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Experimentation to drive sustainable consumption through new business models: examples and transition relevance

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Abstract

Sustainable business models are often seen as a systems-level way to create transitions in business. However, the impact of new business models such as product service systems (PSS) is uncertain and business models need to be developed and designed to achieve the desired impact. Moreover, the actual impact needs to be tracked.

Sustainable consumption is a thorny topic not yet addressed to its full potential in business model literature. However, sufficiency and in particular sufficiency driven business models, have been discussed as a potential business approach to slow consumption patterns. Sufficiency thus can be a key driver for business model innovation and includes strategies, ranging from product strategies focused on longevity and design for maintenance, repair and remanufacturing, to revenue models focusing on premium pricing and PSS, where the service rather than the product is being priced; and anti-consumerist approaches to selling (e.g. no discounting/ special sales). Moreover, Peer-to-Peer (P2P) sharing cases can be seen as special types of PSS, offering interesting and relevant examples, such as prosumers (consumers or end-users that also produce) that contribute to sustainable consumption and production, or sharing the use of products with others in the neighbourhood for moderate costs (e.g. P2P car or product sharing).In order to make sustainable business models more widespread and design them in such a way to create positive impact, experimentation with new business models is needed. Experimentation with sustainable and circular business models is still a relatively new topic in transitions literature, but is a potential valuable avenue for further research. Moreover, business model experimentation is seen as a core capability to remain competitive in turbulent business environment, and drive sustainability transitions through activating businesses.

This paper addresses the research question “How can PSS business models - Pay per Use and P2P sharing - contribute to sustainable consumption and production, and what are opportunities for sustainability transitions?” The paper investigates three cases of business model experimentation to drive sustainable consumption. We present cases in three areas from the Netherlands: *Pay per use appliances (HOMIE case), Peer to peer car sharing (MyWheels case) and Peer to peer energy (VandeBron case).* We present to which extent the case organizations were able to drive sustainable consumption and how benefits and

costs were shared among the different stakeholders and users using a business model framework. Also, wider implications for business and policy makers are provided.

In the case of HOMIE, benefits of sustainable consumption mainly accrue to the customer who benefits from lower prices when washing at lower temperatures and a cheaper when washing less in a pay per use model. The HOMIE case shows significant improvements in consumption patterns. The MyWheels case of P2P car sharing shows reduced personal car use and intensifying the use of existing cars. The P2P renewable energy case of VandeBron shows substitution with renewable energy, as well as increased opportunities for new renewable energy investments by the producers.

Transition relevance is discussed in two different ways. First, we will discuss experimentation in relation to opportunities for scaling up these examples and their business models and how constraints can be overcome. Second, we will discuss challenges associated with transition aspects that can be added to business model innovation processes by bringing in transition and future aspects through sustainability-oriented scenario - and transition management tools.

Keywords: Sustainable consumption; business model innovation; experimentation; product service systems; PSS; business experiments.

1. Introduction

Sustainable consumption is a thorny topic not yet addressed to its full potential in business model literature (, e.g. Edbring et al., 2016). However, sufficiency and in particular sufficiency driven business models, have been discussed as a potential business approach to slow consumption patterns (Dyllick and Hockerts, 2002; Young and Tilley, 2006; Bocken and Short, 2016). Sufficiency thus can be a key driver for business model innovation and includes strategies, ranging from product strategies focused on longevity and design for maintenance, repair and remanufacturing, to revenue models focusing on premium pricing and PSS, where the service rather than the product is being priced; and anti-consumerist approaches to selling (e.g. no discounting/ special sales) (Bocken and Short, 2016). Moreover, Peer-to-Peer (P2P) sharing cases can be seen as special types of PSS (Bardhi & Eckhardt, 2012: Martin, 2016), offering interesting and relevant examples, such as prosumers (consumers or end-users that also produce) that contribute to sustainable consumption and production, or sharing the use of products with others in the neighbourhood for moderate costs (e.g. P2P car or product sharing).

