

Article

Collaborative Consumption: Towards a Resource-Saving Consumption Culture

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Abstract: Resource efficiency in production and technological innovations are inadequate for considerably reducing the current use of natural resources. Both social innovations and a complementary and equally valued strategy of sustainable consumption are required: goods must be used longer, and services that support collaborative consumption (CC) patterns must be extended. “Using rather than owning” strategies, such as product sharing, have the potential to conserve resources. Based on the results of different German studies, this article highlights the resource-saving potentials of CC patterns and recommendations proposed for policies and further research questions. The purpose of this paper is to show that a general resource-saving potential can be realized by “use rather than own” schemes, depending on the application field and the framework for implementation. CC is suitable for making a positive contribution to achieving the Factor 10 target by playing an important role in changing consumer patterns.

Keywords: collaborative consumption; resource efficiency; resource saving potential; rebound effects; product sharing; service; product service systems; ownership-substituting services; sustainable consumption patterns

1. Introduction

One of the major challenges currently facing academia, business, society and the political sector is the issue of resource efficiency and conservation. In this connection, the necessity to achieve an economic, effective use of natural resources—in order to continue to generate wealth in the future and to sustain human life in general—was recognized and analyzed by parts of the scientific community decades ago. Beyond this analysis, normative goals and implementation concepts to enhance resource efficiency were drawn up based on a certain target value. The concepts of “Factor 10” [1] and “Factor 4” [2] were relatively widespread in academic discourse and in parts of society; in addition, the “Factor 10” approach was operationalized in an application-oriented manner following the development of the MIPS concept (MIPS stands for material input per service unit) [1], which can be used to calculate the material input per service unit [3–8].

At the political level, resource efficiency was strategically anchored by the German Resource Efficiency Programme, “ProgRes” [9]. In its National Sustainability Strategy, the German government set the target of doubling energy and raw material productivity by 2020 compared to the base year, 1994 [10]. In this connection, doubling resource efficiency by 2020 can only constitute an intermediate step. In order to enable the economies of emerging and developing countries and future generations to gain needs-based access to resources, Western industrial societies must reduce their absolute resource consumption by a factor of 10 by 2050. In the case of Germany, for example, this would mean reducing the annual per capita resource consumption from the current figure of over 70 to a maximum of eight tons [1,11,12]. Enormous efforts must be made to create such an “eight-ton society”—not only on the part of business, which would have to make products and services along the entire value-chain considerably more efficient, consistent and adequate when it comes to resources, but also on the part of the State, which would have to create economic policy framework conditions that would be conducive to more sustainable production and consumption and that, in addition, would have to provide infrastructures resulting in the consumption of considerably fewer resources [13–17]. Ultimately, an eight-ton society would require consumers switching to resource-light patterns of consumption and lifestyles that would be marked to a lesser extent by consumption and flow rates than by benefit orientation and enjoyment in moderation. [11–13,18–23]. It would therefore appear that technological innovations alone are unable to bring about a substantial reduction in the consumption of natural resources (for example, abiotic and biotic raw materials, water and land). This can be better achieved by adding a further strategy: consumer goods must be used more intelligently, they must be kept longer in the use phase and must be reused. Services that foster “using rather than owning” need to be expanded. Product sharing [24,25], as well as new rental and collaborative models, have great potential for conserving natural resources [19,26]. This is where the concept of “using rather than owning” comes in, involving the prolongation of the use phase of products by pursuing a variety of strategies for action. For instance, the resource consumption of products that are material-intensive in the production phase can be optimized by prolonging the use phase. This paper focused the resource-saving potentials of “using rather than owning” schemes and recommendations proposed for policies and further research questions.

In the present analysis, “using rather than owning” is considered to concern all products and services that aim to achieve the prolongation and optimization of the product utilization phase. This is

usually implemented in the form of services that replace products, for example, by rental or leasing models or forms of exchange. Commercial forms of “using rather than owning” are so-called product service systems. These systems offer a combination of products and services that are able to satisfy consumers’ needs, offering an alternative to purchasing a product or purchasing a new product [22]. Precisely, the following aspects are involved: on the one hand, services for the provision of goods, such as rental systems for the shared use of goods (in the short- or long-term); on the other hand, services leading to the recovery and reuse of components and goods, such as exchange and donation systems, second-hand shops and so on.

