Addressing the design-implementation gap of sustainable business models by prototyping
A tool for planning and executing small-scale pilots

Baldassarre, Brian; Konietzko, Jan; Brown, Phil; Calabretta, Giulia; Bocken, Nancy; Karpen, Ingo O.; Hultink, Erik Jan

DOI
10.1016/j.jclepro.2020.120295

Publication date
2020

Document Version
Accepted author manuscript

Published in
Journal of Cleaner Production

Citation (APA)
Baldassarre, B., Konietzko, J., Brown, P., Calabretta, G., Bocken, N., Karpen, I. O., & Hultink, E. J. (2020). Addressing the design-implementation gap of sustainable business models by prototyping: A tool for planning and executing small-scale pilots. *Journal of Cleaner Production*, *255*, Article 120295. https://doi.org/10.1016/j.jclepro.2020.120295

Addressing the design-implementation gap of sustainable business models by prototyping: A tool for planning and executing small-scale pilots

Article *in* Journal of Cleaner Production · May 2020

DOI: 10.1016/j.jclepro.2020.120295

CITATIONS
6

READS
451

7 authors, including:

Brian Baldassarre
Delft University of Technology
11 PUBLICATIONS **203** CITATIONS
SEE PROFILE

Jan Konietzko
Delft University of Technology
7 PUBLICATIONS **19** CITATIONS
SEE PROFILE

Phil Brown
Delft University of Technology
8 PUBLICATIONS **165** CITATIONS
SEE PROFILE

Giulia Calabretta
Delft University of Technology
34 PUBLICATIONS **555** CITATIONS
SEE PROFILE

This article has been published in the Journal of Cleaner Production. Please cite as:

Baldassarre, B., Konietzko, J., Brown, P., Calabretta, G., Bocken, N., Karpen, I. O., & Hultink, E. J. (2020). Addressing the design-implementation gap of sustainable business models by prototyping: A tool for planning and executing small-scale pilots. *Journal of Cleaner Production*, *255*, 120295.

Addressing the design-implementation gap of sustainable business models by prototyping: A tool for planning and executing small-scale pilots

Brian Baldassarre [a], Jan Konietzko [a], Phil Brown [a], Giulia Calabretta [a], Nancy Bocken [a, b], Ingo O. Karpen [c], and Erik Jan Hultink [a]

[a] Delft University of Technology, Faculty Industrial Design Engineering, Landbergstraat 15, 2628 CE Delft, The Netherlands. b.r.baldassarre@tudelft.nl
[a] Delft University of Technology, Faculty Industrial Design Engineering, Landbergstraat 15, 2628 CE Delft, The Netherlands. j.c.konietzko@tudelft.nl
[a] Delft University of Technology, Faculty Industrial Design Engineering, Landbergstraat 15, 2628 CE Delft, The Netherlands. p.d.brown@tudelft.nl
[a] Delft University of Technology, Faculty Industrial Design Engineering, Landbergstraat 15, 2628 CE Delft, The Netherlands. g.calabretta@tudelft.nl
[b] Lund University, IIIEE, Tegnérsplatsen 4, 223 50 Lund, Sweden. nancy.bocken@iiiee.lu.se
[a] Delft University of Technology, Faculty Industrial Design Engineering, Landbergstraat 15, 2628 CE Delft, The Netherlands. n.m.p.bocken@tudelft.nl
[c] RMIT University, Graduate School of Business and Law, 379 Russell Street, VIC 3000 Melbourne, Australia. ingo.karpen@rmit.edu.au
[a] Delft University of Technology, Faculty Industrial Design Engineering, Landbergstraat 15, 2628 CE Delft, The Netherlands. h.j.hultink@tudelft.nl

Corresponding author:
Brian Baldassarre
b.r.baldassarre@tudelft.nl
+31 639 222 099