In order to make sustainable business models more widespread and design them in such a way to create positive impact, experimentation with new business models is needed (Antikainen et al., 2017; Antikainen & Valkokari, 2017; Weissbrod and Bocken, 2017). Experimentation with sustainable and circular business models is still a relatively new topic in transitions literature with early contributions (Sarasini and Linder, 2017), but is a potential valuable avenue for further research. Moreover, business model experimentation is seen as a core capability to remain competitive in turbulent business environment, and drive sustainability transitions through activating businesses. Interesting examples can be found in PSS that allow for a shift of ownership and delivering functionality. However, the impact of new business models such as product service systems (PSS) is uncertain and business models need to be developed and designed to achieve the desired impact (Tukker, 2004; 2015). Moreover, the actual impact needs to be tracked (Manninen et al., 2018).

This paper addresses the research question “How can PSS business models - Pay per Use and P2P sharing - contribute to sustainable consumption and production, and what are opportunities for sustainability transitions?” The paper investigates three cases of business model experimentation to drive sustainable consumption. We present cases in three areas from the Netherlands: *Pay per use appliances (HOMIE case), Peer to peer car sharing (MyWheels case) and Peer to peer energy (VandeBron case).* We present to which extent the case organizations were able to drive sustainable consumption and how benefits and costs were shared among the different stakeholders and users using a business model framework. Also, wider implications for business and policy makers are provided.

This paper is organized as follows. After the introduction, section 2 provides a literature overview, a framework and methodology. Section 3 presents the three cases, while in Section 4 results are discussed, including their transition relevance Transition relevance includes opportunities for scaling up these examples and their business models and how constraints can be overcome. Moreover, we will discuss challenges associated with transition aspects that can be added to business model innovation processes by bringing in transition and future aspects through sustainability-oriented scenario - and transition management tools. Conclusions are drawn in Section 5.

2. Literature, framework, and methodology

2.1 The rise of sustainable business models

During the last decade significant progress has been made in Sustainable Business Models (SBMs) (Stubbs and Cocklin, 2008; Porter and Kramer, 2011; Boons et al., 2013; Boons and Lüdeke-Freund, 2013; Bocken et al., 2014) and it is increasingly taken up by firms, policymakers, NGOs and academics.

Azapagic (2003) already argued for the integration of sustainability strategy in the business vision and strategy. Thus not merely adding it to the business by means of CSR practices, but integrating it in the core of the firm (see also Schaltegger, et al., 2012). However, the strategic choice to achieve sustainability objectives needs to be implemented in the business logic of a company and its business models, (Al Debei and Avison, 2010). So the strategic choice for a sustainable approach needs to be translated into the business logic, and therefore requires rethinking and innovating business models (Bocken et al., 2014; Boons et al., 2013; Hall and Wagner, 2012; Schaltegger et al., 2012; Stubbs and Cocklin, 2008). Sustainable business models can be seen as the next step in Corporate Social Responsibility (CSR), as it brings financial aspects and profit in a broader sustainability framework for firms. It also allows for multiple value creation, vis-à-vis social and environmental aspects (e.g. Charlo et al, 2017; Slack, 2012), and provides a more comprehensive framework than the Triple Bottom Line (TBL).

Recent progress in sustainable business models includes work by Bocken et al (2014) who have defined archetypes of sustainable business models, making a distinction between technological, social, and organisational archetypes, building on the innovation types in Boons and Lüdeke-Freund (2013). The relevance of sustainable business models for sustainable innovations has been discussed and connected to economic performance and was used to develop a research agenda (Boons and Lüdeke-Freund, 2013; Boons et al., 2013). The concept of SBM has been related to business models for sharing (e.g. P2P car sharing; Jorge, and Correia, 2013; Cohen and Kietzmann, 2014, Munzel et al., 2017), energy prosumers (e.g. energy cooperatives, Huijben and Verbong 2013), energy efficiency (Gauthier and Gilomen, 2015), fishing cooperatives (Karadzic et al., 2013) product-service systems (Ceschin, 2013; Anttonen et al, 2013), frugal innovation (e.g. Levänen et al, 2016), social innovation (Boons and Lüdeke-Freund, 2013), user-driven innovation (Baldassarre et al, 2017), sufficiency in consumption (Bocken and Short 2017) and sustainable procurement (Witjes and Lozano, 2016). New types of business models are also required for a circular economy (e.g. Bocken et al, 2016; Kraaijenhagen et al, 2016), for instance for enabling circular buildings (Leising et al, 2017).