However, the idea behind this is an “old” one: as early as over 15 years ago, the issue was broached under other names, such as “use-oriented economy”, “new utilization concepts” [27,28], “ecological or ownership-substituting services”, “product service-systems” [29,30] or “service-providing machines” [1,31–38]. In 1978, Felson and Spaeth from the University of Illinois published the “Community Structure and Collaborative Consumption: A Routine Activity”. It was the first study that focused on collaborative consumption (CC) and defined collaborative consumption as “events in which one or more persons consume economic goods or series in the progress of engaging in joint activities with one or more others,” such as drinking or eating together with friends and using a washing machine for the family. They describe those acts of collaborative consumption as routine activities [39]. In Germany, Schmidt-Bleek first describes in 1994 the potential for saving resources through the shared use of “service-providing machines” [1], and even back in 1996, the study entitled “Zukunftsfähiges Deutschland” (Sustainable Germany in a Globalized World) stressed that consumer societies that wish to remain sustainable “(...) will focus a large part of the logistics of their goods on use rather than ownership” [40]. Before Rachel Botsman and Roo Rogers spread the “Rise of collaborative consumption” [24] all over the world in 2008, followed by extensive PR, videos, interviews, events and lectures, there were few publications on the buying, sharing or renting of goods. Initial conceptual approaches towards this from the field of sustainability research were presented, e.g., in Germany by Stahel [41] and Schmidt-Bleek [1,8,26], focusing on reducing the quantity of resources used. A good overview of the international debate is given by T.S. Baines *et al.* (2007): “State-of-the-art in product service-systems” [29]. A. Tukker [30] in his article, “Eight Types of Product-Service Systems: Eight Ways to sustainability?” analyses sustainability effects and potentials that can be associated with different types of Product-Service-Systems (2004). This is also where the study underlying this article—“Nutzen statt Besitzen. Auf dem Weg zu einer ressourcenschonenden Konsumkultur” (Using rather than owning. On the way to a resource-conserving consumption culture)—by Leismann *et al.*, 2012, comes in [42]. The basic idea is as follows: “living lighter” or rather “a resource-light life” as a general principle for a new ownership-substituting use culture. After all, the transition to a sustainable society can only be achieved by applying a consistent resource efficiency and conservation strategy. In this connection, saving resources corresponds to a great extent on the ecological and economic understanding of efficiency, which is why it harbors virtually no conflicts of interests. However, a tendency towards limiting the term “resource efficiency” too strongly to a technical and economic understanding of efficiency can be discerned, which can lead to the creation of blind spots, such as with rebound effects. Rebound effects mean that more resource-efficient products and services, as well as the increase in resource efficiency in production do not lead to a decline in resource consumption in macroeconomic terms if they are overcompensated by volume

effects or, in other words, when the rising demand for a product increases the volume of the products on the market. This is the case, for example, when the reduction in energy and water consumption of household appliances is overcompensated by additional sales and increased use [43,44]. However, absolute, rather than relative, resource consumption is decisive for the Earth's ecological sustainability. A sustainable social transformation requires more than just technological and organizational changes. In addition to these aspects, social change and adaptation and design processes must also be taken into consideration (for example, consumer behavior, policy frameworks) [15,29,30,36,37,45–51]. Established concepts for enhancing resource efficiency, such as the MIPS concept [1,3–6,29], take this circumstance into account, explicitly factoring in consumption. Changing individual lifestyles and levels of consumption is a key element in reducing absolute resource consumption [15,52]. The objective is to enable society, and hence business, to be resource-lighter, achieving a transition from previous styles of production and consumption in order to bring about an absolute reduction in resource consumption. Integrated sustainability strategies, such as the integration of efficiency, consistency and sufficiency in production and consumption, play a major role in the development of a resource-light society. Our survival and simultaneous prosperity can only be secured if resources are used as effectively as possible and the impact we have on the environment is lessened [1,13,14,53].

Similar to Schmidt-Bleek, who, in 1994, saw potential for saving resources through the shared use of “service-providing machines” [1], the authors reach the conclusion that a general resource-saving potential can be realized by “use rather than own” schemes, as long as the framework conditions for using the service do not cancel out the savings achieved. This is apparent in the analysis of the selected case studies: textile swapping, tool hire and chemical leasing. Negative impacts on resource efficiency could be, for example, the resources required within a transaction for transportation and/or packaging or the overuse of products [42].

In the following, this article focuses on analyzing the resource efficiency potentials of “use rather than own” schemes. The paper shows that a general resource-saving potential can be realized by “use rather than own” schemes, depending on the application field and the framework for implementation and that it is suitable for making a positive contribution to achieving the Factor 10 target by playing an important role in changing consumer patterns. Therefore, the paper also demonstrates that current results are, in general, in line with those given by Schmidt-Bleek [ibid.]. The recommendations for action and research topics shall be formulated with a focus on political actors, in addition to other stakeholder groups. After all, consumers can only be encouraged to change to a more resource-conserving lifestyle if, alongside the provision of more resource-efficient products and services, innovative policy instruments are in place that show consumers and entrepreneurs which options for action are available to pursue a more resource-efficient lifestyle that support them and offer the right incentives.

2. Methodological Approach

The aim of the present analysis was to contribute to the current debate on “using rather than owning” with a focus on resource efficiency. In the process, emphasis was placed on discussions about the resource efficiency potentials of new use concepts and the possibilities of promoting and disseminating the actual idea.

