

Waste Prevention in a “Leasing Society”

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Abstract

A future-oriented and sustainable “Leasing Society” is based on a combination of new and innovative service-oriented business models, changed product and material ownership structures, increased and improved eco-design efforts, and reverse logistic structures. Together these elements have the potential to change the relationship between producers and consumers, and thereby create a new incentive structure in the economy regarding the use and re-use of resources. While the consumer in a leasing society buys a service (instead of a product), the producer in a leasing society retains the ownership of the product (instead of selling it) and sells the service of using the product. This creates producer incentives to re-use, remanufacture, and recycle products and materials and could become a cornerstone of the circular economy, depending on how the leasing society is implemented. While a predominantly positive picture of the success of a leasing society model and related business cases emerges from the bigger part of the available literature, this paper argues that the resource efficiency of respective business cases is highly dependent on the specific business case design. This paper develops a more cautious and differentiated definition of the leasing society by discussing relevant mechanisms and success factors of leasing society business cases. The leasing society is discussed from a micro business-oriented and a macro environment-oriented perspective complemented by a discussion of conditions for successful business models that reduce environmental impacts and resource footprints.

Keywords: Leasing society; Eco-design; Re-use of resources; Business

Introduction

Facing the globally ever-increasing consumption of natural resources and thus the increasing generation of waste, the prevention of waste in the first place has been identified as a key strategy for an increased efficiency of resource use. But defining the prevention of waste as the top priority of the waste hierarchy—as confirmed by the revised European waste framework directive (WFD, Directive 2008/98/EC)—is much more than a simple amendment of ways how to deal with waste. It is nothing less than a fundamental change of the socio-technical system of waste infrastructures with all its economic, legal, social and even cultural elements [1,2] and requires a transition from end-of-pipe technologies towards an integrated management of resources [3]. In the public opinion large-scale systems based on municipal waste collection schemes and end-of-pipe technologies like waste incineration, shredding or other volume reducing waste treatment procedures seem to literally have minimized these sorrows—in most developed countries and especially in the EU waste seemed to be a “solved problem”.

Only recently has this perception been contested and the idea of a circular economy raised, increasing interest in the public debate, e.g. in the European Commission’s Communication on Zero Waste: *Since the industrial revolution, our economies have developed a ‘take-make-consume and dispose’ pattern of growth — a linear model based on the assumption that resources are abundant, available, easy to source and cheap to dispose of. It is increasingly being understood that this threatens the competitiveness of Europe. Moving towards a more*

circular economy is essential to deliver the resource efficiency agenda established under the Europe 2020 Strategy for smart, sustainable and inclusive growth” [4]. Therefore waste prevention has to be put into the context of eco-innovations in production and consumption that potentially might reduce environmental impacts and at the same time save costs for the different actors alongside the value chain [5].

This paper will look at how the development of a “leasing society” may contribute to waste prevention. Specifically, it focuses on the future potential of the leasing society in the EU for the transition toward a resource efficient, circular economy. It defines what a leasing society is, examines successful case studies, highlights transition challenges and presents key barriers and drivers to the further uptake of the leasing society, as well as the policies needed to overcome these barriers. The purpose of this paper is to strengthen understanding of the potential of leasing society business models and of the kind of challenges, which need to be overcome in order for the leasing society to contribute to a “green transition” in a meaningful way.

Understanding the Leasing Society

The conceptual roots

The term “Leasing Society” (or “Lease Society”) is rather new. However, it is related to other already existing models of a sustainable society such as the “Service Society” or “Functional Society” [6], the Performance Society [7,8], “Collaborative Consumption” [9], the Sharing Economy [10,11], the “Circular Economy” [12-14], or “Using instead of Owning” [15,16]. One common element of these models is based on the idea that customer needs can be met by changing the

business value proposition towards a higher service-orientation and changing product ownership structures towards an increased producer responsibility. Both of these underlying concepts, increased service-orientation and changed product ownership, have been discussed in the scientific realm for decades. Especially the sustainability research and marketing literature [17,18] have paved the way for this new business model approach.

