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Lessons from eight cases

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Experimenting with a circular business model: Lessons from eight cases

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Highlights

- Experimentation is an essential capability to innovate business models for sustainability
- We conducted action research with eight case companies doing business experimentation
- We develop and apply a Circular Business Experiment Cycle
- We describe the role and process of circular business experimentation
- Experimentation processes need to include learning cycles and sustainability checks

Abstract

Experimentation is an important capability in the transition to a sustainable business. The aim of business experimentation is to learn and improve business model innovation activities with limited risks and resources through continuous and collective learning with stakeholders. Through action research we worked with eight case companies on a pathway to becoming a sustainable business. We focused on 'circular economy' as a driver for sustainability. The process and role of business model experimentation were analysed. A circular business experimentation framework was developed and applied. We found that 1) experimentation creates internal and external engagement to start business sustainability transitions 2) experiments can help test assumptions in every building block of the business model 3) collaboration with external partners can ease experimentation, and 4) experimentation processes are iterative and require regular learning and sustainability checks. Further research is necessary to analyse how sustainability targets can be integrated into the experimentation process.

Keywords: Sustainable Business; Business Model Innovation; Circular Business Experimentation; Experimentation; Transition; Lean startup.

1. Introduction

With a growing global population, middle class and associated consumption patterns that put pressure on global resources, it is increasingly apparent that business-as-usual can no longer be sustained. A fundamental shift in the purpose of business and almost every aspect of how it is conducted is needed in the transition to a sustainable future (Jackson, 2009; Ehrenfeld and Hoffman, 2013; Bocken and Short, 2016). The aim of this paper is to explore the role of experimentation in corporate sustainability journeys to support this transition. While the ultimate goal is to understand and create progress in innovation towards sustainability through action research, we specifically focus on the 'Circular Economy' as an important, recently popularised driver for sustainability (Geissdoerfer et al., 2017). The assertion here is that this would provide a more targeted focus on resource-related issues to facilitate experimentation, in contrast to the broader concept of sustainability.

The 'circular economy', in which stakeholders collaborate to maximize the value of products and materials, and contribute to minimising the depletion of natural resources and create positive societal and environmental impact, gained widespread popularity among businesses and governments (Kraaijenhagen et al., 2016). In the circular economy, business model innovation plays an important role to fundamentally change the way of doing business to go beyond prevalent sustainability approaches that focus on efficiency, productivity and 'greening' the supply chain (Bakker et al., 2014). Product service systems (PSS) are an example of a 'sustainable business model' which have gained popularity in the field of circular economy (Tukker, 2015). Although PSS, in which companies remain owners of products, may allow for higher environmental gains (Brezet et al., 2001; Charter and Tischner, 2001; Manzini and Vezzoli, 2002; Mont, 2004; Tukker and Tischner, 2006a, b), this innovation also comes with a higher degree of uncertainty because of the radicalness compared to the traditional way of doing business (Keskin et al., 2012).

From a strategic point of view, large companies already understand the need for business model innovation to ensure survival and growth as they deal with an external threat of continual innovation (Blank, 2013). For corporates looking to create products and services associated with high levels of uncertainty, experimentation has been considered as the most important innovation capability to succeed in radical innovation activities (Chesbrough, 2010; Weissbrod and Bocken, 2017). Chang et al. (2012) identify a positive relation between experimentation and the innovation performance in radical innovation. Methodologies such as the 'Lean Startup' approach (Ries, 2011) acknowledge this and opt for experimentation over elaborate planning; customer feedback over intuition; and iterative design over traditional 'big design up front' development, when launching a new enterprise. Offerings are redesigned through a continuous feedback loop of assembling minimum viable products - early versions of the product/ service – and receiving customer feedback and using this input to revise assumptions (Blank, 2013). Weissbrod and Bocken (2017) integrated this theory in the field of sustainable development and made a conceptual link between lean start-up thinking, triple bottom line value creation (economic, social and environmental) and the organizational capability of experimentation through a single in-depth case study.

The topic of experimentation is not new and is widespread in fields like natural sciences and economics (Bocken et al., 2016). In the natural sciences and economics, experiments often take place in controlled lab settings. Experimentation has also prevailed in literature on strategic niche management (SNM; Kemp et al., 1998) and transitions management (TM) focusing on searching, learning and experimenting for sustainable development (Van de

Bosch, 2010). SNM and TM are established literature streams focused on the emergence of sustainable innovations and the role of public actors (Kemp et al., 1998, Van den Bosch, 2010; Brown et al., 2004, Hoogma et al., 2002). Experimenting may refer to innovative, 'small-scale' experiments conducted in practice to address persistent societal problems (van den Bosch, 2010). An important aim is to stimulate the articulation of needs, problems and possibilities and to enact a broad learning process as a stepping stone in a new direction (Kemp et al., 1998). Brown et al. (2003, p. 291) use the term bounded socio-technical experiment to refer to 'attempts to introduce a new technology, service, or a social arrangement on a small scale'. Analogously to Weissbrod and Bocken (2017) and this paper, the term experiments rather than 'pilots' is used to stress the central idea of 'learning' by doing (Hoogma et al., 2002, p. 5-6). Experimentation goes beyond technical learning, to areas such as user needs, regulation, and societal benefits; it is about tinkering with assumptions, and the process is open-ended and concerned with learning (Hoogma et al., 2002, p. 6).

Whereas there are clear parallels between experimentation in TM and SNM and business experimentation, the concept in business is less open-ended with a focus on deliberate learning by doing and testing specific assumptions at a time (e.g. customer traction) about the future business (Ries, 2011). Business experimentation mainly involves the focal business, sometimes with one or a handful of stakeholders (e.g., supplier, customer), and is low in resource-intensity. It often takes place 'under the radar', initially involving a limited number of stakeholders (Weissbrod and Bocken, 2017). The focus is on one particular type of learning at a time, e.g., the value proposition to the customer (Ries, 2011), with business as the main initiator. In contrast, TM and SNM projects appear to manifest themselves as multi-actor, large scale projects covering an extended period of time involving various public actors (see e.g. the mobility experiments in Kemp et al., 1998, p. 109). Sarasini and Linder (2017) also argue that the role of business and in particular business models remains underexplored in TM, whereas this could be a promising research avenue.

There is insufficient evidence on the role of business in sustainability experimentation, except emergent work incorporating the notion of the Lean Startup in circular business experimentation (Antikainen et al., 2017; Weissbrod and Bocken, 2017). However, it has been recognised that environmental paradigm shifts in business may originate from a small number of organisation members and that individual actions and practices trigger transitions (Halme, 2002; Shove et al., 2012). This paper explores *the role and process of sustainable business model experimentation within companies that shift from a linear to more circular business model*.

Through action research we worked with eight case companies on a pathway to becoming a sustainable business. Considering the limited timespan of the project, no LCA studies have been conducted to quantify the environmental and social value of the circular business models. However, as a selection criterion the transitional businesses models had to meet descriptions of sustainable business models (Bocken et al. 2014; Boons and Lüdeke-Freund, 2013) and maximise the value of products and materials to minimise the depletion of natural resources (Kraaijenhagen et al., 2016). Thereby the analysed transitional business models hold potential for positive environmental and societal impact. Nevertheless, it should be noted that new business models do not necessarily lead to environmental benefits. Tukker (2004) argues that some PSS (e.g. those creating a functional result, e.g. a 'pleasant climate') may be more promising than others (e.g., product lease) from an environmental perspective. As such, business models need to be designed in such a way to create positive effects and avoid additional negative impacts being created as argued by Mont (2002; 2004) and Tukker

(2004; 2015) and environmental value propositions need to be verified (Manninen et al., 2018). Research should more clearly emphasise criteria for design, experimentation and evaluation to develop the most sustainable outcomes (Tukker, 2015).

The remainder of the paper is structured as follows: Section 2 includes the literature review on sustainable and circular business models approaches; Section 3 (Research Method) presents the action research based case study approach; Section 4 (Results) focuses on the process and role of business experimentation for circularity based on the case outcomes; Section 5 includes the discussion which describes the results in the light of extant literature and practice in the field as well as limitations and potential for future work; and Section 6 describes the conclusions.