The findings and discussion thereof presented below are based on a methodological approach using a combination of desk research, case studies, expert interviews and an expert workshop.

First of all, an analysis of the Internet and documents was undertaken in order to identify private and commercial forms and business models related to the idea of “using rather than owning”.

Case studies were conducted to analyze the extent to which “using rather than owning” schemes actually lead to more resource-conserving economic activity. The case studies were chosen within a multi-stage selection process. The type of communication and trade relations, resource efficiency potentials, data availability, market maturity and cultural relevance were considered to be relevant criteria. On this basis, the authors teamed up with the client and selected the following case studies:

- Textile swapping (consumer-to-consumer);
- Tool hire (business-to-consumer);
- Chemical leasing (business-to-business).

The selected case studies—textile swapping, tool hire and chemical leasing—were qualitatively described and assessed with regard to resource consumption and potential savings based on the analysis of documents. The analysis and presentation were undertaken according to the following criteria:

- Resource use and efficiency potential;
- Other environmental impacts;
- Feasibility;
- Economic significance and transferability;
- Communicability.

Eight structured, problem-centered expert interviews were conducted with representatives of various “use rather than own” schemes and with scientists who had previously explored this subject matter.

Recommendations for action, research topics and research funding requirements were derived from the knowledge gained from the case studies and expert interviews. These recommendations were finally evaluated at an expert workshop. The results of the expert workshop were taken up and incorporated into the study. In the process, particular importance was attached to gaining experts from all aspects of society (the political sector, the private sector, academia and non-governmental organizations), to enable as many perspectives as possible to be integrated into the study.

The present analysis and the discussion of the findings shed light on the resource efficiency potentials of (new) use concepts connected to the idea of “using rather than owning” or that give priority to ownership-substituting services. In addition, recommendations are given on how to promote and disseminate the idea of “using rather than owning”.

3. Case Studies

The environmental impact of “use rather than own” schemes has been investigated in the past within a vast array of studies [54–57]. In this connection, most of the studies focused on individual environmental indicators or consumption figures, such as carbon emissions or water consumption. The findings of some of these studies are summarized in Table 1, emphasizing the fact that the environmental impact is not always positive, but can also be negative in some circumstances [58].

Table 1. Summary of the environmental impact of “use rather than own” schemes [58].

Environmental impact of “use rather than own” schemes	
Positive	Negative
<ul style="list-style-type: none"> • Extension of useful life, use of durable products • Use of energy-efficient and/or powerful appliances • Maximization of device utilization • Consideration of technical/ecological progress • Promotion of recyclable construction design • Economies of scale and benefits of specialization 	<ul style="list-style-type: none"> • Greater wear and tear from normal use • Overuse • Accelerated withdrawal from service of rental products that are still in working order • (Too) long of a use of inefficient appliances • Additional resource consumption to extend useful life and durability • Additional transportation
Environmental impact due to changes in demand	
Positive	Negative
<ul style="list-style-type: none"> • Demand reduction due to greater cost transparency • Avoidance of mispurchases 	<ul style="list-style-type: none"> • Easier access to the product, due to the absence of purchase costs • Stimulation of the desire for property • Increased demand in other areas of consumption, due to savings in income

It was also ascertained in a wide range of previous studies that it is impossible to generally claim that “use rather than own” schemes are “resource-efficient”, because individual “use rather than own” schemes need to be considered and analyzed in a highly differentiated manner. Ecological side-effects are revealed, such as when “use rather than own” schemes lead to excessive wear and tear or when users gain easier access to a product, inciting them to purchase goods. However, the tendency can also be formulated that “use rather than own” schemes lead to a more efficient use of material goods and, hence, a more efficient use of resources when certain framework conditions are observed, for example, by using durable products or enhancing device utilization.

Against this backdrop, the problematic nature of generally claiming that “use rather than own” schemes are “resource-efficient” is illustrated. However, their resource-conserving aspects can only be identified on a case-by-case basis. The problematic nature of the quantification shall be presented using the following case studies and assessments formulated as to whether or not resource efficiency potentials can be expected.

3.1. Textile Swapping

Textile manufacturing occurs in mass production, representing approximately six percent of the total consumption of resources in Germany. In this country, each person purchases around 26 kg of textiles annually, half of which is clothing. The global average figure is approximately eight kilograms of clothing. In Germany, the consumption of foreign products dominates the textile and clothing sector. Around 90 percent of all items of clothing purchased here were produced abroad; 881,000 tons of textiles are imported to Germany annually.

Potentials with regard to resource consumption are heavily dependent on the framework conditions in this case study. Depending on the type of fiber (for example, cotton, viscose, hemp, silk and wool) or leather (both mineral tanned leather and vegetable or synthetically tanned leather), type of cultivation and technique used and any finishing processes that may be applied, potentials can differ hugely [56].