On the part of sustainability literature, the idea of the leasing society is strongly connected with the concept of "Product-Service Systems" (PSS). The discussion about PSS was spawned by Stahel and Reday in 1976, who called for a shift of activities from manufacturing to service, that would concentrate on long-term leasing, maintenance and reconditioning activities in order to support economic development while saving resources at the same time [17]. In 1999, the first paper on PSS was published by Goedkoop et al. defining PSS as a "marketable set of products and services, capable of jointly fulfilling a user's need" [20]. Since then, a number of academic papers have picked up and developed the term and the concept, paving the way for the present understanding of PSS that recent articles and studies are based on [19-24]. E.g. Baines et al. have defined it as a "market proposition that extends the traditional functionality of a product by incorporating additional services. Here the emphasis is on the 'sale of use' rather than the 'sale of product'. The customer pays for using an asset, rather than its purchase, and so benefits from a restructuring of the risks, responsibilities, and costs traditionally associated with ownership" [25]. PSS span a wide range of activities on the continuum between pure products and pure services unfolding different subcategories. A number of subcategories of PSS have been developed [26-28], Tukker et al. have identified the following sub-categories [29]:

1. "*Product-oriented strategies*" put the product into the focus of the business activity. The customer buys the product and retains ownership of it, but also extra after-sale services are provided. These services could be product-related (e.g. financing scheme, maintenance, repair or take-back agreement) or include training and advice in order to optimise the product application.
2. "*Use-oriented strategies*" change the ownership structure of the traditional selling and buying activities—use, not the product itself, is sold. Different forms of consumption (e.g. alone or shared with others) and payments (e.g. per time unit or service unit) are possible.
3. "*Result-oriented strategies*" meet the real customer needs in new ways. Instead of selling the product or selling the use of a product, the result of using a product is sold. For example, the customer may purchase an outsourced activity from a third party (e.g. cleaning) or may buy a predefined functional result (e.g. cooling). The producer remains the owner of the product used and the customer pays for the provision of the results.¹

Parallel to the development of the PSS continuum in environmental sustainability research, the marketing literature developed more service-oriented and value-adding concepts, such as "*Full Service Contracts*" [31], "*Functional Sales*" [32], "*Functional Product*" [33], or "*Performance-Based Contracting*" [34], which are very similar to the PSS concept. They focus on how business can improve their value proposition by meeting customer needs in more service-oriented ways while reducing total costs of product functionality. Environmental impacts here are rather subordinate; however the call for more service-

orientation (e.g. through selling functionality or performance) implies a change of incentives on the producer side that could affect the environmental performance of production and consumption, indirectly.

Besides the sustainability and marketing literature, sector-specific discussions in the chemical and energy-consuming industry [17], have brought forward the idea of new business models focussing on the retention of product ownership and selling only the result of using a product, in order to reduce costs for resources and optimize customer satisfaction. Both of the sector-specific concepts, namely "Chemical Management Services" [35] and "Energy Service Contracting" [36], focus on the outsourcing of former in-house activities (varnishing cars, optimizing energy use) and the contractual arranged procurement of performance in order to save resources and thereby costs.

The idea

The leasing society stands for a society or an economy that is characterized by a new relationship between producers and customers connected with new incentives of how to use resources. Thereby, this new producer customer relation is offering the potential of reducing environmental impacts by diminishing raw material extraction, resource consumption, waste generation and associated environmental impacts—as such, the leasing society has the potential to fundamentally contribute to the societal challenge of increasing resource efficiency and preventing waste. The leasing society is based on two main pillars:

1. More innovative and service-oriented business models to fulfil customer needs, focusing on the provision of product use and result of product use, and
2. A product ownership staying in the realm of the producer, while the customer either uses the actual product or consumes the actual result of the product use.

As indicated by the term, the leasing society refers to the established concept of leasing. However, leasing in its original meaning is not a new concept. It comprises a special contract between the owner of an asset and the user of that asset, which gives the latter one the right to use that asset for a certain amount of time. During the contract period, the owner, not the user, is responsible for maintenance and repairs. After the contract has expired, the owner receives the asset back. The leasing society has been coined as such, because a core part of its characteristics, namely the service orientation and the changed product ownership structures, is related to what is traditionally understood as leasing.