2. Literature

The literature section explains the role of circular business models, processes and methods, and the research gap proposing a framework for circular business model experimentation.

2.1 Uncertainty in shifting towards sustainable and circular business models

Business models provide a template to describe 'the way business is done' (Magretta, 2002). They are depicted by the value proposition (the intended product/ service offering- what value is provided and to whom?), value creation and delivery (How is value provided?) and value captured (how does the company make money and capture other forms of value?) (Bocken and Short, 2016, based on Richardson, 2008). Sustainable business model innovation is different from 'traditional' (i.e., not necessarily sustainability-focused) business model innovation, by explicitly incorporating a triple bottom line approach and considering a wide range of stakeholder interests, including environment and society (Stubbs and Cocklin, 2008) on top of the superior or unique customer value being delivered to create a competitive advantage to the firm (Boons and Lüdeke-Freund, 2013). Sustainable business models are defined *as 'innovations that create significant positive and/or significantly reduce negative impacts for the environment and/or society, through changes in the way the organisation and its value-network create, deliver value and capture value (i.e. create economic value or change their value proposition)'* (Bocken et al., 2013, p. 44).

The circular economy has recently been popularised as a driver for sustainability (Geissdoerfer et al., 2017). In the circular economy, the increasing pressure on our resources is made more explicit by defining it as *"an economy in which stakeholders collaborate in order to maximise the value of products and materials, and as such contribute to minimising the depletion of natural resources and create positive societal and environmental impact"* (Kraaijenhagen et al., 2016, p. 15). This also requires designers to think differently; instead of thinking about the product itself, they need to think in systems around products and reinvent how they can generate revenue by creating and maintaining value over time (Bakker et al., 2014). This can come with alternative business models focused on retaining the product value at the highest level longest to slow resource loops (Stahel, 1981). A circular business model can be defined as the rationale of how an organization creates, delivers, and captures value to close and slow material loops (Antikainen and Valkokari, 2016; Bocken et al., 2016a). *These "[c]ircular business model innovations are by nature networked: they require collaboration, communication, and coordination within complex networks of interdependent but independent actors/stakeholders"* (Antikainen and Valkokari, 2016, p. 7).

Whereas a lot of literature has focused on conceptualising business model innovation (e.g., Stubbs and Cocklin, 2008), it should be noted that business model innovation towards circularity and sustainability is an ongoing process of organisational learning and change (Halme, 2002). *"Organizational learning arises out of the daily interaction among diverse organizational members, each possessing different knowledge bases, and among these members and the organization's environment'* (Lenox and Ehrenfeld, 1997). Business model innovation is an iterative process of experimenting, piloting, debriefing and learning, and scaling up (Lüdeke-Freund et al., 2016; Ritala et al., 2018). Furthermore, emergent organisational practices and activities by individuals contribute to changing the dominant logic of the firm and as result the core business model (Boons, 2016; Loorbach and Wijsman, 2013; Shove et al., 2012). Rather than developing tools, companies should focus on developing 'environmental design capability' (Lenox and Ehrenfeld, 1997), which is reiterated by Chesbrough (2010) and Weissbrod and Bocken (2017) emphasising the need to develop experimentation capability.

Finally, innovating towards circular business models can lead to many uncertainties, perhaps because of the collaborative and networked nature of such innovation (Antikainen and Valkokari, 2016). For example, if companies remain the owner of products, reverse in addition to forward logistics is a key activity to retrieve products and reuse components. However, there are uncertainties about product returns in terms of quality, quantity and timing (Shaharudin et al, 2015) that can cause an unpredictable flow (Starostka-patyk et al., 2013), which create uncertainties about how value is created. However, even in the value proposition there can be uncertainties for example related to customer perception. Customers may perceive recovered products to be of lower quality and thereby command lower prices compared to new products in the market (Shaharudin et al., 2015). Also, there may be concerns associated with safety and risks (Catulli and Reed, 2017). However, Mugge et al. (2017) in their study on refurbished mobile phones for example found that there is a market for refurbished products, and that different customer groups can be enticed by tailored incentives. To reduce uncertainty in the value proposition and how value is delivered, created and captured, testing assumptions in business experiments is essential (Ries, 2011; Osterwalder et al., 2014).

2.2 Processes and steps towards sustainable and circular business models

In the field of sustainable business models, Stubbs and Cocklin (2008) argue that sustainable organisations express their purpose, vision and mission in terms of social, environmental and economic outcomes. Businesses must be aware of the often-conflicting values or dilemmas when shifting towards a sustainable business and rather use those dilemmas as opportunities for learning and improvement (Prendeville et al., 2016). To embed a 'sustainability mindset', social, environmental and financial indicators are integrated into internal performance measurement and management systems (Stubbs and Cocklin, 2008). Building upon this, Bocken et al. (2013) argue that the primary step in the business modelling process is to embed sustainability in the core purpose of the firm and its network of stakeholders.

"Value" is of essence in conventional and sustainable business model innovation (e.g. Breuer and Lüdeke-Freund, 2017). In the field of traditional business models, Osterwalder and Pigneur (2014), Ries (2011) and Blank (2013) argue that business model creation starts with defining a value proposition that suits customer needs, suggesting an iterative process in which experimentation is used. Richardson (2008) developed a business model framework

that reflects the logic of strategic thinking about value. This model consists of the value proposition, value creation and delivery system and value capture. *"By our definition, the value proposition is a basic statement of the firm's theory about how to compete. It states that the firm will offer such and such to so and so in a way that offers superior value compared to competitor"* (Richardson, 2008, p. 139). Bocken et al. (2014) add that in a sustainable business, the value proposition provides measurable ecological and social value in concert with economic value. Figure 1 combines these core frameworks into a sustainable business model canvas.

Followed by the value proposition, the value creation and delivery describes *"how to compete by describing how that theory is put into action. It begins to flesh out the organization and architecture of the firm. It also specifies and describes the firm's sources of competitive advantage, i.e., its resources and capabilities"* (Richardson, 2008, p. 139). In contrast to traditional business models, designing circular business models requires a systemic point of view around products (Bakker et al., 2014). Companies need to collaborate with stakeholders to ensure reverse logistics for example, which allows them to maximise the value of products and materials (Kraaijenhagen et al., 2016). Hence, we argue that value creation and delivery for circular business models incorporates multiple stakeholders in the innovation process as collaborative partners. These partners might be quite different from 'conventional' value chain partners. The carpet company Interface for example collaborates with the Zoological Society of London and supplier Aquafil to source nylon fishing nets which are previously discarded into the sea (Kraaijenhagen et al., 2016). These sourced nylon fishing nets, which are collected by local fishery communities in the Philippines, are turned into new carpets. Instead of a carpet producer and yarn supplier alone, local fishery communities and the charity organisation 'Zoological Society of London' are involved as well.

Finally, 'value capture' is about the revenue model. For the move from selling products to selling services as one of the popular examples of a 'circular business model' (Tukker, 2015), initial investments will often be earned back over a longer time than in the case of direct sales, for example, because of paying per use or paying for performance (Tukker, 2004). This means that significant innovation will be needed in financial models to allow companies to successfully move to circular business models (Achterberg et al., 2016).