ABSTRACT

Next to the redesign of industrial products and processes, *sustainable business model innovation* is a strategic approach to integrate environmental and social concerns into the objectives and operations of organizations. One of the major challenges of this approach is that many promising business model ideas fail to reach the market, which is needed to achieve impact. In the literature, the issue is referred to as a "design-implementation gap." This paper explores how that critical gap may be bridged. In doing so, we contribute to *sustainable business model innovation* theory and practice. We contribute to theory by connecting *sustainable business model innovation* with *business experimentation* and *strategic design*, two innovation approaches that leverage prototyping as a way to iteratively implement business ideas early on. Using a *design science research* methodology, we combine theoretical insights from these three literatures into a tool for setting up small-scale pilots of *sustainable business models*. We apply, evaluate, and improve our tool through a rigorous process by working with nine startups and one multinational company. As a result, we provide normative theory in terms of the *sustainable business model innovation* process, explaining that piloting a prototype forces organizations to simultaneously consider the *desirability* (i.e., what users want), *feasibility* (i.e., what is technically achievable), *viability* (i.e., what is financially possible), and *sustainability* (i.e., what is economically, socially and environmentally acceptable) of a new business model. Doing so early on is functional to bridge the design-implementation gap of *sustainable business models*. We contribute to practice with the tool itself, which organizations can use to translate *sustainable business model* ideas defined "on paper" into small-scale pilots as a first implementation step. We encourage future research building on the limitations of this exploratory study by working with a larger sample of companies through longitudinal case studies, to further explain how these pilots can be executed successfully.

KEYWORDS
Sustainable Innovation
Business Model Innovation
Business Experimentation
Design Thinking
Implementation
Prototyping

1. INTRODUCTION

Alongside important work on cleaner production and the related redesign of industrial products and processes, sustainable business model innovation (SBMI) is an approach that takes a strategic viewpoint on how environmental and social concerns can be integrated into the objectives and operations of organizations (Abdelkafi and Täuscher, 2016; Bocken et al., 2014; Stubbs and Cocklin, 2008). For example, new business models based on service provision instead of product sales (e.g., a car-sharing service instead of selling cars) have the potential to reduce the impact of organizations up to 90% across different sustainability categories, ranging from energy consumption to waste management (Tukker, 2004; Tukker and Tischner, 2006).

SBMI has accordingly emerged as a research field of high relevance for cleaner production (Lüdeke-Freund and Dembek, 2017). To this end, SBMI research places a prominent focus on developing actionable knowledge for business (Bocken et al., 2013; Lüdeke-Freund et al., 2016). Former work conceptualized sustainable business models (SBMs) (Stubbs and Cocklin, 2008) and identified different categories (Bocken et al., 2014; Lüdeke-Freund et al., 2019) across industrial sectors (Yang et al., 2017; Yip and Bocken, 2018; Zhao et al., 2018). Furthermore, it explained how negative environmental and social impacts may be turned into business opportunities, thus into positive sources of value (e.g., turning waste into a resource) (Bocken et al., 2013; Yang et al., 2017).

To facilitate the development of sustainable business practices, there has been recent emphasis on tools for performing SBMI (Breuer et al., 2018). Most of these tools – such as the "*triple layered business model canvas*" (Joyce and Paquin, 2016) and the *"flourishing business model canvas"* (Upward and Jones, 2016) – focus on how to ideate new SBMs and not on their implementation (Bocken et al., 2019). Importantly, this results in a design-implementation gap in SBMI, which must be bridged to get SBMs to market and achieve impact (Geissdoerfer et al., 2018). Some SBMI researchers have started to address this issue by establishing connections with business experimentation (Antikainen et al., 2017; Weissbrod and Bocken, 2017) and strategic design (Baldassarre et al., 2019; Geissdoerfer et al., 2016).

Business experimentation and strategic design are two different approaches proposing an iterative process that covers the spectrum of innovation efforts from idea generation to market launch (Calabretta et al., 2017; Chesbrough, 2010). So far, work at the intersection between SBMI, business experimentation, and strategic design demonstrates the relevance of performing specific practices for implementing SBMs (Bocken, Boons and

Baldassarre, 2019; Bocken, Schuit and Kraaijenhagen, 2018). However, despite its relevance for bridging the design-implementation gap of SBMs, research connecting SBMI with business experimentation and strategic design is still limited (Breuer et al., 2018). Indeed, the main focus of SBMI research has been conceptualizing SBMs rather than exploring how to perform them in practice (Weissbrod and Bocken, 2017); as a result, they are rarely implemented (Ritala et al., 2018). Consequently, we pose the following research question:

How may business experimentation and strategic design support bridging the design-implementation gap of sustainable business models?