Before an item of clothing can be marketed, it passes through the lifecycle phases of fiber production, textile production, textile refinement and finishing. The ready-to-wear item of clothing is sold to the customer, who wears it, cares for it and finally disposes of it [56]. Textile swapping intensifies resource consumption during the “use/textile care” phase, because this use phase of the textile chain is extended if the item of clothing is passed on to another user. With many textiles, the use phase is the phase that requires the most energy and is heavily dependent on user behavior. If we take the example of a cotton T-shirt, up to 80% of the energy in the production and use phases and water consumed can be assigned to laundry care. This phenomenon is also highlighted in the following Table 2, showing the results of the analysis of material intensities (MI) and material input for certain service units (MIPS) of an investigation from 2004, taking the example of a cotton T-shirt.

Table 2. Results of the analysis—material intensities (MI) and material input per service unit (MIPS) of a cotton T-shirt [59].

MI	Abiotic material	Biotic material	Erosion earth-work	Water	Air
Production	2.00 kg	1.20 kg	233.00 kg	14,800.00 kg	12.50 kg
Use	117.35 kg	0.00 kg	Not specified	2,719.60 kg	27.44 kg
Disposal	0.15 kg	0.00 kg	Not specified	0.40 kg	0.06 kg
Total	119.50 kg	1.20 kg	233.00 kg	4,200.00 kg	40.00 kg

Note: Resource consumption of a black cotton T-shirt by Hess Natur weighing 171 grams (service unit “worn 100 times”: manufacture + 100 × drying + 100 × ironing)

The result of the analysis of the cotton T-shirt enables a qualitative comparison to be made between swapped and newly produced clothing: in the event of a textile swap, “only one” production and disposal is incurred per product with multiple service (use). The additional input caused by the exchange (factor of transportation, packaging, and so on) must then be added to this. In the case of a newly purchased product, several products have to be produced and disposed of to achieve the same large number of service units. Production and disposal efforts must be added to the use expenditure per daily cycle, which remains the same in the cotton T-shirt comparison. According to Table 2, production and disposal expenditure predominates the consumption of resources and can, therefore, be considered as having resource-saving potential. However, some of the resource savings can be lost, due to the input of resources caused by the hand-down and the use phase, depending on how intensively these are pursued [59]. Long transport distances can also cancel out any resource efficiency potentials. In an extreme case, therefore, the resource-saving potentials generated by the swap can be cancelled out by a resource-intensive hand-down/swap and the form of transport. In general, however, it must be noted that textile swapping promises resource-saving potential in the areas of production and disposal, because no additional product needs to be manufactured [59].

The analysis demonstrates that a general resource-saving potential can be accomplished by textile swapping, as long as the framework conditions surrounding the exchange do not cancel out the savings achieved by the more efficient use of the textiles. Negative effects on resource efficiency could be the resources used for transportation and packaging in the course of the transaction or an overuse of the textiles through too frequent laundry/care cycles, for instance. The example of the cotton T-shirt shows that approximately 80% of resource consumption is caused in the area of care, due to water consumption. However, it remains to be seen whether the speculation that resource savings are achieved

by passing on items of clothing, leading to the recipient refraining from purchasing a newly produced product, does, in fact, hold true.

3.2. Tool Hire

The presentation of the resource-saving potential of this type of “use rather than ownership” must be viewed in a highly differentiated manner. The reason for this is that the potential is dependent on the product group, the performance features of the device, its durability, the frequency of use, the maximum useful life, transportation distances for delivery and procurement by the customer and the modes of transport used, meaning they can vary accordingly. Owing to the inadequate and outdated data available, in this context, only estimates can be formulated that merely enable tendencies towards potential savings to be determined.

However, it can be assumed that positive effects with regard to resource consumption can generally be achieved in the case of rarely used devices. In his study on “Öko-Rent im Bereich “Heimwerken, Baueigenleistung und Gartenpflege” (Eco renting in the area of DIY and gardening), for example, Siegfried Behrendt and Frank Behr [60] identified savings with regard to resource consumption in the case of rarely used equipment. Thanks to short-term rental by service providers, rarely used devices are used more intensively than before, there are no purchase costs and since the devices are more durable and of a better quality, the maximum useful life of the device can be used in line with its purpose.

This conjecture can be illustrated taking the example of energy demand: the energy consumed during the production of a petrol-powered scarifier is around 3500 MJ. Extrapolated to 100 appliances, a reduction potential of 192,500 MJ would be yielded with a non-exhausted maximum useful life of 350 hours compared to sole use. This means that the production-related material flows could be reduced by around 87.5% in the event of rental (with a few uses per year). The same, of course, applies to any other device that is offered for hire [60].