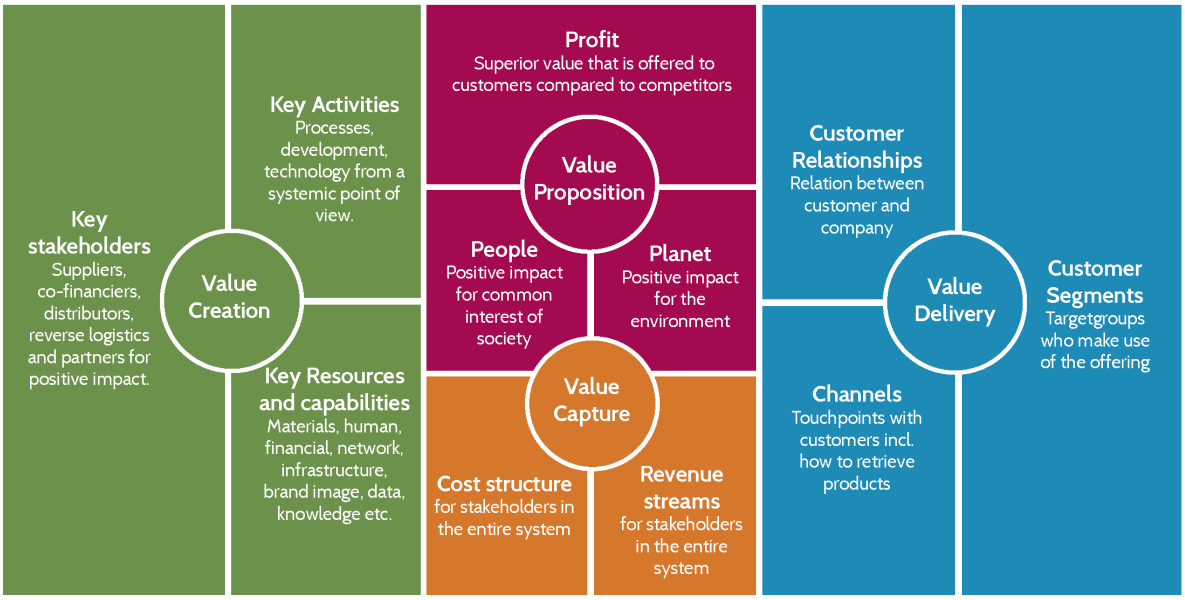

Figure 1 Adapted sustainable business model canvas (Bocken, 2015 developed from Osterwalder and Pigneur, 2010 and building on Richardson, 2008)

2.3 Experimentation for sustainability in businesses

In contrast to experimentation in natural sciences, benefitting from controlled situations, business experimentation aims to explore the diverse possibilities that a business *could create value from,* or understand what works in which particular situations in a real-life business context (Bocken et al., 2016b). Experiments cannot typically be controlled in a business environment, as businesses deal with real customers and immediate business pressures at the same time.

In the Lean Startup developed by Ries (2011) as well as the process of 'Customer development' by Blank (2013) experiments are used to find and understand customers by rapidly testing assumptions and make corrections in real time. Minimal viable products (MVPs) are used to test assumptions with the least amount of time and financial investments (Ries, 2011). An MVP *"is that version of the product that enables a full turn of the build-measure-learn loop with minimum amount of effort"* (Ries, 2011, p.77). Through these experiments, such as A/B split tests (comparing two versions of a website, Facebook advert or app to find out which one performs better), landing pages (an initial website to test the number of clicks) and paper-prototypes (visual representation of an interface or service on paper), feedback of potential customers can be collected in early stages of the innovation process without too much business exposure and risks (Ries, 2011). Experiments are not only suitable for testing the value proposition, because uncertainties can also arise in 'value creation and delivery' concerned with product returns in terms of quality, quantity and timing for example (Shaharudin et al, 2015).

What differentiates pilots from experiments is the fast-paced learning cycle (Osterwalder et al., 2014) and low resource requirements (Ries, 2011). Although experiments allow businesses to test assumptions, it is unknown what happens if all these assumptions come together when offering the actual product-service-system. Building on Osterwalder et al.

(2014), we consider that in a pilot, real customers use the actual, commercial service and/ or product including the business model elements; while in experiments minimal viable products/ service or parts of the business model are used to test an assumption separately. Therefore, a new business model should eventually be evaluated through a pilot, here called a 'field experiment', before fully scaling up in the market.

Figure 2 visualises the position of experiments in the innovation process. First, internal discussion might take place on future business model ideas which involves few people and little time (Osterwalder et al., 2014; Weissbrod and Bocken, 2017). Second, conversational interviews may be set up with customers or other stakeholders to quickly gain market insights (Ries, 2011; Osterwalder et al., 2014). These may serve as an input to A/B Split tests or early prototypes put in the market. Hence, the process moves from being largely internal involving few resources, to testing elements of the new business model with a limited number of stakeholders outside the organisation, to eventually testing all assumptions at once in a large-scale pilot. In line with Ries (2011), the process is iterative and learning would lead to dropping experiments (e.g. because they do not deliver expected results or meet sustainability expectations, Weissbrod and Bocken, 2017). The messy line in Figure 2 indicates this iterative nature, where one might go back to sketching and interviews when learning from advanced experiments. Experiments are necessarily small-scale and limited resource activities, taking place before starting larger scale pilots and eventually scale-ups. Experiments can help challenge business as usual and encourage learning.

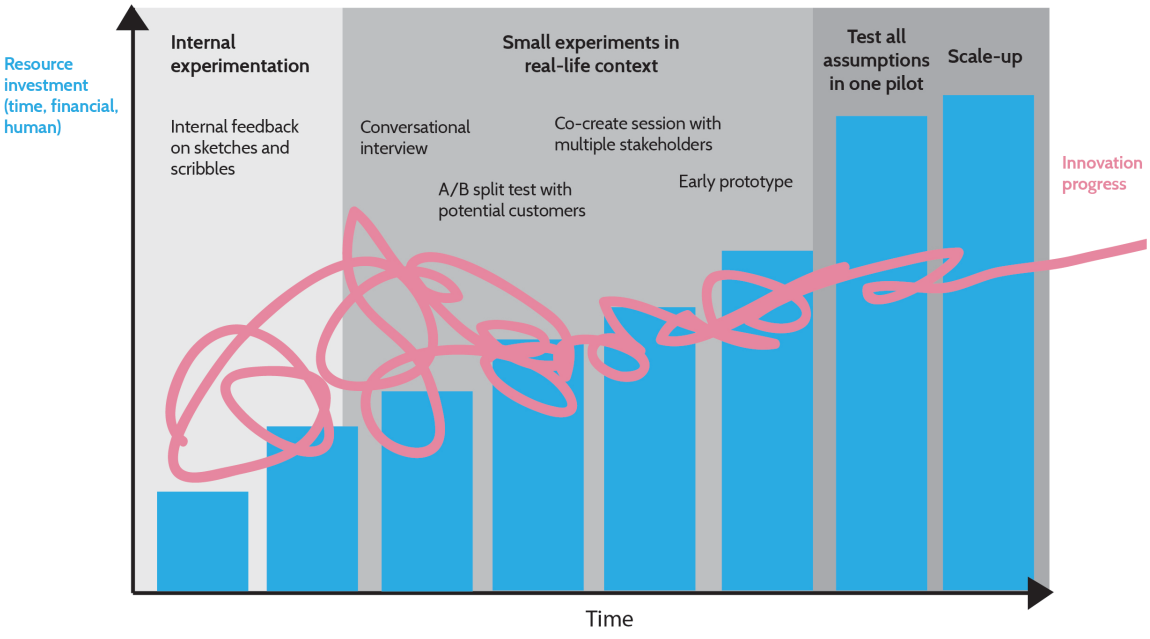

Figure 2 Experiments in the innovation process. *Note. The pink line illustrates the messiness, uncertainty and learning associated with the experimentation process and its iterative nature (Building on Osterwalder et al., 2014)*

2.4 Overview and research gap: Framework for circular business experimentation

In the literature, no suitable framework was identified that could constitute a process of sustainable or circular business experiments. Table 1 provides an overview of which steps

have been identified based on literature on (sustainable) business models and experimentation. First the 'business purpose' is a starting point for sustainable business model innovation: why is the business there in the first place and how can environmental and societal concerns be embedded in the business purpose? This is based on conceptualisations of sustainable business models by Stubbs and Cocklin (2008) and Bocken et al. (2013) where the business purpose and vision are central to the development of a sustainable business model. The next fundamental aspect to consider is the value proposition to the customer(s) (e.g., Blank, 2013; Ries, 2011), the (potential) partners but also the society and environment (Bocken and Short, 2016), followed by the value creation and delivery, and value capture (Teece, 2010). After experiments in each of these areas a larger scale pilot can be developed to test all assumptions together as suggested by Osterwalder et al. (2014). This framework will be used as a starting point for the action research with the eight case companies, discussed next.