These pillars set the incentives to use resources more efficiently. However, responding to this incentive requires further elements, which allow for keeping the used products in circular flows. These include a product design enabling later remanufacturing, respectively the process of rebuilding a product (including cleaning, inspection, disassembly, replacement of defective components, reassembly, testing and inspection of the new product) [37]. Moreover, it requires reverse logistic structures in order to collect and transport used products and thereby physically supporting the remanufacturing of the used products. In their entirety and interplay, the named pillars and elements can be labelled as "leasing society".

¹ What we want from these products is not ownership per se, but the service the product provides: transportation from our car, cold beer from the refrigerator, news or entertainment from our television [30].

In a leasing society, what business sells to customers (value proposition) is different. Products are still manufactured, but from the customer perspective they are complemented, if not even substituted, by services. Selling services instead of products changes ownership structures, responsibility for upkeep, maintenance and disposal is transferred from the customers to the producers. As the products are returned to the owner (the producer) at the end of their use instead of disposal, the producer has the incentive to design and produce its products according to eco-design criteria, e.g. making them more resource-efficient, optimising their utilisation, extending their lifetime, enabling easier remanufacturing or recycling and thereby avoiding waste. As such, the leasing society re-orientates the value chains for physical goods towards more circularity. In the vision of a leasing society, the changed producer-customer relationships contribute to shifting conventional production and consumption models, largely based on linear supply chains, towards more circular value chains and a circular economy in the big picture.

An ideal business case

Taking a washing machine producer as a hypothetical example, demonstrates how a conventional business model (1. product-oriented PSS: selling washing machines with little additional services) could be transformed into a conventional washing machine leasing (2. use-oriented PSS: selling the use of washing machines) or into an ideal leasing society business case by delivering fresh laundry (3. result-oriented PSS: selling "cleanliness of laundry" as a result of using washing machines), see also [13,23,26]. Furthermore, it explores how the different economic incentives and environmental implications change within the transformation of the established business model to the leasing society business models.

Like any other producers of consumer goods, also a washing machine producer (1st example referring to a product-oriented PSS) strives for maximising profits. Profits in this conventional business model are mainly generated by selling washing machines at a competitive price, which is higher than the production costs. As the business model is based on the product sale, it tends to create incentives for designing the machine in a way that it just covers the warranty period. This can lead to an artificial reduction of the product's lifetime, so-called built-in or planned obsolescence [19,38]. It also motivates business to stimulate changing trends by means of advertising, to motivate a maximum exchange of products by new ones. Producing as many machines as possible results in a high demand for resources. Accordingly, the economic incentives within a conventional, sales-based business model tend to steer the producer and consumer towards resource-intensive behaviour.

In the case of a conventional leasing business model (2nd example referring to a use-oriented PSS) that is based on certain contract arrangements (like agreements regarding regularly maintenance), still requires the production of a washing machine, but the producer is also responsible for additional services, like the installation and repair of the machine. In order to avoid the costs of repair or replacement of the washing machine, the producer has an interest in creating a product with a long lifetime. After the contract expires, the machine is returned to the producer, who remanufactures it and either leases or sells it to another customer. The shift from selling to leasing washing machines

in a leasing society business model could lead to more durable products and to an increased re-use of machines, machine parts or built-in material. Environmental pressures could be decreased by a reduced number of manufactured—and increased numbers of remanufactured machines, resulting in less use of resources and less waste production.