The reduction in quantity, therefore, depends on whether or not the maximum number of operating hours or useful life is reached following use by a single household. Here, again, the example of the scarifier clearly shows that the device is not nearly used efficiently. After all, the appliance is used on average for only 50 hours over a period of 15 years. In other words, there are 350 more hours available until the maximum capacity of utilization of the device is achieved. There is only potential for savings by sharing devices if the maximum useful life is not exhausted. These interrelations are shown in Table 3 using the example of selected devices.

Table 3. Useful life and unused capacity of selected appliances. Given in operating hours, estimates based on information provided by manufacturers and users [60].

Devices	Average useful life	Maximum possible useful life	Unused capacity
Drill	45 h in 15 years*	300 h in 15–25 years	255 h*
Lawnmower	375 h in 15 years	400–600 h in 15 years	25–225 h
Scarifier	50 h in 15 years	400 h in 15 years	350 h*

Note: * = rough estimate.

Schmidt-Bleek also supported this hypothesis by mentioning the example of the lawnmower in 1994, stressing the low utilization rate: a lawnmower is used between five and 20 times a year; after a

while, a new one is then purchased. This process is repeated five to 10 times in a person's lifetime [1]. In view of the aforementioned table, his hypothesis that a lawnmower is not used according to its maximum useful life in everyday use is confirmed.

Behrendt's and Behr's study [60] also demonstrated that the ecological advantage of renting tools within a "use rather than own" scheme is that a rarely used device does not need to be purchased especially. The customer merely rents it for the time required to perform the work. Due to multiple use, rental appliances are usually utilized more effectively. This is compounded by the fact that service providers usually use high-grade professional equipment that is designed to be durable and is suitable for heavy duty applications. As a result, resources are saved in the manufacture of devices, and emissions and quantities of waste are reduced.

Nevertheless, tool hire can also lead to an undesirable ecological "side effect", such as when collaborative use of rental tools leads to excessive wear and tear and overuse of the product. According to Behrendt and Behr, therefore, in the case of tool hire, service providers ensure that durable, top-quality appliances are offered and that these are used according to their maximum useful life [60].

Renting do-it-yourself equipment generally has the potential to reduce resources and negative environmental effects. In practice, however, ecological aspects play a relatively insignificant role, or none at all, in motivating consumers to exploit these possibilities. Instead, in the event of the alternative use of goods, economic, logistical and informational aspects (with regard to instructions on how to operate the device and how it functions and concerning the products available for rent) are decisive for consumers with regard to whether a device is ultimately purchased, hired or not procured. Whether an ecologically effective impact is achieved in terms of resource consumption in the individual case is generally dependent on the particular framework conditions of the respective rental situation and usage requirements. Depending on the individual case, hiring goods can either be beneficial or involve drawbacks.

3.3. Chemical Leasing

Every year, over 50 million tons of chemicals are used in Germany, the majority of which concerns value-creation chains in the chemical industry in which reactions occur with fixed quantities of substances and recipes [61–63]. By leasing chemicals, companies' economical use of chemicals cannot only optimize and minimize, but also reduce, the use of raw materials, chemicals and energy, contributing to a responsible use of resources. After all, the rising quantity of chemicals produced and used constitutes a growing problem in this industry. This quantity has multiplied over the past twenty years and puts pressures on the environment and human health. In addition, large-scale use leads to the shortage of important non-renewable raw materials.

According to the UBA, around 10 million tons of chemicals could be leased annually [61]. The UBA was able to estimate the potential savings for the use data of chemicals listed below that are relevant when it comes to chemical leasing (ibid).

Table 4 shows the rough estimates of the reduction potential of relevant chemicals in the event of chemical leasing. These figures are not only of interest to purchasers, but also to manufacturers. Specific statements cannot be made at present, because more detailed market surveys have yet to be presented. UBA estimates that in around one per cent of the potential applicable cases for chemical

leasing, an average reduction in a quantity of up to 20% could be achieved (ibid.). In Germany, this results in total potential savings of around 10,000 to 20,000 tons per year. Up to 20% of this potential is expected to be realized over the next five years. This would equate to an annual reduction in quantity of approximately 2000 to 4000 tons [61].

Table 4. Reduction potential of relevant chemicals [61].

Chemical	Use in t	Estimate of reduction potential in t
Solvents	7,000,000	7,000–14,000
Paints and lacquers	1,500,000	1,500–3,000
Adhesives	500,000	500–1,000
Plant protection products	50,000	50–100
Disinfectants	50,000	50–100

All in all, the study identified other major case-specific environmental impacts that could be reduced in the event of leasing chemicals. From the environmental perspective, reductions arise in the quantity of chemicals used due to more efficient use. This reduction leads, for example, to less waste from residues and surpluses [61–63].

According to the Federal Environment Agency, environmental and health-related improvements could be achieved in all of the known cases of successfully applying chemical leasing. The use of chemicals was reduced and their handling enhanced [61–63].