Table 1 Framework for sustainable business model experiments based on literature review

	Activity	**Description**	**Literature**
Strategy	Purpose	Defines why the organisation is in operation in terms of measurable social, environmental and economics outcomes.	Stubbs & Cocklin (2008) Bocken et al. (2013)
Business model experiments	Value Proposition Experiment	An experiment that tests assumptions on the superior value that the firm and partner offer together to a customer compared to its competitors. Environmental and societal impact of this offering are explicitly included.	Business model: Richardson (2008); Teece (2009) Sustainable business model: Boond and Lüdeke-Freund (2013); Bocken et al. (2014) + Bocken & Short (2016)
	Value Creation & Delivery experiment	An experiment to test assumptions how the offering is put in action by the firm and collaborative partners to obtain a competitive advantage while creating positive customer and stakeholder value.	
	Value Capture experiment	An experiment to test how the firm and partners earn revenue and capture wider stakeholder value (incl. Society & Environment) by exchanging resources and capabilities or providing customers with good, services or information.	
Pilot	Field test experiment	Real customers use the actual service and product to test all assumptions together.	Osterwalder et al. (2014), p. 208 Kraaijenhagen et al. (2016)

3. Research method

The research method first describes the context and the approach (Section 3.1), followed by the framework used in the study (Section 3.2) and the selection of the cases (Section 3.3).

3.1 Context and action research approach

This research started with the premises that sustainable and circular businesses can be a good source of business and a source for good, but that to date there are few fully sustainable businesses in practice. Therefore, collaboration was sought with eight case companies who are on their journey of becoming a sustainable business. Research was done in a participatory, action-led manner involving the usage of deliberate, exploratory and collaborative methods over time (Van de Ven, 2007 in Prendeville et al., 2017). Action research is particularly useful to accelerate research in pressing areas such as sustainability challenges (McManners, 2015). It consists of a flexible approach focused on changing thinking through collaboration that works well in conjunction with case studies (Prendeville et al., 2017).

The action research with case studies was conducted at Delft University of Technology, in collaboration with a societal and environmental purpose-driven innovation consultancy firm, Innoboost, both based in the Netherlands. The objective of this joint project, 'Kickstarting circular business experimentation', was to help eight case companies transition to (profitable) circular business models through experimentation over a project period of twelve months (February 2016 - January 2017). The authors at Innoboost conducted the experiments (e.g. workshops, A/B split tests), and were supported in the set up and active participation in activities (e.g. workshops) by the author from Delft University of Technology. Analogously with the Lean Start up (Ries, 2011), different types of experimentation activities were developed, including focus groups and interviews, A/B split tests (two advertisements with the same target group in which one variable is changed), and landing pages (initial draft website to test interest). The unit of analysis is the role and process of circular business model experimentation explored through eight cases.

3.2 Framework: Circular Business Experiment Cycle

To explore the process and role of business model experimentation when shifting to circular business models, the eight case companies were offered a framework (Figure 3) that has been developed by the authors of this paper based on a literature study (summarised in Table 1) and Figure 1 in this paper.

Experimentation often starts off with reiterating the business purpose or trying to strengthen it through joint discussion (Bocken et al., 2013). In contrast to just 'making money', the business purpose for a sustainable or circular business also includes clear societal and environmental goals (Stubbs and Cocklin, 2008; Bocken et al., 2016a). In a circular business model, the focus will be on resources (Geissdoerfer et al., 2017), and whether the model contributes to slowing, closing or narrowing resource loops (Bocken et al., 2016a). After drawing lessons from this, a value proposition experiment focusing on the customer to test the viability of the product/ service offering, is a logical next step (Ries, 2011). Value delivery is a logical next step and is most closely related with the customer. It is focused on customer relationships, customer segments and channels (see Fig. 1). The cycle then moves to more operational aspects often involving more stakeholders by following with value

creation and value capture experiments and finally a field experiment or even larger pilot (Osterwalder et al., 2011). Other stakeholders, including those representing 'society' or the 'environment', such as local community representatives or NGOs can get involved in these experiments to test whether and how the business can create and capture wider societal and environmental value (Bocken et al., 2013). The Circular Business Experiment Cycle consists of iterative learning cycles of steps that have been identified in literature to shift to sustainable business models and are expected to take place in a certain order analogous to Table 1. At each stage, deliberate learning takes place (Ries, 2011; Kraaijenhagen et al., 2016) represented by the lightbulb (Fig. 3).

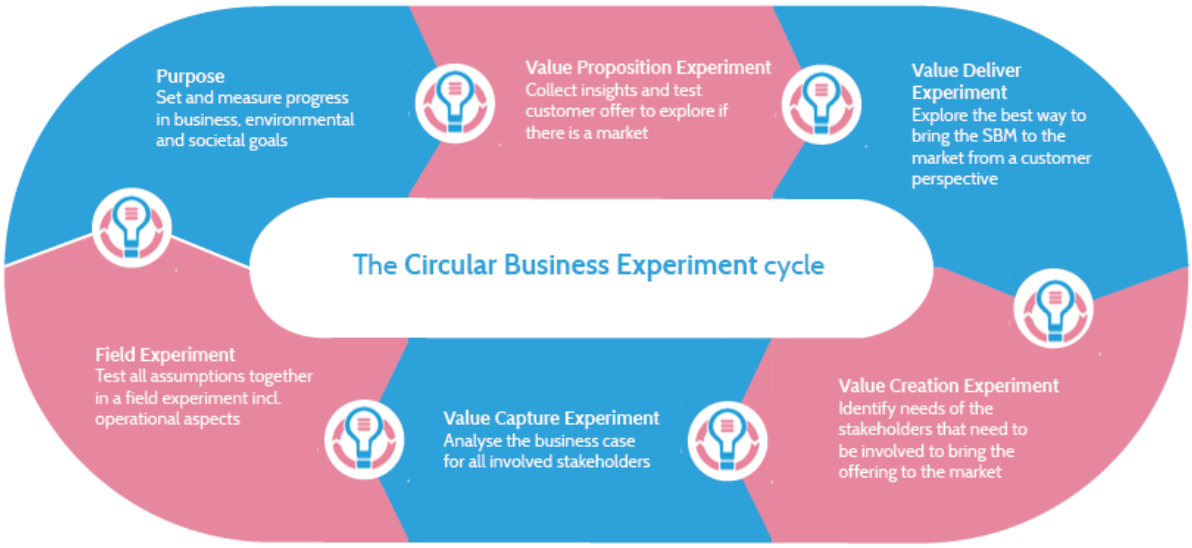

Figure 3. Initial framework for case studies at start of project: Circular Business Experiment Cycle *Note. Developed in this research based on Table 1. The lightbulbs represent deliberate learning instances. SBM refers to 'sustainable business model' used a generic term of which circular business model innovation is a subtype*

The activities covered in this research spanned a period of twelve months during which companies were contacted and selected and during which the experiments took place. Due to time constraints and specific needs of the company, the full experiment cycle has not been fully executed with each company. Instead, a selection of steps was executed at each case company depending on the needs and maturity of the sustainable business. Appendix A, reported on in Section 4.1, includes the detailed activities per company performed by the project team.

3.3 Criteria for case company selection

In this study, we selected a range of companies (Table 2 & Appendix B) who went through a number of business experiments.
The following selection criteria were applied to companies:

- To include varying levels of maturity in the transition process to a sustainable business, as well as differences in business size and industry.

- Availability and willingness to establish new business model experiments, provide access to processes and people, and share lessons learned and give insight in the outcomes afterwards.
- Although no LCA study on the transitional business model (the business model further explored in this project) had been performed, companies had to be willing to explore alternative business models focused on retaining the product value at the highest level longest to slow loops (Stahel, 1981). The case companies were mapped according to the sustainable business model archetypes and the value proposition; value creation delivery; and value capture framework recognised in (sustainable) business model literature (Richardson, 2008; Teece, 2010; Osterwalder & Pigneur, 2010; Bocken et al, 2013; 2014) (Appendix B). Four out of eight cases focused on 'deliver functionality, not ownership', which can be described as the shift from products to services and where value is assumed to be retained at the highest level (Achterberg et al., 2016). Other business models included 'develop scale-up solutions', 'Adopt a stewardship role' and 'Create value from waste' as they had a better fit with the company (Appendix B).

