntary)

Innovation vouchers are (small scale) funding schemes used in national or regional systems of innovation to stimulate the use of the available knowledge within research centres or other specialised knowledge providers as a means of promoting innovation by SMEs (Krell, 2011). They are aimed at small & medium-sized enterprises to encourage the take up of new or the acceleration of existing, innovative activities and enhance SME competitiveness. Voucher schemes support SMEs by providing full or partial funding to purchase services

¹³ Technology platforms enable the cooperation between public and private stakeholders in the identification of the obstacles to market development.

¹⁴ The lead market (LM) concept was first developed by Beise (2001), and further adapted to the context of eco-innovations by Beise and colleagues. Some of the basic assumptions on the lead markets notions for the specific case of eco-innovations include (Beise, Blazejczack, et al 2003): 1) eco-innovations are induced by a combination of local market conditions, global (environmental) trends, and national (environmental) regulations. 2) The lead markets concept supports Porter and Van der Linde's (1995) hypothesis, and considers the double externality effect of eco-innovations. 3) Lead markets is also based on findings (and dynamics) of international diffusion of general innovations and 4) new markets for (product, process, organisational) eco-innovations can be created; other countries adopt such innovations, and export opportunities are created for the pioneer country. See for more information the EU Lead Market Initiative website at http://ec.europa.eu/enterprise/policies/innovation/policy/lead-market-initiative/index_en.htm#h2-5 (Accessed 5 May 2012)

such as R&D, IPR, testing or innovation management from universities, research organisations, or other parties in the knowledge infrastructure. To date, there are 23 programmes run by 21 different authorities (some at national level, some at regional level), including national schemes in France, Poland, Former Yugoslav Republic of Macedonia, Greece, Slovenia, Ireland, Denmark, Austria, Netherlands, Cyprus, Portugal, Switzerland, and regional schemes in i.e. Germany and the UK.¹⁵

Depending on the needs for innovation intermediation of companies, the focus of action of the funding provided by this instrument can be used to hire expert services aiming at the modification of their business models and servitisation. However, only anecdotal and case-study evidence is available of the use of this type of innovation intermediation services for eco-innovation in business models.¹⁶ A pre-condition for successful implementation of the instrument must exist: a match between the absorptive capacity of small firms to recognise the need for external, often new, knowledge and the availability of the latter in the regional proximity. In addition, innovation services have to be precisely described and linked to clear objectives (Schade and Grigore, 2009). In spite of mixed evidence about the effectiveness of innovation vouchers in Member states (Cornet et al., 2005, Schade and Grigore, 2009), recent policy initiatives focusing on innovation in services identify innovation vouchers as an instrument to foster change in business model innovation (EC, 2012b), which could possibly also be beneficial for PSS.

¹⁵ Data from the Europe Innova web portal (DG Enterprise and Industry). Accessed 16 December 2011

¹⁶ Some examples include the demonstration projects: KIS-PIMS (service innovation), GreenConServe (services for sustainable construction) and Remake (energy efficiency audits) projects that ran from 1 February 2008 until 30 June 2011. Another example comes from the Innovation Vouchers programme in the West Midlands Region in the UK (Birmingham). In the last couple years at least a dozen cases of innovation projects have received an innovation vouchers for green product and services redesign.

5 Concluding remarks

The aim of this review paper was twofold. On the one hand this paper aimed at the identification of existing policy instrument in the European policy sustainability and innovation toolbox. In the other hand, it presents an exploratory enquiry whether or not specific policies have the potential to foster the uptake of product service systems (PSS). The authors of this paper reviewed the state of the art of PSS, business models and policy intervention in the aforementioned policy areas. This literature review aimed at the identification of key policy concepts which could serve as guiding principles for policy intervention in PSS. In addition, the authors of this paper performed an exploratory qualitative analysis of the policy papers and relevant studies in order to: (i) identify specific policy instruments which could be relevant to PSS, and (ii) to explore the potential of 20 policy instruments from the sustainability and innovation policy areas to foster the market uptake of PSS. Some preliminary findings, on-going research efforts and salient limitations of this study are presented in this concluding section.

PSS is a business model, and the latter concept is the true link to integrating production and consumption in a more sustainable manner. In this review paper we mentioned that the PSS concept rests on the relationship between production and consumption, so it has the two elements of eco-efficiency and sufficiency. PSS has the two elements: one is to improve producer's eco-efficiency and the other is to seek consumer's sufficiency. Although eco-efficiency has improved, sufficiency has had a tendency to be exempted from discussions. PSS is important, because it can deal with sufficiency. One reason for its slow uptake in the market might be the difficulty in quantitative measuring of environmental loads of the lifecycle of product and service

The literature review presented in this paper also unveiled four key policy principles related to the promotion of PSS: (i) polluter pays principle, (ii) Extended Producer Responsibility – internalising externalities; (iii) circular economy; (iv) redefinition of policy to focus on outcomes and performance rather than products, and; (v) knowledge and innovation via public private collaboration / networks and partnerships. The authors of this review paper found no evidence on European policy documents related to policy tools explicitly designed for assessing the benefits of and prompting the uptake of PSS. The explorative analysis of policies based on narrative analysis found that less than a handful of the reviewed policy instruments could have some potential to help fostering the uptake of PSS (Eco label, energy label, GPP, and innovation vouchers). The potential of about a dozen other policy instruments could be improved if each of the instruments would be modified in order to increase its usability in the context of PSS. Member States have additional policy areas that could potentially affect the implementation of PSS. In particular innovation and consumer policies have the potential to contribute to the uptake of PSS, being one example the innovation voucher scheme.¹⁷

¹⁷ Additional examples at the Member state level are presented by Bisgaard et al 2012.