Bocken et al. (2014) have proposed eight different archetypes of business models for sustainability, which can be related to their technological, social or organisational focus. This later on got updated to nine archetypes by Ritala et al (2018), who also assessed the uptake of such business models by large business. For instance, the technology related BMs focus on maximizing material and energy efficiency, creating value from waste, and on substituting with renewables and natural processes. Social related BMs focus on delivering functionality instead of ownership (leasing models), adoption of stewardship roles, and encouraging sufficiency. Organizational BMs focus on repurpose for society/ environment, and on scaling up solutions. Although Bocken et al. (2014) label these as archetypes, many BMs will in practice combine elements of these "archetypes". As we also have seen in other BM

typologies (for example Weill and Vitale, 2001) pure expressions of archetype BMs are seldom and most often combinations of innovative elements leading to innovative BMs. Gauthier and Gilomen (2015) looked at organizations that are collectively engaged in energy efficiency projects and identified components from business models in literature. Abdelkafi and Täuscher (2016) developed a conceptual model for a business model for sustainability, where the focus lies on the value creation capacity, value to the customers, value to the natural environment, and captured value and how they can reinforce each other. Finally, Roome and Louche (2015) have emphasised the importance of stakeholder involvement, as also do Boons and Lüdeke-Freund (2013). They also point to considering value destruction next to value creation, as do Bocken et al (2013). This points to the relevance of what value is destroyed and prevented or reduced to use this as a starting point for debate to create new forms of value.

When relating business models and sustainability, Boons and Lüdeke-Freund (2013) identify four main elements that connect business models to sustainability. This builds partly on Stubbs and Cocklin (2008), while those elements can also be found in Schaltegger et al. (2012) and Gauthier and Gilomen (2015):

1. value proposition needs to guide, next to economic value, measurable ecological and/or social value,
2. actors do not shift their ecological burdens to their suppliers and, or customers, but internalise these,
3. actors motivate customers to take responsibility, and
4. the revenue model is based on a financial model that reflects cost and benefits across actors involved and accounts for ecological and social impacts.

2.2 Business Models, Sufficiency and Sustainable Consumption

Sufficiency can be regarded as “consuming a quantity of goods and services that is just sufficient for optimal well-being, refraining from both under-consumption and overconsumption” (Gorge et al., 2015, p.11). Sufficiency stands for consumption and lifestyles in which the level of material consumption is strongly reduced, and in which quality of life is more determined by wellbeing, social relationships, more quality time, less time pressure. It can also be related to alternative economic models like degrowth, steady state (developed by Herman Daly), and Tim Jackson’s (2009) plea for prosperity without growth. Sufficiency is particularly concerned with the higher strategies in the waste hierarchy to avoid resource use (e.g. Patagonia’s “Don’t Buy This Jacket”), reduce resources (e.g. demand reduction) and reuse products and resources (e.g. 2nd hand) (Bocken and Short, 2016). Indeed, alternative modes of consumption include models for extending the lives of products (e.g. through reselling of second-hand goods), access-based consumption (e.g. renting and leasing), and collaborative consumption (e.g. sharing platforms) (Edbring et al., 2016). Whereas in the developed world, consumption rates far exceed planetary sustainable limits (O’Neill et al, 2018), which requires the moderation of consumption and possibly radical shifts in what and how we consume; in the developing world, livelihoods will need to be elevated from poverty, but also in a sustainable way, off-grid solar business models being one example (Prabhu, 2017).

As a business model strategy, “sufficiency-based business models deliver sustainability by reducing absolute material throughput and energy consumption associated with provision of goods and services by moderating end-user consumption: encouraging consumers to make

do with less" (Bocken and Short, 2016, p. 46). Consumers are crucial in the success of these models and whether they are willing to adopt new propositions and behaviours such as participating in peer to peer sharing models (e.g. Edbring et al., 2016). Moreover, in our current capitalist system, sufficiency-driven business models are far from mainstream. Corporate structures focused on growth through shareholder value, classic business models focused on growth as well as competition from low cost high volume competitors are just a few barriers to the pursuit of sufficiency-oriented business model innovations (Bocken and Short, 2016). Hence, in sustainability transitions, the role of business models (Sarasini and Linder, in press) and in particular, sufficiency-driven business models need to be better understood.