Table 2 includes the companies who participated in this research in the displayed order. Table 2 also shows that the familiarity of implementing the circular economy varied from not knowing what 'circular economy' entailed to 'implementing circularity', but not succeeding to generate sustainable revenues yet. This shows that the companies had different starting points and different needs for experimentation.

Table 2 Description of selected eight case study companies. *Note: Philips is assigned the more generic 'circular business model' label due to confidentiality reasons.*

	Company	**Industry**	**Size**	**Familiarity with implementing the circular economy**	**Transitional Sustainable business model archetype**	**Project focus**
1	Fresh-r	**Consumer durables** Decentral ventilation system with heat recovery	Start-up 5-10 employees	Aware of circular economy concept. Wanted to explore how circular economy changes their business.	Deliver functionality, rather than ownership	Shift from ownership to access or performance business model. Instead of selling ventilation systems with heat recovery, start selling m^3 of fresh air.
2	Mud Jeans	**Clothing industry** Jeans	Start-up 5-10 employees	Implemented circular business model. Wanted to explore how to generate more sustainable revenues.	Deliver functionality, rather than ownership	How can we make leasing jeans more attractive for customers?
3	Bugaboo	**Consumer durables** Strollers	Mature >1000 employees	Understands that circular economy changes their business. Explores	Deliver functionality, rather than ownership	Focus on win-win situation for the company and retailer for longer

				different circular models and their impact.		lasting products.
4	Vereijken Hooijer	**Agriculture** Stables and nursing homes for pigs	Mature 10-30 employees	Unfamiliar with circular economy. Wanted to explore what circular economy means for their business.	Adopt a stewardship role	Develop a business model that allows farmers to invest in sustainability and wellbeing of pigs.
5	Boska Holland	**Consumer durables** Accessories for cheese, also called Cheesewares	Mature 10-30 employees	Unfamiliar with circular economy. Wanted to explore what circular economy means for their business.	Deliver functionality, rather than ownership	Develop a circular business model to enhance the company's positive impact.
6	Peerby	**Product sharing platform** A platform that allows neighbours to borrow or rent items from each other.	Start-up 10-30 employees	Implemented circular business model. Wanted to explore how to generate more sustainable revenues.	Develop scale-up solutions	Look for a business model that can create additional revenue streams by using their existing community and platform.
7	Evides	**Drinking water & tailored water services** Provides drinking water to consumers and businesses in the Southwest of the Netherlands and provides tailored water services for large industrial companies in the Netherlands, Belgium and Germany.	Mature >500 employees	Understands that circular economy changes their business. Explores different circular models and their impact.	Create value from waste	Develop a business model that solves the rainwater-issues in neighbourhoods by re-using water.
8	Philips	**Consumer durables** Electronic appliances for	Large >100.000 employees	Understands that circular economy changes their business. Explores different circular	Circular business model	Develop a circular business model for one of their products.

		a healthy lifestyle		models and their impact.		

4. Results

The results are organised according to the experimentation process taken (Section 4.1) and the role of experimentation (Section 4.2).

4.1 Experimentation process

Each project started with framing the scope of the project, which led to different activities in relation to the Circular Business Experiment Cycle shown in Table 3. A detailed description of all project activities can be found in Appendix A. The results are organised using the literature framework of Purpose, Value Proposition, value creation & Delivery and Value capture and Field experiment presented in Table 1, followed by some overall lessons about the process.

Table 3 Description of experiments for the case study companies. Note: *R=done in research; V=done by company before the research project*

		Purpose	Value Proposition experiment	Value Deliver experiment	Value creation experiment	Value capture experiment	Field experiment
1	Fresh-r	V	R	R	V		
2	Mud Jeans	V	R	V			
3	Bugaboo	V			R		
4	Vereijken Hooijer	R	R	R			
5	Boska Holland	R	R				
6	Peerby	V	R				
7	Evides	V			R		
8	Philips	V	V	V	V	V	R

4.1.1 Purpose

As can also be observed from Table 2, six out of eight cases (Fresh-r, Mud Jeans, Bugaboo, Peerby, Evides and Philips) had already defined a clear sustainability purpose, which gave a good starting point for circular business model experimentation. In three out of these six cases, the companies looked back at their purpose to make decisions about experiments to develop their future business: Verreijken Hooijer and Boska needed to develop experiments related to their purpose, whereas Mud Jeans used their purpose as a starting point for further experiments.

A clear sustainability purpose is fundamental when embarking on the process of becoming a sustainable business (Stubbs & Cocklin (2008; Bocken et al., 2013), as can be observed from the case with Boska, the cheesewares company. After generating ideas for potential circular business models and experimenting with value propositions, Boska questioned the impact of

the radicalness of these ideas on their current way of doing business. This ignited a discussion on what becoming a sustainable business entails for Boska and whether a circular business model is too radical for the company at the moment. Boska decided to start with improving internal sustainability and addressing low hanging fruits such as separating waste, using renewable energy in their offices and stimulating cycling to work, before continuing with external experimentation. This means that first, some more internal sustainability practices needed to be initiated before embarking on more advanced experiments.

In the case of Mud Jeans, the company involved in leasing jeans, their purpose was already focused on the circular economy: reducing waste to landfill and encouraging reuse of fibres through a leasing model. Mud Jeans used its purpose to select which value propositions they should test for leasing jeans. Ideas that stimulate seasonal or special event purchases were not tested, because they were linked to 'fast fashion' and did not suit their purpose of 'becoming a circular company that reduces waste'.

4.1.2 Value Proposition Experiments

The value proposition describes the value, including the societal and environmental benefits a company and its collaborative partners intend to offer to its customer(s) in a superior, unique and differentiating way compared to competitors or alternatives in the market (Boons and Lüdeke-Freund, 2013). The value proposition is the starting point to create the product/ service offering (Ries, 2011).

Value proposition experiments were found to help reduce the risk associated with approaching new target groups to generate additional revenue streams for circular business models and they can help sharpen up the purpose of the company. For example, Fresh-r, who sell decentralized ventilation systems with heat recovery, aims to set-up a circular business model for their already modular ventilation system with heat recovery, which they currently sell to private homes. After the realisation that people are not interested in the product, but in accessing fresh air to optimize concentration to feel better and live healthier, three potential target groups were selected: Offices, nursing homes and schools. Interviews and desk research about these target groups showed that schools were most promising because of indoor climate legislations posed by the government. Three interviews with school principals indicated that there is an interest in offering fresh air as a service in which installation, maintenance and repair are included. School principals want to focus on their students, teachers and education, instead of ensuring that the indoor climate meets national legislation at all times. The Peerby case (peer-to-peer product sharing), led to a similar finding that value proposition experiments help to identify which target group to focus on for circular business models. This case started with a Facebook panel in which community members were asked questions about the existing platform and how more value could be added. The Facebook panel showed that community members were already satisfied. Project members therefore reflected on unique resources and capabilities of the company, which led to new customer segments that could be interested in these assets.

Finally, value proposition experiments can help sharpen up the purpose of the company. Mud Jeans tested two propositions for leasing jeans in an A/B split test on Facebook. In an A/B split test two advertisements are run with the same target group in which one variable is changed. This can either be the image or text. The click-through-rate, which measures how many users click on the advertisement, gives an indication which advertisement appeals more to the target group. Two advertisements for leasing jeans were placed on Facebook with the

same overall target group. The image was kept the same - only the text was changed to test which type of focus would appeal more to the target group. The experiment showed that customers preferred another direction than was initially expected. These results were incorporated in their brand book and can thereby contribute to their strategy.

4.1.3 Value Delivery Experiments

Value delivery is concerned with customer relations, segments and channels (Osterwalder and Pigneur, 2010; Fig 1.). The transactional model between the company and customer has an influence on the acceptance of the business model. Vereijken Hooijer, the pig stables and nursing homes company, experimented with different transaction types for their value propositions and found that the perspective on the ideas changed. As part of one idea, farmers would lease stables and agree to purchase feed of a certain partner, which helps to pre-finance installation. This however was seen as a limitation of their entrepreneurial freedom. Farmers were more open to transaction models in which a percentage goes to a fund that helps other farmers to invest in sustainable stables.