Given the scant research on this topic, our study is exploratory. Our exploration first integrates SBMI, business experimentation, and strategic design knowledge. Through a literature review and synthesis, we contextualize the design-implementation gap of SBMs and explain how a prototyping expertise derived from business experimentation and strategic design can be leveraged to address it. Consequently, through a design science research approach (Peffers et al., 2007), we develop a prototype-driven tool for setting up small-scale pilots, which is a first crucial step into the implementation of SBMs. Then, we iteratively apply, evaluate, and improve the tool by working in business practice. Finally, we delineate our contributions to theory and practice; in particular, offering normative theory and managerial guidance based on our empirical study on how to prototype towards the implementation of SBMs and the related tool to support organizations.

2. LITERATURE REVIEW

2.1 Sustainable business model innovation

SBMI is an emerging research field, which provides an effective lens to investigate and communicate sustainable innovation with practitioners (Lüdeke-Freund and Dembek, 2017).

The origins of SBMI are rooted in the business model framework, which organizations can use to plan and execute their strategy (Teece, 2010; Zott and Amit, 2010). The framework is based on a value proposition (i.e., what the organization offers and to whom), value creation and delivery (i.e., how the organization generates the offering and reaches customers), and a value capture element (i.e., how the organization covers costs and generates revenue) (Richardson, 2008). SBMI leverages this framework to embed sustainability into the strategy of firms (Boons and Lüdeke-Freund, 2013). While, in a broader context, sustainability refers to a state of human

development that meets present needs without compromising the future (Brundtland, 1987), in our business context, we refer to it more narrowly as embedding a multi-stakeholder perspective, triple-bottom-line (people-planet-profit) thinking, and impact assessment orientation into business objectives and operations (Elkington, 1998; Stubbs and Cocklin, 2008). Recent work conceptualized SBMs ("a value proposition that provides economic, environmental and social value; a supply chain and a customer interface that allows stakeholders and customers to act responsibly; a financial model that reflects an appropriate distribution of costs and benefits across stakeholders") (Boons and Lüdeke-Freund, 2013) and brought together disparate sustainable innovation approaches (e.g., PSS, social enterprises, the blue economy, green product development) under the common framework of SBM archetypes (Bocken et al., 2014).

The SBMI field is currently in a consolidation phase and new reviews are contributing to defining its scope and boundaries (Lüdeke-Freund and Dembek, 2017). In parallel, several tools have been conceptualized to support organizations performing SBMI (Breuer et al., 2018). However, SBMI researchers have realized that SBMI lacks a process dimension needed to advance toward the implementation of SBMs (Baldassarre et al., 2017; Weissbrod and Bocken, 2017). Thus, they have started connecting to business experimentation and strategic design theory by following two directions. The first direction leverages the iterative process dimension of business experimentation and strategic design, arguing that it is needed to gradually integrate stakeholder objectives with sustainability concerns, stepping toward the implementation of SBM ideas (Geissdoerfer et al., 2016; Weissbrod and Bocken, 2017). The second direction zooms into this process dimension, and explains how each step can be supported by specific practices including (but not limited to) conversational interviews, booklet interviews, ethnography observations, brainstorming, co-creation sessions, A/B testing, and prototyping (Bocken, Boons, et al., 2019).

2.2 Business experimentation

Business experimentation is a broad concept that advocates a shift from a linear innovation process toward a faster and less risky process in which new business ideas are developed gradually and more flexibly in iterative cycles (Chesbrough, 2010; Sarasvathy, 2001).

The origins of business experimentation can be traced back to innovation and entrepreneurship theory (Schumpeter, 1934). More specifically, it is possible to identify two theoretical roots. The first root is effectuation, an entrepreneurship theory that advocates taking "*a set of means as given and focus on selecting between possible*

effects that can be created with that set of means" (Sarasvathy, 2001). Effectuation theory explains that this frame of thinking and acting is particularly suitable when operating in high uncertainty conditions, and therefore can support the creation of new ventures (Sarasvathy, 2001). Effectuation is about using available knowledge, means, and resources within iterative business innovation processes based on design experiments and stakeholder interactions (Keskin, 2015; Sarasvathy, 2001). The second root is the business model concept framed as a strategic architecture (Chesbrough, 2010; Teece, 2010). In line with effectuation, but in contrast with conventional business strategies that emphasize analysis, this stream of literature argues that new business opportunities can be discovered through a different approach based on trial and error, which is explicitly defined as business experimentation (McGrath, 2010). This literature also explains how the business model framework facilitates experimentation by allowing to *"construct maps of business models, to clarify the processes underlying them, which then allows them to become a source of experiments considering alternate combinations of the processes"* (Chesbrough, 2010). More recently, these perspectives have been combined with some of Toyota's manufacturing principles from the 1970s and 1980s, resulting in the lean startup movement, which has been successful in disseminating these ideas (Ries, 2011; Womack and Daniel, 1997). Lean startup maintains that most new ventures do not fail because they lack a product but because they lack customers (Blank, 2006). Consequently, the foremost challenge of entrepreneurship is achieving a good product-market-fit by treating business ideas as hypotheses to be tested in front of potential customers as quickly and cheaply as possible (Ries, 2017).