In case of a performance-oriented business model (3rd example referring to a result-oriented PSS), the producer is neither selling nor leasing washing machines, but delivering a result or a performance in terms of fresh laundry. The producer, who is more a service provider now, operates the washing machine. The machine remains not only in the ownership but also in the possession of the producer (or third party). This has implications for the incentive structure. Due to his professional know-how, the producer is able to ensure the best possible machine utilisation, which reduces costs of use, maintenance and repair. Further, as operating costs for energy, water or detergent are now shifted from the customer to the service provider, the producer has an increased interest to design its washing machines with low energy, water or detergent requirements. In order to be environmentally beneficial, it is necessary that the consumer demand does not increase to avoid a rebound effect (e.g. having clothes washed more frequently because customers no longer have the work of doing laundry or because of the attractive rebate schemes). As the washing machine is designed to be cost-effective also during the use phase, it meets resource efficiency requirements. Due to capacity optimisation, the number of washing machines that need to be produced decreases. Furthermore, a decreased amount of resources is required for maintenance and repair because of the knowledge driven optimum operation of the machine.

Another conceivable constellation for the performance-oriented business model (3rd example) would consist in the inclusion of a third party (e.g. a laundrette) delivering the laundry performance. However, the above discussed example shows that it is of crucial importance to confront the original washing machine producer with the entire product lifecycle costs in order to change the producer's incentive structure towards a cost-effective and resource-efficient operating of machines. Respective incentives could be set by contractually arranged gain sharing mechanisms or agreements on the equipment with the most efficient machines combined with regularly maintenance arrangements.

Potentials of a Leasing Society

The micro perspective

While conventional leasing activities are well established in society and as such also well documented, the activities related to a leasing society do not correspond to common practices yet and are comparatively poorly and non-systematically documented. However, there are a number of studies that investigated exemplary business cases without labelling them as leasing society business practices but e.g. as entrepreneurial eco-innovation, green business models or sustainable PSS [15,20,26,38-47]². The various cases comprise different brands as for example chemical industry, waste disposal, office equipment, textiles, automotive, and machinery and equipment. They cover as well business-to-business (B2B), as business-to-consumer

² Nonetheless, not all eco-innovation, green business models or sustainable PSS can serve as leasing society business cases. E.g. the introduction of a process-related eco-innovation, green business models that built on an innovative new product or a prolonged product guarantee in terms of a product-oriented PSS are not automatically leasing society business cases.

(B2C) as consumer-to-consumer (C2C) constellations. Furthermore, they include different types of PSS such as the use-oriented and results-oriented types.

From selling chemicals to Chemical Management Services (SAFECEM example): The provision of CMS³ instead of selling pure chemicals constitute one of the most well-known, and discussed examples of a possible leasing society (and related concepts) business model. In a conventional business model, a chemical producer or retailer sells chemicals. Incentives to help the customer using its chemicals more efficiently are limited. In contrast, the buyer is interested in a decrease of the chemicals' volume and costs. In this business model, the customer is still responsible for the chemicals' application. With the contractual agreement on a special result (like e.g. a coated car), the activity of using the chemicals can be outsourced to the chemicals supplier in a leasing society business model. In this constellation, the supplier still owns the chemicals and is responsible for an agreed performance and is paid on the basis of this performance (e.g. cost savings delivered). The costs of using chemicals are shifted to the supplier, who will seek for an efficient use of the chemicals by reducing the lifecycle costs of materials, labour and waste management. Geldermann et al. highlights the economic benefits for users and suppliers that often sum up to 20%. Often cited examples comprise SAFECEM, Ashland, and Castrol [21,35,43,49].

From selling waste disposal to resource management (GM example):

In the conventional business model, the manufacturing company manages its resources on its own and charges another company with the waste disposal. As the waste disposing company is paid by the waste volume, potential efforts of the waste disposing company to support resource-efficient structures within the manufacturing company do not exist. In a business model, in which the manufacturing and the waste disposing company set up a contract and agree on a resource management performance payment (that rewards resource-efficiency), they form a strategic alliance. Together, they have the same economic incentives: Savings through resource-efficiency efforts. Thus, instead of rewarding waste-creating behaviour, resource-efficiency and waste avoidance are recompensed. In addition to the traditional waste disposal, activities of the contractor in the new business model include services over the whole value chain activity of the producer, like the design of products and processes, procurement and delivery, inventory and storage, use and recovery of resources, monitoring and reporting and training. The analysis of case studies e.g. in Leipzig or Berlin shows cost saving potentials of around 20-30%. The scheme of resource management contracting corresponds to energy performance contracting. Often cited examples comprise GM, Public Service Enterprise Group, and Innotec [39-50-52].