4.1.4 Value Creation Experiments

Value creation is concerned with activities, resources and capabilities and key stakeholders involved (Osterwalder and Pigneur, 2010; Fig 1.). Experimentation is needed to create a joint-consensus between stakeholders, which helps them to take a next step in their collaboration. Evides, the water company, for instance organised a co-creation session between a municipality, a social housing corporation and water experts to help neighbourhoods become more water-resilient. This experiment showed that several assumptions were holding stakeholders back to take a next step. The stakeholders concluded that more experiments in the actual neighbourhood are needed to take away assumptions as each stakeholder perceived different barriers, which may be unnecessary.

Bugaboo, who sell baby strollers, experimented with retailers on how long-lasting products could create a win-win-win situation for Bugaboo, retailers and customers. Interviews about the changing role of retailers and discussing value propositions indicated that retailers were open-minded against what was expected. Retailers experienced a need to change with developments in the market such as e-commerce, which opened opportunities for different business models.

4.1.5 Value capture Experiments

Value capture is about the cost and revenue streams (Osterwalder and Pigneur, 2010; Fig. 1). Besides calculating the business case in financial terms, societal and environmental impact should also be measured. Peerby thought about adding features to their sharing platform to attract retailers as an additional target group to generate revenue streams. When proposing value propositions to a retailer in a value proposition experiment, the business model was changed to better meet the retailers' needs. After exploring the business case and analysing these ideas on their impact, Peerby decided not to continue with this business model idea, as it counteracts with their purpose by stimulating sales of products. In fact, its purpose is to enhance the sharing economy by offering an alternative for excessive consumption.

4.1.6 Field Experiments

Field experiments are necessary to combine tested assumptions in previous experiments

(Osterwalder et al., 2014; Kraaijenhagen et al. (2016). For example, Philips (focused on electronic appliances) launched several ads on Facebook on value propositions for a circular business model. After filling in a questionnaire on a landing page, Philips invited fifteen participants to a field experiment where people received the actual appliance with the proposed circular business model. These participants were asked questions in a Facebook panel over a period of five months to explore the possibilities of the model. Insights were used to convince internal stakeholders of the potential of the circular business model and sharpen the value propositions.

4.1.7 Process in general

The case studies showed that although there is a certain sequence in steps, companies can go back-and-fourth between steps as an iterative approach based on outcomes of the experiments. To refer back to the previous given examples, for Mud Jeans (leasing jeans) different value propositions were tested with an experiment of which results were incorporated in the brand book. In essence, this means that results are transferred back into the purpose of the company. After a co-creation session where Peerby (peer-to-peer product sharing) discussed ideas with a retailer, they went back to the value proposition experiment when finding out that the business model contradicts their values. The circular business experiment cycle should therefore be considered as an iterative process of going back-and-fourth, instead of a linear approach with a checklist.

4.2 The role of experimentation

It was found that experimentation could serve as a means to gain internal and external traction for a sustainability transition. However, tracking progress against sustainability goals is found to be an important part of the experimentation process. Finally, it is essential to move from experiments to scaling up.

First, experiments can help gain internal traction towards sustainability by gradually making steps to a full scale circular business. Two case study companies of a mature size, Philips and Bugaboo, mentioned that experiments help to create internal engagement for circular business models, which was expressed by their quote ‘Think big, start small’. Experiments help to collect proof to convince colleagues and other internal stakeholders of the business potential. In one of the case companies, Philips, there was an assumption about the new business models that needed to be tested: customers would have concerns about hygiene when products are reused in a new circular business model. The experiment showed that six out of ten customers did not have hygiene concerns. Two out of the four who *did* have concerns were open for a product-solution, containing some new parts. This example shows that experiments are necessary to push circular business models forward by demystifying inhibiting assumptions and steer on fact-based decision-making. Also by proposing these as temporary experiments, internal stakeholders are more receptive to give approval, because risks, time and financial investments are considered to be low. Also, the experiment can be stopped at any time. Particularly in the larger and more established businesses, like Philips and Bugaboo, it seems that the number of internal stakeholders involved needs to be build up gradually over time and that it is better to start with a small, cross-functional team.

Second, experiments can help create external engagement of other stakeholders. The case of water company Evides indicated that field experiments are necessary, because involved external stakeholders were all making assumptions. Another case (Bugaboo) showed that against expectations, retailers were surprisingly open-minded to circular business models, but

demanded a business case before taking the next step. This indicates that experiments are needed to convince external stakeholders of the business potential of circular business models. Moreover, when internal engagement is low and the organisational structure is not suitable for experimentation, collaborating with external companies could offer a solution, because they have more freedom and can 'take the blame' when stakeholders are not satisfied with the new direction. In one of the case-companies, the external consultancy was presented as the idea developer to prevent reputational damage of the brand of the case company. In contrast, the two start-up cases of Peerby and Mud Jeans indicated that the value of collaborating with external companies like a consultancy was to give a fresh perspective on their business.

Third, one needs to remain vigilant about the actual impact of experiments. For one of the case companies, Boska, the actual sustainability impact of the transitional business model became unclear, as the focus was more on the business case. For Philips, the new proposition could have actually led to *more material consumption,* creating adverse effects. In contrast, for some of the companies where their sustainability purpose was evident from the start (e.g., Peerby and Mud Jeans), experiments were stopped or changed if the desired sustainability impact was not achieved or if negative rebound effects were expected. This shows the importance of having a clear sustainability purpose and abiding by it in business innovation processes.

Fourth and finally, similar to what is proposed in Lenox and Ehrenfeld (1997), Halme (2002) and Weissbrod and Bocken (2017), circular business model experimentation needs to become an internal capability. Overall, experimentation was found to create an internal entrepreneurial atmosphere, where organisational activities are directed towards a transition. The internal resistance towards transitions can be carefully managed, by including learning loops through experimentation. Moreover, investments and risks, as well as negative exposure towards external stakeholders, are limited due to the low-resource and small-scale nature of experiments as opposed to large scale pilots. While we did not conduct a longitudinal study for the cases, we did see evidence of companies taking the ideas forward and taking next steps to scale up experiments. For example, Mud Jeans further scaled-up with the chosen direction based on the experiments. Within Philips it was found that other business units were inspired by the experiments and are replicating these in other contexts.

5. Discussion

To date, few if any processes for sustainable and circular business model experimentation have been developed, although insight can be gained from approaches such as experimentation in TM (Kemp et al., 1998; Brown et al., 2003), the Lean Startup (Ries, 2011) and emerging work on circular business experimentation incorporating the notion of the Lean Startup (Antikainen et al., 2017; Weissbrod and Bocken, 2017).

In this research, we identified circular business model experimentation as a capability to help initiate a sustainability transition in businesses, in line with work by Halme (2002) and Lenox and Ehrenfeld (1997) and Bocken and Weissbrod (2017) who emphasise the need to develop a sustainability innovation capability. Based on literature and action research, a process (Circular Business Experiment Cycle; Figure 4) is developed that could guide companies in the transition. Figure 4 shows that a sequence of experiments could be applied starting with the purpose and value proposition, which was the case for the companies in this study. Although a certain sequence is proposed, companies can move back-and-forth between steps

and the process can be highly iterative. Perhaps in contrast to the work by Ries (2011), some companies starting test out other business model building blocks (e.g. value creation) or first needed to revisit their purpose, instead of starting with the value proposition. At each step, deliberate learning is needed in line with the Lean Startup (Ries, 2011) and Circular Business approach in Kraaijenhagen et al. (2016).

The role and approach of circular business model experimentation were explored. It was found that the number of internal stakeholders involved needs to be build up gradually over time and that it is better to start with a small team, which is also reflected in Figure 2. This resonates with the case findings in Weissbrod and Bocken (2017), who found that in corporate innovation, timing of (senior) stakeholder involvement is essential. Moreover, experimentation can help build internal engagement for sustainable business model innovation opportunities and projects. Sometimes, external partners are involved before creating wide awareness of a project internally. This 'external validation' could help to create and prove the internal business case, which was also found by Kraaijenhagen et al. (2016). External partners are included in the business model innovation process to develop a better business model that works for all stakeholders involved, which resonates with sustainable business model research (Bocken et al., 2013).