2.3 PSS, business models and sustainable consumption

Product service systems, put simply, are systems where a firm offers a mix of both products and services, in contrast to the traditional focus on products (Tukker, 2004). These product service systems can be more product oriented (e.g. product with high levels and warrantees) or more service oriented (e.g. results driven models focused on deliver a result like 'clean laundry' rather than a product) (Tukker, 2004). (Goedkoop et al, 1999) have defined a PSS as "a marketable set of products and services capable of jointly fulfilling a user's needs". The initial move to PSS was largely motivated by the need on the part of traditionally oriented manufacturing firms to cope with changing market forces and the recognition that services in combination with products could provide higher profits than products alone. Product-service systems (PSS) are thus business models that provide for the combined delivery of products and services. While not all product service systems result in the reduction of material consumption, they are widely being recognized as having environmental improvement potential (Goedkoop et al., 1999; Mont and Tukker, 2006). For example, Mont (2003) defines PSS as "a system of products, services, supporting networks, and infrastructure that is designed to be competitive, satisfy customers' needs, and have a lower environmental impact than traditional business models. A slightly different definition is "A PSS is a pre-designed system of products, service, supporting infrastructures, and necessary networks that is a so-called dematerialized solution to consumer preferences and needs. PSS models can also enable collaborative consumption of both products and services, leading to pro-environmental outcomes (Piscelli et al, 2015). However, the design of PSS models and deliberate inclusion of environmental impact reduction – e.g. incentives for the user to reduce energy or water use, while using the service or optimizing energy performance when delivering the 'result' e.g. fresh air or clean laundry - is essential to the environmental success of such models.

It can thus be concluded that experimentation in business models for sustainable consumption is highly needed, and should be properly studied to test whether the environmental claims materialize. This paper aims to contribute to this by studying PSS business model experimenting in real-life, by not only looking at their BM performance, but also to what extent they contribute to both sustainable consumption and sufficiency.

2.4 Framework

Based on the previous discussion the sustainable business model (SBM) framework as proposed by Bocken and Short (2016) and shown in Figure 1 will be used to describe and analyse the cases of business model experimentation. This SBM framework can be seen as based on the well-known business model canvas (BMC), but extended with sustainability in the value proposition, value creation and delivery and value capture.

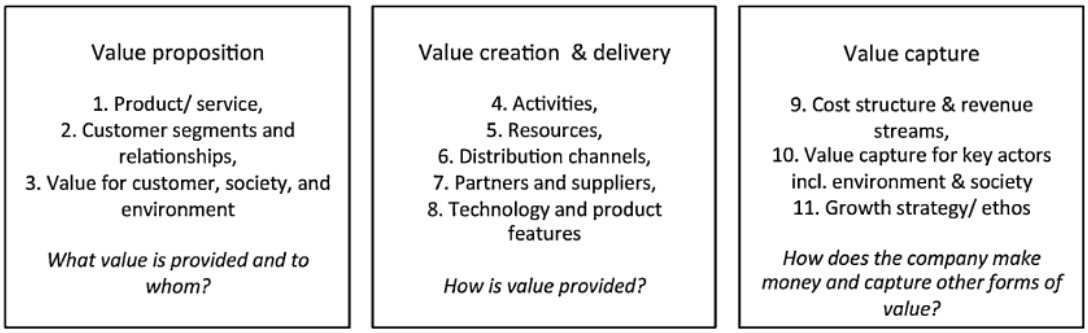

Figure 1 Framework for Sustainable Business Models (source: Bocken and Short, 2016 based on Richardson, 2008 and Osterwalder & Pigneur, 2010)

However, the SBM framework does not yet show a clear picture whether it leads to (more) sustainable consumption, so consumption and use practice needs to be added and is in this paper complemented with the sufficiency business model categories proposed by Bocken and Short (2016), as shown in Table 1. Whereas the categories of sustainable consumption and sufficiency type look for the positive effects, we also add the category of potential rebounds in order to have a check on those effects that are potentially increasing the environmental impact, instead reducing it.