These enhancements concern, amongst other things:

- Lower quantities of waste;
- Less contamination of waste water with chemicals;
- Fewer air emissions;
- Improved workplace conditions;
- Risk avoidance/reduction from handling chemicals.

It follows that the chemical leasing business model harbors great potential for saving resources. At the same time, it must be noted that these assessments can, of course, vary considerably, depending on the particular example. Nevertheless, the overall impression gained is that chemical leasing harbors high to medium estimates of potential.

4. Results and Discussion

As already presented in other studies [30,54–57,60,61] and confirmed by the present analysis, the general statement that “use rather than own” schemes are “resource-efficient” is not applicable. The findings of the analysis illustrate that “use rather than own” systems may be associated with negative ecological side-effects caused, for example, by any transportation services or packaging material required. At the same time, however, the cases analyzed also clearly convey the fact that “use rather than own” schemes can contribute to a more efficient use of material goods and, hence, to a more efficient use of resources, if certain framework conditions are observed, for example, by using durable products or enhancing device utilization.

The results of the analysis also emphasize the need to make distinctions when considering different product groups: the example of the cotton T-shirt revealed how relevant the use phase of products is and how resource intensity varies, because the greatest consumption of (biotic and abiotic) resources is caused by water consumption in the area of care and production. Renting do-it-yourself equipment generally harbors the potential to reduce resources and negative environmental effects; however, the potential for reducing resource consumption is greater in the case of rarely used devices. Additionally, the same applies to the chemical leasing business model: the analysis confirms a great potential for saving resources, even though these assessments can, of course, vary considerably, depending on the particular example.

The aforementioned MIPS concept based on Schmidt-Bleek [1] constitutes an indicator to assess and compare the environmental implications of products, processes and services throughout the entire lifecycle (from extraction, production and use to waste/recycling). On the basis of the MIPS concept, the service life and usage intensity of products are equally relevant key properties, because the resource consumption of a product that is material-intensive in the production or disposal phase, for example, can be optimized by extending the use phase [1,31]. “Use rather than own” schemes, therefore, offer the possibility to achieve a reduction in resource consumption, with the satisfaction of needs level unchanged, by increasing the total number of service units (by swapping, for example). In other words, the longer a product is retained in the use phase, the lower the product’s total material footprint (*ibid.*). According to this, endeavors should be made to prolong and intensify the use phase, as shown also by the findings of the present analysis (*ibid.*).

Contrary to our cultural consciousness of society that many “service-providing machines” only please us if we actually own them, the analysis undertaken by Leismann *et al.* [42], shows that, due to the whole host of existing offers, any products and services can be borrowed, rented, leased or exchanged for the duration of use, which also show signs of resource efficiency potentials. Thus, product sharing is a relevant example of use concepts that, considered comprehensively, reduce material flows [15,31,36,39].

Against the backdrop of the present results, once again, the problematic nature of a general claim that “use rather than own” schemes are “resource-efficient” is highlighted. However, as explained, their resource-conserving aspects can only be determined for individual case analyses. At the same time, it is emphasized that considerable efforts are still required in order to be able to provide the necessary data and facts, infrastructure and information. Accordingly, there is a great need for research. In order to enhance the resource efficiency potentials of “use rather than own” schemes, the following recommendations can be derived.

4.1. Identifying “Use Rather Than Own” Schemes and Tapping Potential

Existing schemes and those currently under development are to be systematically assessed against the backdrop of the investigation results based on resource efficiency criteria. To this end, suitable assessment tools are required, such as the MIPS concept devised at Wuppertal Institute [1]. This tool is based on the consideration of resource consumptions throughout the lifecycle, from raw material extraction through production, distribution and use to recycling or disposal. In this connection, any potential displacement or rebound effects are included in the examination. This way, various

(conventional or ownership-substituting) schemes can at least be allocated approximate values on resource consumption, revealing which business model is more resource-efficient. The data could be made available via tracking codes or apps, offering consumers guidance. The following priority research questions requiring funding can be derived from the above discussions:

- How and to what extent can specific resource efficiency potentials be achieved by “use rather than own” schemes along the entire value-creation chain;
- Which ownership-substituting schemes in the B2B (business-to-business), B2C (business-to-consumer) and C2C (consumer-to-consumer) areas make sense from an ecological or resource-conserving and, also, social perspective;
- Which potential displacement or rebound effects result from the utilization of “use rather than own” schemes;
- Which resource-intensive hot-spots can be identified in the various scheme types, and what measures can be taken to optimize them?

In addition to expanding basic knowledge about resource consumption, additional aspects must be considered if the intention is to disseminate ownership-substituting services. The research questions and funding requirements identified in the investigations are addressed in the following section.

4.2. Raising Awareness of “Use Rather Than Own” Schemes as a Consumption Option

Since the utilization of “use rather than own” schemes depends on the attitudes, degree of awareness and knowledge of those who offer and use the schemes, the need for action must be formulated for the areas of image and awareness-raising work and information and educational activities.