The aim of this project was to initiate change in an organisation by focusing on circular business model innovation as a driver for sustainability. Perhaps differently from SNM and TM (Hoogma et al., 2002; Kemp et al., 1998; Van den Bosch, 2010), focusing on multi-actor, often large-scale projects, circular business model experimentation is mostly initiated by one main actor, the focal company. Advancing from experiment to pilot and scale up remains challenging. However, the circular business experimentation method with companies in a focal role looks promising as our case companies were found to continue experimenting and putting ideas into practice. The main reasons for this might be the fact that responsibility lies within one company, compared to SNM and TM involving multiple public and private actors who test multiple facets at the same time. This is also where the limitation lies for circular business model experimentation: it is change driven in a company context and success will depend on the transformative power of companies. However, initial results in large and start-up companies look promising, because the notion and process of experimentation seem to catch on within different types of companies and across business units. Future research might focus on better integration of the SNM and TM concepts such as the multi-level perspective by Geels (2011) to better understand the impact of experiments at the micro, meso and macro levels. Analogously to Sarasini and Linder (2017), the role of business models in TM can be further explored. Further coordination between business- and policy-driven experiments might also be promising.

Finally, some form of sustainability measurement will need to take place after each experiment to validate whether the experiment is still leading the company in the right direction, as is also suggested by Manninen et al., (2018). E.g., is clothing waste really prevented in the case of Mud Jeans when switching clothing each season to follow trends? To what extent is positive social impact created? Simple rules of thumb (e.g. whether the innovation is contributing to slowing or closing loops; Bocken et al., 2016a; Kraaijenhagen et al., 2016), or streamlined type of methods (Vögtlander, 2016; Manninen et al., 2018) could be used for assessment. This 'sustainability check' step is found to be essential, as in two of the experiments companies lost focus on the original aim of the experimentation process to improve certain environmental impacts. This resonates with the work by Weissbrod and Bocken (2017, p. 2674), which found that during corporate experimentation *'there must [be]*

some absolute sustainable development boundaries that frame experimentation activities' in order to achieve the desired sustainability goals. We updated Figure 3 by including sustainability checks points. The revised Figure 4 now shows the sustainability checks (symbol ✓) in addition to the lightbulb for additional learning. Indeed, during the experimentation process with the case companies, discussions took place about which 'circular aspects' would be addressed and the focus was often on keeping products at the highest level as long as possible, thus slowing resource loops (Stahel, 1981; Bocken et al., 2016a). Hence, such checks are often intuitive, and should be regular as recommended by Weissbrod and Bocken (2017), but could also be formalised with tools and methods such as (streamlined) LCA. The experimentation cycle could provide a helpful means to evaluate which type of experiments are possible and in which order they could be conducted, starting with the purpose.

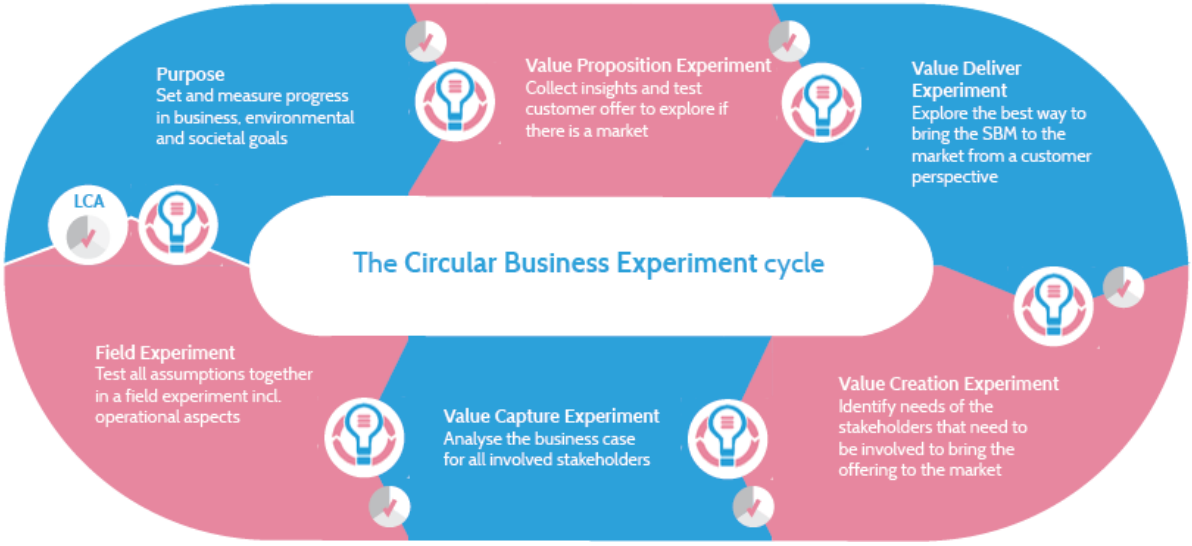

Figure 4. ***Circular Business Experiment Cycle developed in this research.*** *Note: The Circular Business Experiment Cycle includes triple bottom line checks in addition to deliberate learning. After the field experiment, a more thorough LCA could be performed.*

5.1 Limitations and future research

This research has some limitations related to environmental impact analysis, organisational learning as well as the embeddedness of sustainable innovations in society.

First, the environmental impact and societal impact was not quantified through an LCA study, nor were there *measurable* environmental and societal targets at the beginning of the project or in the mission and vision of each case company. While we included 'quick sustainability checks' in Figure 4, further research is necessary to identify how sustainability targets can be incorporated in the experimentation process. This includes how companies can be aware of rebound effects (Maxwell et al., 2011), as new business models do not necessarily lead to environmental benefits unless they are designed to do so (Tukker, 2004). This resonates with work by Lüdeke-Freund et al. (2016) and Schaltegger et al. (2016), which

positions sustainable business model innovation as a continuous process of iteration. The 'ideal business models' in literature (Stubbs and Cocklin, 2008) need to be subjected to assessments in the development process. Also, new business models need to be designed with positive intent from the start (Tukker, 2004; 2015; Mont, 2002; 2004). Besides measuring ecological and social value, the economic value for stakeholders in the value chain needs to be assessed. However, typically, business and customer value are foundational elements of the innovation process. Further research on how to incorporate and balance sustainability and more traditional business-oriented goals is needed.

Second, circularity and sustainability were used somewhat interchangeably in the project analogous to observations in Geissdoerfer et al. (2017). While we expected that Circular Economy could give a narrow focus in the research project, this objective was only partially met: the focus on Circular Economy provided companies with a focus on resources, but the broader language of sustainability was still used throughout the project.

Third, as researchers 'outside' the businesses, it was not possible to observe the full internal dynamics of the change process, which is important in innovation (Halme, 2002; Lenox and Ehrenfeld, 2003). Future research might follow the internal experimentation process more closely, e.g. through ethnography and longitudinal case studies. We also focused on business model innovation at a high level and did not go into the detail of required value chain and product design changes, partly due to the scope of this study but also due to confidentiality reasons with regards to the case companies.

Fourth and finally, it should be recognised that radical technologies, and presumably also business model innovations, might require special support efforts with a societal embedding component (Kemp et al. 1998; p. 193). The notion of sustainable business experimentation, originating from business literature (Chang et al., 2012; Chesbrough, 2010; Ries, 2011; Blank, 2013; Osterwalder et al., 2014) and nascent sustainability literature (Weissbrod and Bocken, 2017) could be integrated better with the multi-level, multi-actor perspective (e.g. government, business, NGOs, citizens) presented in TM and SNM (Kemp et al., 1998; Geels, 2011). However, it should be noted that despite of, or perhaps because of the lack of governmental support (e.g. financial safety nets after the financial crisis), certain novel business models such as the ones by Uber and Airbnb have emerged. This complex interplay is a fruitful avenue for future sustainable innovation research.

6. Conclusions

Business as usual can no longer be sustained with an increased pressure on resources. Companies have to fundamentally change their way of doing business to maximise value of products and materials under growing resource constraints. Experimentation can help companies make the first steps with low risk and resource investments to reduce uncertainties of how value is created, delivered and captured in this radical shift and provide obtain continuous (organisational) learnings towards a circular and sustainability transition.