Table 1. Sufficiency business models: adapted from Bocken and Short (2016)

	Business model initiative	Value creating logic	Examples
Avoid	Moderating sales and promotion Conscious action to moderate sales activities – eliminating manipulative consumer marketing campaigns, no sales incentives, choice editing.	The business model is built on customer long-term relationships and trust in payback in terms of loyalty and reputational benefits. Revenue models are often focused on premium pricing.	Vitsœ, Patagonia.
Reduce	**Demand reduction services:** Solutions that mitigate the use of energy and resources by individuals and businesses - Provision of add-on services that assist consumers in reducing consumption. - Public subsidies and, or preferential tax treatment may be used to strengthen the business case.	The firm is paid for services, while the consumer makes savings that are greater than the fees, so both consumer and firm benefit. It may be necessary to strengthen the business case and provide incentives for consumer or provider adoption.	ESCOs (FOR A, 2010), Kyocera, Riversimple E.g. Energy feed-in tariffs, green-deal subsidies for home insulation, etc.
	Sharing; no ownership: sharing the same product across multiple customers. The customer never 'owns' the product. Rather, a service	The firm is paid for the service (e.g. car access) rather than ownership (of cars). For the customer this can create convenience and transparency (car availability and	Riversimple, Other sharing models: Zipcar, BlaBlaCar, Couchsurfing, Airbnb (Chase,

	is sold	full service)	2012)
Reuse	Extending product life Provide products designed to last a lifetime (eliminate built-in obsolescence), be repairable, upgradable, and not subject to fast-fashion trends.	The business model is built on long-term customer relationships and trust, leading to loyalty and reputational benefits, and follow-on services. A premium price or service charges can justify slower sales. Customers benefit in through-life cost savings.	Cucinelli, Patagonia, Vitsœ.
	Direct reuse Creation of second-hand markets for used goods to reduce waste to landfill or idle assets.	Consumers are encouraged to pay premium price because a strong used market creates re-sale value offsetting initial higher purchase costs.	Patagonia in partnership with eBay.
Full life cycle	Full life cycle sufficiency Design and product use are focused on minimising resources, the most important example being 'frugal innovations'. Unfortunately, most of these solutions have been mainly focused on low income countries, not developed countries	Depending on the type of product (frugal or premium) affordable or premium pricing is adopted. In both cases, customers benefit from cost reductions in the use phase (e.g. energy). In frugal innovation, social enterprise models with lower profit drive might be used.	Kyocera's full life cycle impact approach; Frugal innovations (Bocken et al., 2014) based on simple technology and low impact across the life cycle.

This leads then to the following analytical dimensions for the cases:

- Business Model Experimentation:
  - value proposition
  - value creation and delivery
  - value capture
- Sustainable Consumption effects:
  - Contribution to sustainable consumption
  - sufficiency BM types
  - possible rebounds

2.4 Case study methodology

This study follows an exploratory multiple case study approach (Yin, 2003). Cases of sustainable business models on PSS have been selected that have potential for contributing also to sustainable consumption and sufficiency after which these cases were (re)analysed, for which existing material including interview transcripts, reports and other empirical results were re-examined. The following cases from the Netherlands were selected:

- Pay per use appliances (HOMIE case),
- Peer to peer car sharing (MyWheels case), and
- Peer to peer energy (VandeBron case).

3. Case results

3.1 HOMIE Pay-per-use washing

HOMIE is a TU Delft spin-off company founded in 2016, which aims to significantly reduce the environmental impact associated with domestic appliances, by offering home appliances on a pay-per-use basis, starting with washing machines (www.homiepayperuse.com). HOMIE was founded to demonstrate that new sustainable business models could contribute to sustainable consumption and circular economy, thus testing normative expectations about new business models in academic literature in practice through business experiments (e.g., Tukker, 2004; 2015; Bocken et al., 2014). Customers pay per wash and differential pricing is used to stimulate sustainable behaviour: a cold wash costs €0.75 compared to €2.50 for a 90°C wash (www.homiepayperuse.com), and uses nearly 90% less electricity[1]. By introducing paying per use, high quality appliances can be offered affordably, and sustainable behaviour can be stimulated by making the decision to wash and at which temperatures more salient (Thaler and Sunstein, 2008).