Implementation knowledge

The concept of business experimentation is intertwined with early business model implementation. The lean startup movement puts a major focus on this aspect by proposing an actionable framework to set up small-scale pilots based on three iterative steps, called the build-measure-learn loop (Ries, 2011). The "build" step is about creating a minimum viable product (MVP), defined as the simplest version of a product that can be sold to consumers. The "measure" step assesses how the product performs on the market. Finally, the "learn" step integrates the learning collected in the previous two steps into the next version of the MVP. The steps are iterated until the MVP fits the needs of a solid customer base, and sales can be scaled up. Within this framework, several practices and methods can be employed. The most central one is prototyping, which is essential for the creation of MVPs, and physical or digital artifacts (e.g., a landing page for a web-based service) to be tested with consumers on the market (Ries, 2011). A/B testing is a method to evaluate two (or multiple) prototypes simultaneously (Blank,

2012; Ries, 2011). The key method for evaluation is defining key performance indicators or metrics, and then using them to quantitatively measure product performance (Ries, 2011).

2.3 Strategic design

Strategic design is an innovation approach that leverages design principles, practices, methods, and tools in the context of strategy and innovation management (Calabretta et al., 2016; Liedtka and Ogilvie, 2012). Compared to product design, strategic design deals more with long-term, systemic initiatives that typically require significant organizational commitments and investments, seeking to achieve competitive edge and shape markets.

The origins of strategic design connect to design literature as a rational process to solve complex problems (Buchanan, 1992; Simon, 1973). These ideas have recently been leveraged into a business context, focusing the design process beyond a product scope to business and organizational challenges, in order to innovate experimentally across three spaces: inspiration, ideation, and implementation (Brown, 2008). As this discussion gained momentum, questions arose around how to actually apply these ideas in business practice (Rylander, 2009). In response, academic research clarified that design is not only an abstract process but also "*a practice,*" meaning the way in which designers think and act (Dorst, 2011; Kimbell, 2012). This conception of design-as-a-practice allows shifting the discussion on the design process away from "what it is" toward defining "how" organizations can actually use it to achieve a competitive advantage, which leverages design up to a strategic rather than purely tactical level, hence the emergence of strategic design (see Baldassarre, Calabretta, Bocken, Diehl and Keskin, 2019; Calabretta et al., 2016). According to strategic design, specific design principles, practices, methods, and tools can be leveraged to balance desirability (i.e., what customers want, the value proposition of a business model), feasibility (i.e., what is technically achievable, the value creation and delivery system of a business model), and viability (i.e., what is financially possible, the value capture system of a business model) (Brown, 2008; Calabretta et al., 2016), while considering systemic conditions and implications of the design. Balancing desirability, feasibility, and viability in view of systems is key to effectively implementing new products, services, and the business models around them (Calabretta et al., 2016; Karpen et al., 2017).

Implementation knowledge

Strategic design supports the implementation of new business model ideas through a set of practices that allow making them tangible and testable early on in the innovation process (Calabretta et al., 2016). Specifically,

prototyping can be used not only to present and test concepts in the development stage of innovation, but also to inspire stakeholders and to convince them to embrace an innovation and commit to introducing it in the market. By going beyond the traditional application of a prototyping logic to physical objects to test desirability of a new product, strategic design proposes innovative prototyping methods and tools to simulate also the intangible components of a new business model in order to test innovation feasibility and viability (Calabretta et al., 2016; Stickdorn et al., 2011). The service blueprint is an example of a tool that allows the prototyping of intangible service components and financial transactions of a new business model by defining a sequence of actions that organizations must perform to execute the business idea as part of a small-scale pilot or a full-scale implementation. Finally, implementation by strategic design is also supported by the definition of key performance indicators and iterative business casing, needed for assessing the feasibility and viability of the innovation early on (Azabagic and Karpen, 2016).