From selling jeans to leasing jeans (Mud Jeans example): Under the slogan "Using instead of Owning" the Dutch company Mud Jeans developed a leasing model for Jeans in 2013, which is based on a contract in which consumers pay a deposit and a monthly rate for the use of a pair of jeans, while they have the possibility to exchange it in case it breaks. After a year of leasing, the customer can either keep the jeans and pay four more months, or get new jeans and keep paying his monthly rates [53]. The jeans returned to the company are either sold in the shop again, or they are recycled and turned into new jeans or

other products like up cycled bags. This innovation serves as a best practice example for a circular economy, as it allows retailers to ensure that products are recycled in the best possible way. But also consumers are educated and their awareness of an interest in sustainability and environmental problems is raised. So far, there are eight Mud Jeans stores in the Netherlands and 19 in Germany. Mud Jeans already received different awards, among which the Sustainia100 Study, the NCD Change Award and the Circular Economy Award[54].

From selling electric cars to leasing batteries (Better Place example):

In 2007, the Israeli electric-car battery technology start-up. Better Place raised \$ 200 million venture funding for a leasing society business model being based on giving its customers mobility guarantee[55]. The basic idea was to separate the ownership of the electric car (owned by the customer) from the battery (owned by Better place). The customer buys the electric car (from Better Place partner Renault-Nissan) but leases the electric car battery (from Better Place partners A123 Systems and AESC), which allows to just switch depleted batteries (in a dense network of quick-swap battery stations) after having driven long distances and to drive on. This business idea targets the weak point of the e-mobility diffusion—the dependence of the driver on the battery, being connected with a limited power density and thus driving distance, and waiting time for charging the battery including limited flexibility and independence. Keeping the ownership of the battery by Better Place and partners would have created the incentive to produce effective, efficient and long-living batteries—thereby supporting resource efficiency targets. However, in 2013, better Place had to apply for insolvency. It is reported that the company failed due to missing customer acceptance and cooperation with the automotive industry [56].

The macro perspective

The various PSS subcategories identified by Tukker et al. [57] come along with different potential to reduce environmental impacts—only a few PSS have the potential for a considerable improvement of the ecological situation. While the product-related PSS have the potential for an incremental reduction of environmental impacts (< 20 % compared with a reference product) of environmental impacts (the traditional product lease might even worsen the situation), the use- and result-oriented PSS can be connected with a considerable reduction of environmental impacts (<50 %). Amongst the latter PSS type, especially the functional result delivering PSS (in contrast to a pay per unit use) is associated with a potential radical reduction of environmental impacts. Accordingly, the more the focus switches from the products to the service functions, the higher the potential for environmental savings. In general, there seems to be a prevalent assumption in literature and society that PSS solely have positive ecological effects and economic benefits, so-called win-win situations, e.g. [15,26,38,39,41]. However, empirical studies [44,58,59] demonstrate that significant environmental improvements can only be reached under certain conditions. Some of these conditions will be presented here in more detail.

Product lifetime optimization on the part of the leasing society producer needs to take into account intensified and more careless product use: Despite improved eco-design being part of a leasing society, some PSS constellations may rather shorten than extend the use-phase of products. For example, in cases where products are

³ Similar expressions that can be found in the literature are chemical product services, chemical leasing, shared savings contracts, service contracts, servicing, performance contracts, contracting, total care and total gas and chemical management [48].

rented or pooled, they may be used much more intensively. The joint and intensified use of a product itself is not an impaired situation compared with the normal business case situation—however, two factors could contribute to negative environmental effects: First, the offer of an always and easily available product may increase the customer's need to make use of that product. Second, customers might tend to show less care when they use a rented or leased product instead of a product that they own. Under these circumstances, the intensified and more careless product use could lead to a withdrawal of the product out of the use phase before its originally planned end and the production (and use of resources) of more products.