The company does not manufacture its own washing machines but acquires existing quality washing machines and adapts them for the pay-per-use model (e.g. adding a tracker). The company thus has its capital expenditure returned over the course of time by charging a 'pay-per-use fee'. This pay-per-use fee includes maintenance, repair and replacement of the machine if the machine were to fail. Also, when customers move house, the washing machine will be (re)moved. HOMIE also provides its customers advice on how to wash better (i.e., in a more sustainable way) and offers them the occasional free 90°C wash to 'clean' the machine. This regular contact allows for a better maintenance of the machine but also ensures a close customer contact which leads to many new customers being attracted through positive word of mouth.

The company takes a lean start-up (Ries, 2011; Blank, 2013) type of approach to sustainable business model experimentation, which signifies rapid low-cost experiments with customers. Indeed, before the washing machine is installed, each of the customers is asked how often and at which temperatures they wash. In addition, each customer is given a free month of washing. After this, informative mailings and comparison to peers are given to further influence sustainable behaviour (Bocken et al., 2017 a,b). also, goal setting (e.g. urging customers to use the eco-bottom more often) is used (Thaler and Sunstein, 2008). In earlier research it was found that over time the pay per use business model leads to a reduction in the number of washes per user as well as the temperature at which people wash (Bocken et al., 2017 a,b). However, because of the short-term nature of the start-up long term effects on consumer behaviour as well as impacts on the longevity of the washing machine cannot yet be assessed.

This reduce-type of business model (Table 1) pursued by HOMIE focuses on reductions in electricity, energy and water use. In the case of HOMIE, it was found that the number of washes and temperature over time per customer are reduced, leading to cost savings for the customer as they pay per wash and pay less for lower temperature washes (Bocken et al., 2017 a, b). Energy efficiency improvements increase the real income of households and is expected to lead to 're-spending of the cost savings on non-energy goods and services' (Chitnis et al., 2013). Energy efficiency type of measures studied by Chitnis et al. (2013)

[1] Based on HOMIE energy measurements for several cold and 90ºC cotton washes with Zanussi A+++ washing machine. Cold wash used 0.19kWh, 90ºC wash 1.71kWh. 2018 price levels.

ranging from installing insulation to using LEDs and solar thermal, amounted to 5-15%. These may be comparable to the case of HOMIE but would need to be measured. It may be difficult to assess the actual rebound effects of this business model in individual customer surveys or interviews, as individuals might not immediately link those two aspects – i.e., what they saved on washing to what they spend in other areas. Nevertheless, it could be interesting to make customers aware about their overall behaviour and create greater awareness of rebound effects (e.g., Chitnis et al., 2013) in general. It could also be the case that HOMIE customers who already make a deliberate 'sustainable choice' for the HOMIE business model are already more aware about their other behaviours (e.g. car ownership, flights, meat consumption etc.) so that the rebound effect is less apparent.

3.2 MyWheels P2P car sharing

Peer to peer car sharing is a form of car sharing where cars are not owned by a firm, but car owners make their car available for other people to use. Although this form is still smaller than regular car sharing in usage, it has been growing very fast over the past few years in the Netherlands both in terms of users and of car owners. Various platforms facilitate this form of car sharing, thereby taking care of transactions and insurance issues. More importantly, they provide the platform through which people can get connected with each other and get a fee for every car rental. These cars do not come with fixed parking spots, while there is a wide variety of cars available for rent. Major P2P car sharing platforms in the Netherlands are MyWheels and Snappcar, although these platforms are also starting activities in regular car sharing (Quist et al 2018).

MyWheels has adopted a business model for P2P car sharing using an internet platform. The environmental value focuses on a reduction in cars needed to fulfil transport needs of peers. However, how big this environmental value will be, is largely dependent on choices made by the users regarding, type of fuel and type of car they use from the platform. What is certain is that through P2P fewer new cars are needed. MyWheels also delivers social value, for instance through enhanced liveability of neighbourhoods, due to fewer cars. But also through offering people access to a car that otherwise would not be able to afford it. Moreover, MyWheels offers the opportunity for community's formation. Neighbourhoods that start such a community are likely to interact more, which will contribute to social cohesion. MyWheels has brought this social component in their value proposition. So, it can be concluded that the three components of sustainability are present in the value proposition.