2.4 Research gap

SBMI is characterized by a design-implementation gap that hinders the diffusion of new SBMs in practice (Geissdoerfer et al., 2018; Tukker, 2015). The design-implementation gap refers to the fact that new SBM ideas are not implemented on the market (Geissdoerfer et al., 2018; Ritala et al., 2018), and often fail when they are (Tukker, 2015). To start addressing this gap, recent SBMI research established a connection between business experimentation (Weissbrod and Bocken, 2017) and strategic design (Baldassarre et al., 2019). So far, this body of work has demonstrated that framing SBMI as an iterative process, where sustainability objectives are gradually integrated with stakeholder priorities, allows shaping the design of new SBMs in a way that is functional to implementation (Baldassarre et al., 2017). Furthermore, research has shown how each step of this process can be supported by multiple business experimentation and strategic design practices (Bocken et al., 2019).

Prototyping is mentioned as a practice for executing pilots, simulating early on the implementation of SBMs in a real-world context (Bocken et al., 2018). However, despite its potential for bridging the design-implementation gap, the application of this practice remains largely unexplored. To our knowledge, few SBMI studies (e.g., Baldassarre et al., 2017; Geissdoerfer et al., 2016) have focused on prototyping, specifically looking at how this practice can be used to get a conceptual SBM defined “on paper” to actually unfold in “the reality of practice.” On the other hand, our literature review on business experimentation and strategic design highlights important knowledge on how to prototype toward business model implementation (Calabretta et al., 2016; Ries, 2011).

Therefore, the aim of this paper is to transfer relevant prototyping expertise from business experimentation and strategic design into the SBMI field, exploring how the design-implementation gap of SBMs may be addressed. To this end, we develop a tool to set up small-scale pilots for new SBMs. The tool allows applying a prototyping logic beyond a focal product to the intangible components of an SBM, including service elements, stakeholder interactions, monetary transactions, and sustainability impact. Materializing these aspects in a small-scale pilot allows validating the desirability, sustainability, technical feasibility, and financial viability of a new SBM, which is essential to advancing toward its full-scale implementation.

The choice of developing a tool is justified by the intention of producing a tangible output to support SBMI practice (Bocken et al., 2019). SBMI research is placing an increasing focus on the development of tools (Lüdeke-Freund et al., 2016). A recent review has categorized them according to their purpose: ideating, implementing, and evaluating SBMs (Bocken et al., 2019). A deeper analysis shows that while most of these tools fit into multiple categories at the same time, with a prominent focus on ideation, none of them focuses on how to bridge the design-implementation gap (Bocken et al., 2019). Consequently, we aim to expand this body of knowledge by proposing a tool for implementing existing SBMs concepts within small-scale pilots.

Figure 1 shows the design-implementation gap in SBMI innovation literature and practice, and how this gap may be addressed by infusing prototyping expertise from business experimentation and strategic design into a tool for setting up small-scale SBM pilots.