Amongst other things, the focus here is on resolving issues concerning not only the capability of the new forms of use to tie in with the existing symbolism involving ownership, but also current social trends (for example, the declining importance of ownership amongst young adults). Image and awareness-raising campaigns could reflect upon social thought/action patterns. In addition, they are suitable for accentuating the positive aspects associated with “use rather than own” concepts and emphasizing the burdensome obligations connected to ownership.

What is more, many users are unaware of existing service providers and schemes. This deficiency could be resolved by providing sources of information matching demand to supply. It appears appropriate to set up an Internet platform and to create an information brochure in print form, showing the range of schemes within the region.

In addition to practiced routines, knowledge about the existence of alternative forms of use and the effects associated with them are decision-relevant in the selection of consumer choices. In order to create an appropriate knowledge base, the topic of “using rather than owning” must be integrated into current educational systems and formats [52]. The open didactic development of the topic in the form of devising experimentally oriented teaching/learning modules and media formats for different target groups could play a major role here [52,64]. Against this backdrop, the following research questions that require funding are given as examples:

- Image and awareness-raising work: How can cultural barriers (for example, commitment to ownership, negative associations concerning ownership-substituting services) be dismantled? How should image campaigns that aim to change values and behavior be designed;
- Information and communication: Which preferences and obstacles concerning the utilization of “use rather than own” schemes can be identified? Which target groups are receptive to which offers? What elements must a communication strategy that takes up and positively attends to preferences and obstacles (according to specific target groups) contain;
- Educational work: What content must be made didactically accessible to enable systemic interrelationships to be experienced and to promote the ability of potential users to make judgements? What competencies do members of the teaching staff require, and where in the education system can priority connecting factors for mediation be found? Which formats are most suitable for which target groups?

In order to establish ownership-substituting services in society on a broader scale, additional factors are required alongside raising awareness and creating knowledge, namely the stimulation of both the provider/supply side and the demand side by way of accompanying activities. The expansion of the infrastructure and the advisory structure, innovative projects and cooperative activities can make a major contribution in this direction, as described in the following paragraph.

4.3. Expand Infrastructure, Initiate Innovative Projects and Enter into Collaborative Activities

An infrastructure that facilitates advisory services (for example, start-up consultancy, specialist information), practical everyday accompaniment (for example, testing schemes) and the implementation of (funded) projects and that is geared towards both providers and users could support the dissemination of “use rather than own” schemes. A point of reference for such an infrastructure could be local authorities or neighborhoods (for example, waste avoidance centers, re-use enterprises) [39].

New constellations of stakeholders can additionally have a positive effect on the market success of “use rather than own” schemes (for example, by spreading the scheme, facilitating access to target groups, exchanging information and solving problems together). If providers of different “use rather than own” services join forces to make a “branded community” with its own corporate design (for instance, a logo as an “umbrella brand”), the concept of using without owning and of social interaction could be promoted jointly. The following research questions and funding requirements result from this state of affairs:

- Expansion of infrastructure: Which facilities are suitable, and how should their awareness of the topic be raised? How should such a contact point be designed and the range of tasks and communication (for example, for specific target groups) prepared;
- Innovative constellations of stakeholders: In addition, the extent to which the trend of swapping or sharing that is currently booming amongst private consumers can be transferred to the relationship between companies should be investigated.

In addition, a positive effect could be achieved by accompanying this package of measures with an incentive scheme tailored towards ownership-substituting services, as well as guidelines offering providers and users legal certainty, as shown below. Especially analyzing public libraries,

Hal R. Varian in the *Journal of Industrial Economics* (2000) already argued that it is not necessarily true that sharing of goods is bad for original producers, because the price of the good that should be shared would be much higher than the book would cost for single purchase [35]. Thus, incentives must especially be created for companies so that they make “using rather than owning” offers.

4.4. Creating Incentives and Legal Certainty for Ownership-Substituting Services

Trust coupled with transparency are two fundamental prerequisites for the utilization of “use rather than own” schemes. This is the case for regional offers and, in particular, for Internet-based services. Credibility and trust in the seriousness of the offer and in the participants is achieved by information gleaned from rating systems. In this respect, the development and advancement of customer/user rating systems is an important aspect. Trust in individual schemes can also be enhanced if independent organizations investigate and certify the quality of the scheme based on specific criteria.

Addressees for incentive schemes to promote “use rather than own” schemes can be found on both the provider and the user side. For providers, support measures from free start-up consultation to start-up support would be conceivable. Tax advantages (for example, depreciation provisions) and state subsidies could offer further incentives. On the consumer side, the demand for “use rather than own” schemes could be linked to tax relief (for example, reduced value-added tax) or achieved by promoting user communities.