Next to delivering value for its customers and the environment MyWheels is able to deliver value for other actors outside the value chain. MyWheels has a similar value proposition for municipalities as B2C car sharing companies, as they can provide a solution to overcome congestion and lack of parking spots in cities. Moreover, they also offer an open platform to other car rental companies, or car sharing initiatives, as a common IT infrastructure. MyWheels platform can thus be considered to be a radical and proactive innovation stimulating the growth of car sharing. For MyWheels it does not matter if other parties and competitors in car sharing make use of their platform. Because MyWheels does not earn money based on kilometres or hours driven, but rather on the number of cars that are shared through the platform. Prices for using are determined by the car sharer.

The financial model gives peers clear insight for what they pay each other. The tariffs incurred by MyWheels are clear; 12.5% of the fare is for insurance and €2.5 euro is for the

platform. With a growing user base this can lead to a substantial revenue stream, which is reinvested in MyWheels. As such MyWheels would not require outside investments to expand its business. Overall MyWheels does not require much investment only seed capital has been used But regarding its fleet, it strongly depends upon the users who privately bought a car and offer it for sharing, which can be seen as a form of shared investment that makes the service offering possible.

A very strong point of the MyWheels platform is that it strongly urges its users to think about the modes of transport they use, thereby stimulating sustainable behaviour. In using a car via MyWheels the user directly has to pay for its usage to the car sharer. Sometimes people give free mileage of a 100km, irrespective of the amount you drive between 0 and 100km you will pay a fixed price. This will however blur the insight in what people are paying for, and it makes people less conscious about their car usage. Users are triggered to participate on the MyWheels platform for two reasons. First there is the financial incentive. People can earn money on their car where it otherwise would remain idle. Second people join because they want to use a car.

P2P car sharing clearly contributes to more sustainable consumption patterns of the P2P user. This BM for P2P car sharing can be related to both the Avoid type and the Reduce type of sufficiency BMs, as fewer cars are needed (and less parking space is needed on the streets) and the P2P users have on average a strongly reduced car mobility demand. However, the environmental gain also depends on the behaviour and choices by the persons who make their car available and the environmental performance of the car offered. When the owner uses the gains to keep the car instead of changing to a car with better environmental performance or instead of selling the car, the environmental benefit might be less clear and possibly lead to unwanted rebounds. On some of these aspects B2C car sharing companies might perform better, as these often commit themselves to owning cars with better environmental performance, e.g. hybrid cars, or electric vehicles.

3.3 VandeBron P2P energy

VandeBron has been able to redefine the value proposition of a utility company, by directly connecting consumers with renewable energy producers via a two-sided platform business model. In doing so VandeBron offers consumers transparency as to where their energy comes from and as to how it is produced.

This leaves consumers the freedom to make a deliberate choice for a renewable energy source. On the producer side of the platform VandeBron offers the producers the freedom to determine the price of their energy, based on the market price while staying below the prices of the big three incumbent market players. Producers personally tell the story behind the energy they offer.

VandeBron’s revenue model is based on a fixed fee. This decouples the energy price from the prices paid to the grid operators and the utility company. This results in a transparent financial model as to what is paid to the producer, VandeBron, and the grid operator. As the fees to both VanDeBron and the grid operator are clear, it implies that all other gains on the energy are given back to the producer, which makes investing in renewable sources more attractive.

Producers on the VandeBron platform only offer renewable energy, so VandeBron has found a way to offer 100% renewable energy sources in an economically feasible way, while people are guaranteed access to energy as they are used to. However, VandeBron does not automatically lead to changes in consumer behaviour.

Although VandeBron delivers environmental value through their renewable energy sources, negative value can be attributed. For instance, the biomass installations offered by VandeBron can use wood or cattle feed, which can have other feed or food applications too. Such negative effects are taken into account by VandeBron when selecting producers, in order to prevent such biomass installations to deliver energy via the platform. VandeBron is exploring the possibilities of reducing negative value, for example by in setting up criteria for producers, before they can offer their business case via the platform.