Table 5 Main results

Policy area	Policy focus	Policy instrument	PSS Potential
Environmental	Product policies	Eco design Directive	Some
		Eco label	Good
		Energy labelling	Good
		Green Public Procurement	Good
	Production policies	Environmental Liability Directive	Some
		Industrial Emissions Directive	No
		Restriction of the use of certain hazardous substances	No
		REACH directive	Some
		Eco-management and Audit Scheme	No
	Waste policies (incl. Extended Producer Responsibility)	Waste Framework Directive	No
		WEEE	Some
		Packaging	Some
		End-of-life Vehicles	Some
		Batteries	Some
	Consumer	Consumption/Use policies	Energy Efficiency Directive
Energy Performance of Buildings Directive			Some
Unfair Commercial Practices Directive			Some
Science, technology & innovation	Innovation policies	Lead Market Initiatives	Some
		CIP Eco-innovation market replication program	Some
		Innovation vouchers	Good

The overall policy message from our review is that although PSS concept has great potentiality, specific policy measures supporting PSS uptake are not yet developed. Moreover, the potential for creating business and reducing resource use is too large to ignore. System level change is needed for sustainable development and PSS represents such a system level change than can reconcile traditional production and consumption systems into a sustainable consumption and production. Policy is needed to support such a transaction as the uptake of PSS is slow and far from reaching its full potential. A major challenge with PSS in relation to policy is that problems in environmental and innovation policy tend to be defined in terms of products and technologies rather than societal or human needs, e.g. regulation is focused on the energy efficiency of fridges, not whether food is stored at the appropriate temperature. It is in the intersection of all of the aforementioned policy areas where intervention for the promotion of PSS could render better results. This is particularly due to the focus of PSS on the performance of products, the combination of demand and supply side of policy intervention and the closing of material loops. In particular, information support about resource use and environmental impacts of products and services is fundamental as a support tool for policy action. Another important point identified is that accounting rules need to change, in particular in relation to commercial practices and the creation of fair conditions for greener products in general.

One of the salient limitations of the exploratory results provided in this review paper is that a more detailed analysis of each of these instruments needs to be performed. How and under which circumstances new forms of business model

innovation can be effectively supported by particular combinations of instruments is an important policy challenge to be solved. At this stage we only have anecdotal evidence about the intertwined nature of policy instruments and their potential to foster PSS, but little can be said about the complexity of their timely use and complementarity across the policy and innovation cycles. Additional critical questions to solve remain, mainly related to barriers or drivers to implement these policies, and about the best combinations of policy instruments that could lead to a no-rebound effect situation. For example, Eco design requirements and RoHS could actually work against reused/remanufactured products. Intlekofer et al. (2010) show, for example, from an energy saving point of view it makes sense to replace consumer goods rather quickly, because of the improvements in energy and water efficiency. If the efficiency gains of the new products are combined with remanufacturing of the used goods, it may result in a net decrease of material and energy use. Even if instruments such as Eco labelling and Environmental Product Declarations (EPD) can stimulate companies in “greening” their products, and give users the possibility to select the best option to buy, on the other hand these instruments still promote a consumption based on individual product ownership; in other word “they provide no alternatives to the existing consumption system” (ibid.), based on the production and sale of material products (Ceschin & Vezzoli, 2010). Innovation-based initiatives using policy mixes could be a promising way to foster PSS uptake, but their current focus and orientation does not consider product service combinations. The limitations hitherto described posed possible avenues of research for the epistemic community of sustainability transitions.

The work presented in this review paper is currently focusing on the formulation of a more detailed framework for providing recommendations to policy makers. The outcome of our analysis will be peer-validated via an expert enquiry among policy makers and key stakeholders. Finally, a process of data triangulation will be executed in order to cross-validate the findings of all different research methods so that a primer of an overarching framework could be suggested. The outcome of this analysis will provide a summary table with a description of policy and link to PSS followed by discussion of future potential for diffusion/uptake (See table 5).

Policy	Type of instrument	Intention / the original objective that was envisioned	How it works?	How does it support PSS?	How could it support PSS?
Eco design Directive (2009/125/EC)	<i>Mandatory</i> Minimum energy/ environmental performance standards, information requirements, etc. for products placed on the market and/or put into service. Only energy-related products excluding transport of persons or goods.	To optimise the environmental performance of products through design	Manufacturers have to comply with minimum performance standards, which remove the worst performing products from the market. Information requirements can also be set to inform consumers about environmental characteristics and performance of products.	The point of reference for the environmental performance of products is based on 'functional qualities' and environmental impacts throughout its entire life cycle should be considered.	By setting reusability requirements, Standard/ modular components / component compatibility
Green Public Procurement (COM(2008) 400)	<i>Voluntary</i> Information based / communicative instrument that offers legal and operational guidance to public authorities on cost-effective procurement of products and services with improved environmental performance. Includes a formal target for public procurement.	To have clear and ambitious environmental criteria for products and services and provide information on the life cycle costing of products	The European Commission sets common environmental criteria for a number of product groups. , tools for stimulating GPP and examples for a number of product groups.		By prescribing contracts based on functionality/ service (instead of products)

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Vitae

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