Through action-based research, eight case companies of different sizes and sustainability maturity were accompanied in their journeys to analyse the process and role of business model experimentation when shifting towards circular business models. Research into the process of these eight case companies together with knowledge from other studies on (sustainable) business model innovation have been integrated in a 'Circular Business Experimentation Cycle' framework.

Concerning the role of experimentation, the authors found that 1) experimentation creates internal and external engagement for change towards sustainable business models 2) experiments can help test assumptions in every building block of the business model 3) collaboration with external partners can contribute to setting up experiments faster and 4) experimentation processes are iterative and need to include regular learning cycles and sustainability checks.

There were some limitations to this research. While the main experimentation activities were revealed, not all experimentation detail could be disclosed because of commercial sensitivity. Furthermore, none of the case companies went through the entire Circular Business Model Experimentation Cycle due to time and budget constraints. For each of these case companies this study was a small part of their journey towards becoming a sustainable business. To prove effectiveness of this framework more case companies need to be followed in their journey for a longer period of time, including measurements of internal and external engagement of circular business models. Also, the complex interplay between socio-technical regimes and landscapes and business would require further research to understand (inhibitors to) scaling up sustainable business experiments.

Further research is necessary to analyse how environmental and societal targets can be integrated into the experimentation process to quantify and monitor triple bottom line value creation. Moreover, successful case companies need to be monitored for a longer period of time in their journey towards becoming a sustainable business.

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Appendix A: Overview of activities per company in this study

	Company	Nature of the experiment	Lessons learned by stakeholders involved	Decisional consequences
1	**Fresh-r** (Consumer durables - Decentral ventilation system with heat recovery)	Interviews to test value proposition with representatives of the target group.	Access to the benefit of the product, instead of the product or technology itself, is relevant to the (new potential) target group. E.g. access to fresh air to optimize employees' concentration levels to feel better and live healthier, instead of the ventilation system itself. Through value proposition experiments, risks associated with approaching new target groups can be reduced.	Tested value proposition led to continuation of exploring a new circular business model
2	**Mud Jeans** (Clothing industry - Jeans)	Online A/B split test to test which proposition receives the most website clicks	Having a clear sustainable purpose and abiding to it is important to keep an eye on adverse effects of circular ideas. The other way around, value proposition experiments can sharpen the purpose of the company e.g. by integrating test results back in the brandbook and strategy.	Integrate test results of the value proposition experiment into the brandbook and strategy.
3	**Bugaboo** (Consumer durables – strollers)	Interview retailers to collect insights. Interview retailers to discuss and revise ideas.	Interviews showed that when discussing value propositions retailers were open-minded about what was expected.	Selected direction based on insights of retailers as input for draft Value Propositions and Business Models
4	**Vereijken Hooijer** (Agriculture – stables and nursing homes for pigs)	Focus group with ten farmers to test three Value Propositions and Business Models	Experiments on other building blocks of the business model are often linked to the value proposition. E.g. the transactional model influenced how the value proposition was perceived by farmers	Selection of a Value Proposition and Business Model
5	**Boska** (Consumer durables - Cheesewares)	Facebook community with people who love cheese to collect insights what 'Cheese and their Cheese-moment' means to people. Questionnaire to validate four value propositions with the target group.	A clear sustainability purpose is key when embarking in the process of becoming a sustainable business as value propositions of circular business models can be radical compared to the current way of doing business.	Boska decided to start with improving internal sustainability and addressing low hanging fruits.
6	**Peerby** (Product sharing platform - A platform that	Facebook community to collect insights from Peerby members.	Reflecting on unique resources and capabilities of the company can lead to new	Peerby decided not to continue with the value proposition and business model idea as it counteracts with their purpose

	allows neighbours to borrow or rent items from each other).	Cocreation session with ex-retailer to generate ideas for circular value propositions and business models. Calculate business case and talk to retailer to explore the potential of the business model.	customer segments that could be interested in these assets. Exploring the business case and analysing ideas on their impact is important to check if the ideas still suit the purpose of the company.	of enhancing the sharing economy.
7	**Evides** (Drinking water & tailored water services in the Southwest of the Netherlands)	Facebook community with inhabitants of Rotterdam Lombardijen to collect insights on what can be improved in the neighbourhood and what inhabitants find important Interviews with architects of Gebouwd Water, municipality of Rotterdam and neighbourhood manager of Rotterdam to collect insights on their perspective on the water issue and re-using rainwater. Co-creation session between a municipality, a social housing corporation and water experts to help neighbourhoods become more water-resilient.	Experimentation can reveal assumptions that are holding stakeholders back to take a next step. Discussing these can create a joint-consensus.	More experiments in the actual neighbourhood are needed to take away assumptions as each stakeholder perceived different barriers, which may be unnecessary.
8	**Philips** (Consumer durables Electronic appliances for a healthy lifestyle)	Interviews with second-hand sellers of the product to collect insights why sellers decide to sell this specific product. Call panel members to collect insights if people who did not bought the specific Philips product yet, would be interested in the circular business model. Facebook ads to test conversions on different value propositions. Facebook community with consumers who are taking part in the circular business model to collect	Insights were used to convince internal stakeholders of the potential of the circular business model and sharpen the value propositions.	*Confidential*

		real-life insights of what consumers think of the product in combination with the circular business model.		

Appendix B: Sustainable business model archetypes pursued by the companies in this research

Business model archetype pursued by the companies	Value Proposition	Value creation and delivery	Value capture	Case studies
Deliver functionality, rather than ownership	Provide services that satisfy user needs without users having to own physical products. Business focus shifts from manufacturing 'stuff' to maximising consumer use of products, so reducing production throughput of materials, and better aligning manufacturers' and consumers' interests.	Delivery through product/service offerings require significant changes within the firm to deliver this and may incentivise redesign for durability, reparability and upgradability. Potentially, more direct consumer contact and consumer education to shift away from ownership. Value chains become more integrated.	Consumers pay for the use of the service, not for ownership of products. Cost of ownership of physical products are borne by the company and/or partners. This can enable consumers to access previously expensive products, so expanding the market potential of new innovations.	Fresh-r Mud Jeans Bugaboo Boska
Create value from waste	The concept of 'waste' is eliminated by turning existing waste streams into useful and valuable input to other production.	Activities and partnerships to eliminate life cycle waste, close material loops and make best use of underutilised capacity. Introduction of new partnerships (e.g. recycling firms), potentially across industries, to capture and transfer waste streams.	Economic and environmental costs are reduced through reusing material, and turning waste into value. Positive contribution to society and environment through reduced footprint, reduced waste and reduced virgin materials use.	Evides
Adopt a stewardship role	Manufacture and provision of products and services intended to genuinely and proactively engage with stakeholders to ensure their long-term health and well-being. Broader benefits to stakeholders often become an important aspect of the Value Proposition by better engaging the consumer with the full story of	Ensuring activities and partners are focused on delivering stakeholder health and wellbeing. Production systems and suppliers are selected to deliver environmental and social benefits. Network reconfiguration may require alternative suppliers. To achieve scale, use of third-party certification may facilitate implementation and monitoring.	Stewardship strategies can generate brand value and potential for premium pricing. Stakeholder well-being and health generate long-term business benefits for the company. Healthy customers are good for the firm and for society, healthy happy workers may claim less sick days and may be more productive and secure suppliers ensure more	Vereijken Hooijer

	production and the value chain		resilience.	
Develop scale-up solutions	Scaling sustainability solutions to maximise benefits for society and the environment.	Ensuring a sustainable business model solution can achieve scale by employing the right channels, and partnering with others. New, and potential unusual partners (e.g. government for infrastructure change) and business relationships are required to scale the business.	Ensuring a variable (e.g. franchising, licensing) or fixed (mergers and acquisitions) fee is paid for scaling up a solution/venture and that other mutual benefits between partners are achieved through scaling up (e.g. market penetration).	Peerby

Note: Value Proposition, value creation and delivery and value capture explanation taken from Bocken et al. (2014). Note: The Philips case is confidential.