By connecting producers and consumers directly, VandeBron follows a platform approach. This means that both sides share cost for investments in sustainable infrastructure. The contributions of producers that have invested in their renewable energy sources do this on a larger scale than households with solar panels who offer their surplus power. The latter approach, labelled “collective solar”, allows consumers to contribute to sustainable energy supply on a small scale. This also means that the consumer becomes a prosumer. In connecting producers and consumers directly no further additional value is created.

With their platform approach VandeBron, is dependent upon the two sides of the platform. The risk they run with increasing competition is that their influence upon the type of renewable energy and at the same time the negative value attributed to this source becomes less. Producers determine what sources they use for their energy, and if the criteria of VandeBron are considered too strict producers can switch to other platforms. At the same time since consumers are price sensitive, so VandeBron needs to competitive on price. VandeBron has been able to redefine the value proposition of a utility company, by directly connecting consumers with renewable energy producers via a two-sided marketplace/platform. In doing so VandeBron offers consumers transparency as to where their energy comes from and as to how it is produced.

In sum, this leaves consumers the freedom to make a deliberate choice for a renewable energy source, thus greening their use of especially electricity. On the producer side of the platform VandeBron, offers the producers the freedom to determine the price of their energy, based on the market price while staying below the prices of the big three incumbent market players. Producers personally tell the story behind the energy they offer.

The BM of VandeBron allows consumers to green their electricity use and thus contributes to sustainable consumption, while it has additional advantages to green energy producers like (i) better and more personalized connections to their customers and (ii) higher gains that can be used for further green investments. However, there are no clear sufficiency or energy reduction incentives present in this case and this is something on which the BM of VandeBron could further improve. Interestingly, such additional services can be found at several other utilities providing green electricity, such as Qurrent in the Netherlands (Quist et al, 2018). This might be of relevance, as the use of green electricity may reduce the motivation for saving energy and energy conservation.

4. Cross-case discussion and transition relevance

With regard to BM experimentation relevance (and cross-case comparison) the following conclusions may be drawn:

- Experimentation is important and can lead or contribute to larger societal shifts (e.g. new generations who are less interested in ownership)
- Experimentation can be applied at different levels and elements of the business model (Bocken et al., 2018) – and can range from more operational and technical, to value proposition, revenue model, and customer relations type of interventions. As seen in the HOMIE case the combination of multiple experiments (from pricing to customer interactions) may be powerful.
- Nevertheless, good evaluation is needed, as sometimes there is negative value or missed value present for which value mapping (Bocken et al, 2013) can be used for BM innovation in a direction that the relevance for sustainable consumption and sufficiency can be enhanced. This is important when aiming at scaling-up.
- Also, the connections with other business models and dependencies on others need to be investigated: e.g. in the case of car sharing are petrol cars still used?; if electric cars are used, what is the electricity mix?; do we need to encourage car usage in general or rather promote public transport? (Boons & Bocken, 2017)

Transition relevance

- Business model experiments occur more at the level of emerging niches, but may lead to larger translations in the incumbent system (e.g. large established car manufacturers and rental car companies taking over B2C car sharing companies; Schaltegger et al., 2016)
- Business models are a potential key part in the transition to a sustainable society (Sarasini & Lidner 2017). However, such business models need to be designed to deliver the desired results (Mont & Tukker, 2006). Also, the overall impact and interactions (e.g., dependencies, parasitic and mutualistic relations) with other business models needs to be understood to gain a full understanding of the actual impact of such business models (Boons & Bocken, 2017).
- The transition relevance can be increased by adding a long-term view and vision to BM (re)development to make them more robust. For this, elements from backcasting (e.g. Quist 2013, Quist and Tukker 2013), transition management (e.g. Loorbach et al 2017) and scenario methods can be used (e.g. Gaziulusoy et al, 2013).

5. Conclusions

This paper has shown three types of business models that support sustainable consumption, namely P2P car sharing, pay-per use washing, and P2P renewable energy. Although these business models are still in their niche phase they show considerable potential for further growth and upscaling and therefore have transition relevance and potential. In-depth evaluation of their gains and benefits are needed in order to increase their relevance for both sustainable consumption and sufficiency, as well as to prevent potential rebounds. Business experimentation will need to occur to design the best business models from as business, as well as a systemic sustainability perspective.

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