Product lifetime optimization on the part of the leasing society producer needs to take into account user behavior: Users of leased products often expect new equipment or machinery, e.g. regarding mobile phones, car sharing or photocopying machines. The product lifetime optimization in a leasing society must take this into account as resources would be used inefficiently if all products were solely designed with the aim being as durable as possible. Also, at least nowadays leasing contracts are often designed in a way (amongst others as it is prescribed by law) that the lease term does not exceed 75 % of the lifetime, with the product being detracted from the use phase before its potentially possible working life has finished. These regulatory conditions automatically lead to an inefficient use of resources and would need to be revised in order to further a resource-efficient leasing society.

Product lifetime optimization on the part of the leasing society producer should take into account dynamics of technological advance: Some of those products with an artificially reduced use phase are often sold as used products at the end of their leasing period. It is however not self-evident that selling leased products as used products leads to a reduced resource use (compared with buying a new product). This is especially true for products where environmental impacts are mostly incurring during the use phase and less in the production phase of the product. For consumer goods such as washing machines, where the environmental impacts are connected mainly to their use phase, it might even be useful to replace these products well before reaching the end of their lifecycle. For example, from a resource saving point of view it would make sense to replace consumer goods even rather quickly, because of the technical improvements in energy and water efficiency [58]. If the efficiency gains of the new products are combined with a remanufacturing of the used goods, it may even result in a net decrease of material and energy use. For part of the leased products it thus may make sense to reduce their use phase—thus designing products in a leasing society a priori as long-lasting products is not entirely true.

Remanufactured goods in a leasing society should not create additional markets: Furthermore, former leased and subsequently remanufactured goods that create an additional market instead of solely replacing new goods might lead to increased resource consumption—this is particularly problematic if a second or third use phase of goods and service takes place in regions that are not yet characterized by appropriate recycling facilities. While selling used and remanufactured goods in those regions make sense from a business perspective, as new markets can be opened to sell their products in different price segments, the economy-wide environmental consequences are far less clear. Under certain circumstances, the global energy and material consumption of such PSS solutions would be higher than in the traditional purchasing model.

In a leasing society, a direct producer-customer relationship has some advantage instead of interposing a third party: Another point concerns the incentives for the producer to design and run its products more resource efficient. Those incentives are only true for those constellations, where the original equipment manufacturer offers the PSS. However, PSS are often offered by specialized companies that are interposed between the consumer and the producer (e.g. specialised leasing companies, independent remanufactures). In this case, the producers may lose interest in producing goods, which require less material and energy or in designing products with provisions for easy repair or recycling.

In Transition Towards a Leasing Society

Discussion of trends

The selected case studies present anecdotal evidence that specific leasing society business models have the potential to increase resource efficiency and improve the firm's competitive position. They also clearly highlight that waste prevention needs integrated approaches that go beyond technology-dominated end-of-pipe infrastructures, including production and consumption patterns. A circular economy aims at overcoming the division between waste production and waste treatment. PSS point out the potential of institutional solutions to radically reduce the waste intensity of consumption and production. However, the evidence presented in this paper suggests that not every PSS reduces environmental impacts. Depending on the type of PSS, leasing society business cases may even increase negative environmental impacts.

Three key trends can be observed:

1. Although the intense discussion about PSS began in the late 90s, *"the uptake of such ideas by industry appears limited"* [25].
2. PSS success-stories are repeatedly reported in specific market segments (such as chemical management or car-sharing).
3. So far, the effective use of PSS, and especially of the result-oriented product-services, seems to have found a stronger foothold in commercial B2B activities rather than B2C activities [60].

Drivers and barriers

The current dynamics of technology push and market pull are probably not sufficient to promote the transition toward a leasing society [54] (with regard to eco-innovations more generally see [55]). In order to realise the economic and ecological potentials of PSS, government intervention would be required. Transition management towards more sustainable patterns of production and consumption will require the identification of existing barriers and drivers that *"offer the best leverage for guiding change in a desirable direction"* [61-63].