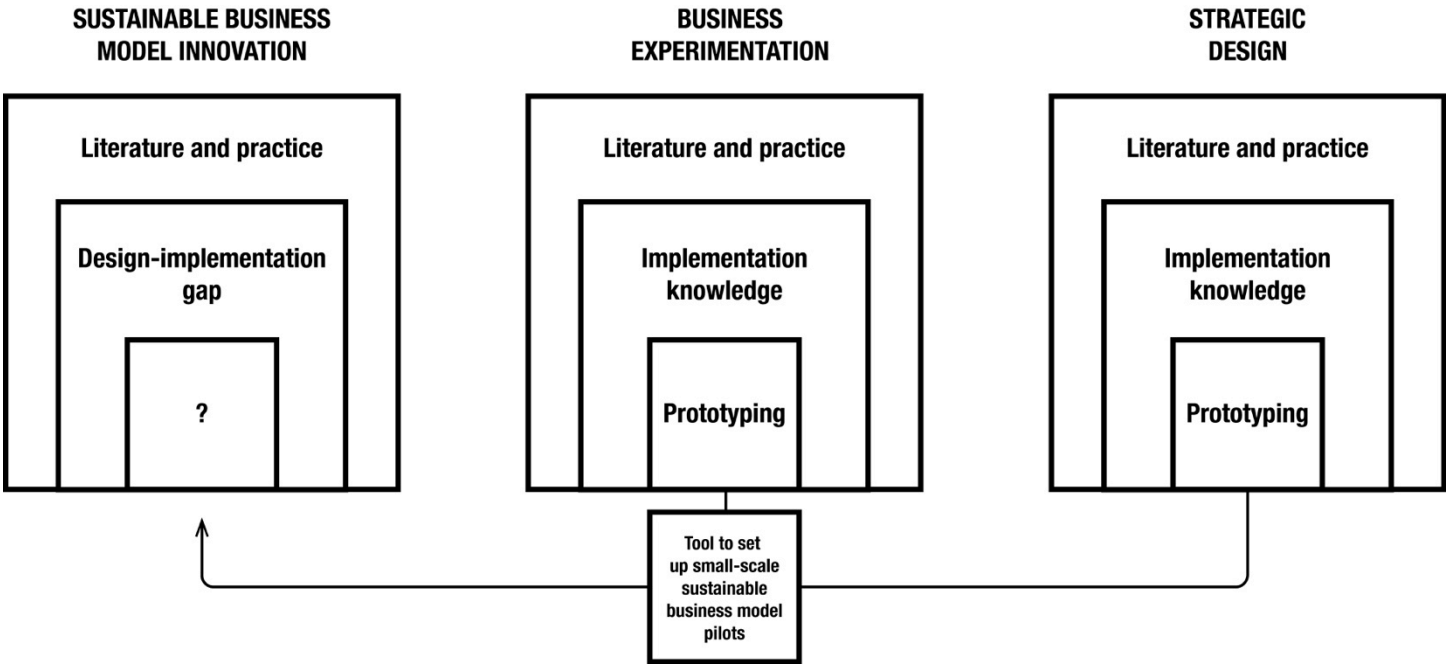

Figure 1. Visual representation of the design-implementation gap of SBMI and explanation of how this research aims to address it.

3. METHODOLOGY

This study uses a design science research (DSR) methodology (Peffers et al., 2007). DSR comes from the field of information systems, but more recently it was applied in entrepreneurship (Romme and Reymen, 2018), management (Van Aken and Romme, 2009), and service design research (Grenha Teixeira et al., 2017), in order to structure a solid scientific inquiry around innovation efforts and tools. DSR generates scientific knowledge about a theoretical issue by creating and evaluating an artifact through empirical work (Peffers et al., 2007). Artifacts include tools to address organizational and innovation challenges (Peffers et al., 2007); thus, this method is suitable for our research. DSR provides a meta-methodological process, within which several other research techniques are deployed (Collatto et al., 2018). In line with Peffers et al. (2007), our DSR process is visualized in Figure 2 and further explained in the paragraphs below.