Additional incentive schemes could aim to: further develop the ecological tax reform, introduce a material input or resource tax, internalize disposal and recycling costs and reward high waste recovery rates.

With regard to policy, framework conditions must be created that give providers and consumers legal certainty. Gaps in legislation need to be closed and a transparent legal situation created. Standard warranty and liability rules, assistance in drafting contracts (for example, drawing up standard or model contracts) and support in clarifying insurance-related issues, for instance, are conceivable. Needs for research requiring funding can be identified in the following areas:

- Rating systems: Which confidence-building measures are pertinent, and how can they be integrated? Which evaluation methods are suitable for assessing offers directionally (regional/web-based)? What role can certification play;
- Monetary/immaterial incentives: Which measures play a key role in dismantling barriers for consumers and entrepreneurs;
- Legal framework conditions: How can legal and financial obstacles (for example, commercial, tax, warranty, planning law, and so on) be overcome for entrepreneurs who wish to develop or use a “using rather than owning” scheme? How can price economics be shaped in favor of “using rather than owning”?

P. Söderholm and J.E. Tilton also conclude from their analysis of material efficiency in an economic perspective that incentives should play a central role in a policy to effectively promote resource efficiency. They argue: “that environmental externalities and information failures, rather than concerns over depletion and growing resource scarcities, provide the main justification for policies promoting material efficiency. Policy makers should thus opt for regulatory measures that target the

relevant market failures (e.g., environmental damages, absence of internalized environmental costs, false information and asymmetric lack of information, innovation-related market imperfection) as closely as possible” [51].

Prices are a relevant aspect for decisions, both on the side of producers and consumers. Because as long as environmental costs are not internalized, prices for products remain accordingly lower and prices for services are higher, it will be hard to promote “using instead of owning” schemes. Additionally, people tend to ascribe high symbolic value to the ownership of goods and, thus, a cultural shift is required “to place value on having a need met as opposed to owning a product” [3]. Central barriers are seen in consumers’ reservation towards consumption without ownership and producers have to consider, e.g., organizational change, formation of prices and shifting back risks into their own business, which have, so far, been born by consumers. To handle these tasks and the possible lack of previous experience, time, capital and information are required. Incentives here can help to overcome barriers both on the side of consumers and producers [29,51,65,66].

5. Conclusions

Similar to Schmidt-Bleek, who in 1994 saw potential for saving resources through the shared use of “service-providing machines” [1], the analysis shows that a general resource-saving potential can be realized by “use rather than own” schemes, as long as the framework conditions associated with using the service do not cancel out the savings achieved. This is apparent in the analysis of the selected case studies: textile swapping, tool hire and chemical leasing. Negative impacts on resource efficiency could be, for example, the resources required within a transaction for transportation and/or packaging or the overuse of products. “Using rather than owning” can lead to the optimization of the resource consumption of products that, for example, are material-intensive in the production phase, by extending the use phase.

In addition, the investigation results clearly indicate that, besides expanding basic knowledge concerning data and facts about resource consumption and how to generate them, other aspects must also be taken into account if ownership-substituting services are to be disseminated. On the one hand, there needs to be a change in attitude in society leading to a loss in the symbolic strength of ownership. Enhancing the image and the level of information amongst (potential) providers and users about “use rather than own” schemes and the framework conditions associated with them can contribute to this. The structural entrenchment of a consultancy infrastructure that goes well beyond merely providing information (for example, neighborhood-based re-use centers, start-up consultation, and so on) can also give important impetus to disseminating supply and demand in the area of ownership-substituting services. This can be done by enabling schemes to be experienced, offering both potential providers and users a testing ground. Experimentally oriented teaching/learning modules and media formats, prepared for different target groups, would be suitable for use in different areas, such as academic and vocational education. Furthermore, incentive schemes (for example, start-up support, tax advantages for providers and users, promotion of user communities), the subject of legal certainty for providers and users (for example, standard warranty and liability rules, assistance in drafting contracts and the clarification of insurance-related issues) and research promotion set guidelines that are suitable for positively stimulating supply and demand for ownership-substituting services.

To summarize, it can be concluded that “use rather than own” concepts alone will undoubtedly not suffice to reduce resource consumption to the extent necessary. It can be assumed, however, that they can make an economically relevant contribution, particularly because, according to forecasts, above all, Internet-based schemes will continue to expand further and play an important role in changing consumer patterns, due to the wide use and networking opportunities offered by the Internet. The reputation of flexible access to products or services and affiliation to (Internet-based) social networks or the social additional benefit associated with specific schemes are being enhanced, particularly amongst younger population groups. It is a trend within which the well-tried logics of ownership begin to totter or become displaced. In this connection, however, it is important to consider resource consumption and resource efficiency potentials in a differentiated manner. However, the principles underlying “use rather than own” schemes are suitable for making a positive contribution to achieving the Factor 10 target.

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