Depending on the type of chosen PSS combination, the market and the producer-customer relationship, and the concrete sector, there is not only one leasing society business model, but diverse business strategies possible. Details regarding specific arrangements regarding e.g. maintenance, product take-back, gain sharing mechanisms etc. again multiply the number of possible business model options. The variety of possible business strategies, relate to different barriers and drivers that influence the implementation of PSS.

The following tables (Tables 1 and 2) sum up the identified drivers and barriers of leasing society business cases for a result-oriented PSS in a B2B relationship—each from the perspective of the producer (respectively service provider) and the customer.

Producer / Service provider	Customer
<ul style="list-style-type: none"> Increased competition and declining margins in traditional markets Maintain and gain new market shares, customers and profits Diversification / increased range of services possible Benefit from gain sharing mechanisms Built-in material is not lost and residual material value can be retrieved Technological advancement that enables new solutions Business customer makes buying decisions rather rationally than emotionally 	<ul style="list-style-type: none"> Demand for more services Discontinuation of ownership responsibility / risk Reduced contract complexity Flexible contract conditions (ability to purchase, renew, cancel focus on core competencies) Possibility to upgrade and access to latest technology Improved production process efficiency and reduced complexity Reduced life cycle costs Predictable costs Advantage of tax benefits Improved liquidity Reduced environmental pressure Advantages for health and safety

Table 1: Drivers of result-oriented B2B leasing society business model.

Producer / Service provider	Customer
<ul style="list-style-type: none"> Investments into new infrastructure Increased fixed and operating costs Long-term relationship as a risk (coupled with success of customer) Lack of capital Diversity of regulations Variable client requirements afford expert experience, knowledge and skills Lack of (skilled) personnel Lack of flexibility Public procurement guidelines Technological progress that benefits resource-inefficient production patterns Dependency from other business model partners Risk of underperformance 	<ul style="list-style-type: none"> "We can do it better" Long-term relationship as a risk (changing supplier is more difficult) Fear of loss of control Need to include supplier in confidential processes Lack of awareness and priority towards resource-efficiency Unknown total costs of ownership Uncertainty about saving potentials Certain level of company size needed in order to be profitable

Table 2: Barriers of result-oriented B2B leasing society business model.

Drivers and barriers on the customer side take on a new dimension when it comes to the relationship between business and private customers (B2C). In comparison to the decision-making of commercial customers (B2B), decisions of private customers tend to be more influenced by emotions. This might promote but also hinder the distribution of PSS. For reasons of flexibility, safety, time, convenience, personal identity perception, status symbols and living standards, people tend to prefer owning the products they use. This affects cars as well as white ware, computers, toys, tools and other private equipment. However, as sharing products could become a lifestyle change of a new generation, PSS have high potentials in private consumption.

Leasing society policy measures

General policy measures can set the right background conditions for a leasing society and at the same time they can counteract rebound effects that may arise from the utilisation of PSS. PSS will require a change in political and economic framework conditions, as well as information campaigns and grants. Otherwise, product substituting business models run the risk of becoming costly and short-lived solutions for marginal niche markets. Changing the framework conditions and thereby indirectly supporting PSS is more likely to meet the requirements of a Circular Economy. However, direct measures aimed at supporting the uptake or up-scaling of PSS can

have a secondary but nevertheless important effect: They can help to overcome resistance against changing framework conditions by raising producer interest in general framework conditions that are supportive for their own business models and thus amplify interests in favour of a Circular Economy. While active support for PSS in research and development is important, an exclusive focus on innovative business models instead of framework conditions runs the risk of providing insufficient incentives for innovation as there are insufficient or no cost to environmentally harmful activities [64]. Nevertheless, a number of specific recommendations can be given. They are divided into research-based, market-based, regulatory, information and participation policy instruments.

Research-based policy instruments:

- The transition towards a leasing society would require a better assessment of social, economic and environmental impacts. The different manifestations of PSS have completely different intended and unintended macro-economic effects. This calls for more systemic research, including on impact assessments and transition management towards a leasing society.
- Research and assessment on the impacts of a leasing society could be complemented with demonstration and pilot projects, monitoring and comparison of existing PSS as well as diffusion of best practice, and targeted experimental public procurement

initiatives. Eventually, public-private partnerships of relevant actors along the innovation cycle could be initiated.

Market-based policy instruments:

- An ecological tax reform could shift taxation from labour towards resource consumption to give the right incentives for a transition towards less resource-intensive products, lifestyles and more labour intensive maintenance and repair of more durable products and innovative PSS.
- Reduced VAT rates for maintenance, repair and remanufacturing could give the right incentives for a longer lifetime of products and leasing business models e.g. for electronic and household equipment. In addition, a reduced VAT rate could be granted to producers who offer an extended warranty going beyond the typical time period.
- Landfill and incineration charges could give incentives for re-use, remanufacturing and recycling, including supporting product service supply.
- Longer depreciation periods could contribute to extending the average use phase of a product.
- Public procurement could create niche markets for developing a leasing society.

Regulatory policy instruments:

- The Eco-Design regulations could be extended towards resource savings and efficiency including requirements for materials.
- Producer responsibility could be strengthened including deposit refund schemes in areas such as end-of-life vehicles or electric and electronic equipment.
- Minimum warranties for products could be further expanded.
- The introduction of communal laundry and car sharing facilities for housing complexes exceeding a certain number of housing units should be tested.
- The legal framework for PSS for standardised and harmonised contracting could be developed in economic areas such as the EU Single Market.

Information policy instruments:

- In general, economic and ecological impacts over the entire life cycle of conventional products in comparison to PSS are insufficiently explored. Better assessment procedures and their results need to be shared among producers and consumers.
- Voluntary labelling for leasing-solutions could be encouraged with tax credits for assessment and auditing expenses to facilitate consumer choices and public procurement.
- Knowledge on life cycle costs advantages of PSS including public assessments of PSS and products should be integrated in government procurement procedures.
- Research, pilot projects, education and the dissemination of information on PSS can be supported in the framework of policy programs.

Participation policy instruments:

- Business, civil society, policy-makers and scientists should be consulted for improving a shared understand of possible opportunities and risks connected to the leasing society.

Discussion

This article has raised a number of key issues to be considered in assessment of a leasing society, with the overall aim of contributing to a transition toward a resource efficient, circular economy. Achieving this aim depends on how the leasing society is implemented. Business is already developing innovative PSS strategies and business models. The challenge for policy makers is to act in a timely manner to establish the framework conditions and support mechanisms for shaping these activities so that they contribute in an effective way to smart, sustainable and inclusive growth. In conclusion, four challenges for further research and policy may be distinguished:

- Taking into account lock-ins: Complex products with long lifetimes combined with multiple remanufacturing steps may tend toward more incremental innovation. Especially in "use-oriented" PSS small incremental steps could "lock-in" opportunities for disruptive innovation. Research on the risk of potential lock-ins for different markets would help to better understand such dynamics to shape innovation.
- Expanding beyond niche markets: Leasing society business models seem to be well established in certain areas (like in chemical markets) whereas there is little evidence of leasing in other markets. Research to better understand the barriers and assess the suitability of leasing business models for other markets could help to provide more targeted policy support for the wider diffusion of successful leasing business models (in particular as regards B2C relationships).
- Addressing value systems and rebounds: Better understanding of consumer behaviour in relation to new leasing business models would help to anticipate rebounds (e.g. associated with intensified and careless product use), overcome barriers (e.g. related to value systems concerning ownership) and more effectively engage citizens in the transition process. Limits to a leasing society related to customers' preferences of ownership might be analysed, too.
- Quantifying environmental effects: The environmental performance is highly dependent on the design of the individual business case. The mechanisms described in this paper need further case-related validations. From a macro perspective especially those case studies with high economic saving potentials show relevant resource efficiency potentials due to an expectable market uptake – nevertheless these inter-linkages between eco-innovation patterns, changed economic incentive structures and resource savings will require further research.

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