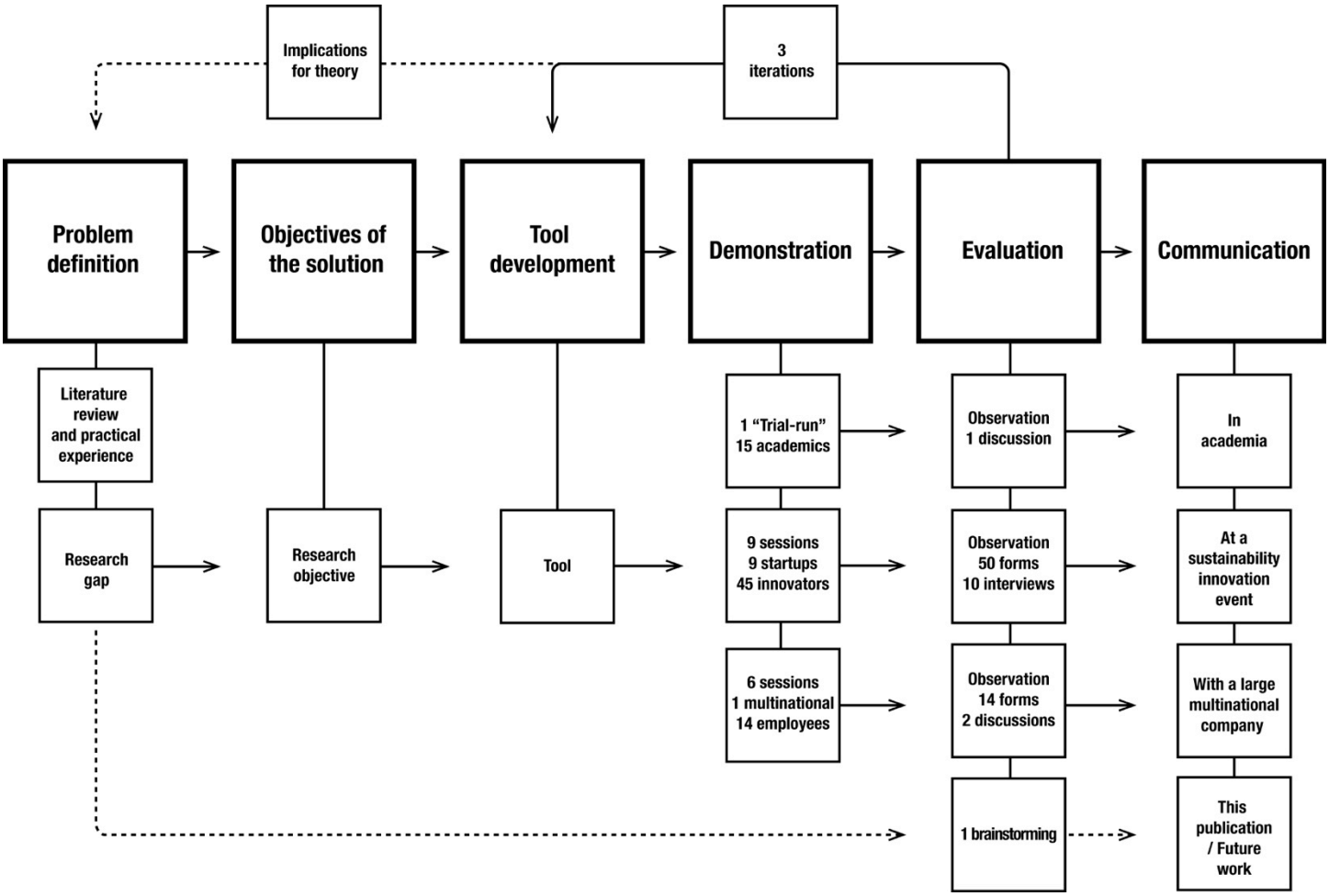

Figure 2. Overview of the design science research process applied in this research (based on Grenha Teixeira et al., 2017; Peffers et al., 2007).

3.1 Problem definition

The research process starts with a problem definition based on a theoretical investigation summarized in the literature review of this paper and substantiated by the experience of the authors working in SBMI practice. Specifically, the problem definition relates to the design-implementation gap of SBMs. Our literature review on business experimentation and strategic design shows that prototyping is often mentioned as a way to implement new business models. However, the full potential of this practice remains, to date, largely unexplored both conceptually and empirically in SBMI.

3.2 Objectives of the solution

The objective of this paper is to address the design-implementation gap of SBMs by leveraging prototyping expertise found in business experimentation and strategic design. We pursue this intent via an exploratory objective:

Explore how the practice of prototyping may be leveraged to set up small-scale pilots and address the design-implementation gap of sustainable business models.

3.3 Tool development

The objective is addressed by developing a tool to set up small-scale SBM pilots by means of prototyping. Tool development is iterative. Section 4.1 presents the initial version of the tool (Figure 3), explaining how theoretical knowledge from SBMI, business experimentation, and strategic design is combined into it. Section 4.2 describes the first iteration, based on a practical demonstration and follow-up evaluation. Section 4.3 presents the second iteration. Here, an improved version of the tool (Figure 4) is applied in an empirical demonstration and then evaluated. Section 4.4 illustrates the third iteration. Specific details about the content of the pilots within this iteration cannot be shared for confidentiality reasons. Finally, Section 4.5 summarizes the improvement points identified in the previous iterations and presents the final version of the tool (Figure 5).

3.4 Demonstration

The tool was applied in three practical demonstrations. Each demonstration was based upon a mix of qualitative (Corbin and Strauss, 2008; Sanders and Stappers, 2012) and action research techniques (Swann, 2002). The tool was introduced to research subjects through a thirty-minute presentation. Consequently, it was applied in a set of workshop sessions, where the subjects (in groups) used the tool to plan an SBM pilot. Each session was audio and/or video recorded. The researchers led the sessions and took written notes.

The first demonstration was a trial run at the Delft University of Technology. Research subjects were 15 academics with relevant knowledge and experience in the SBMI field. They were split into three groups and worked for one hour on fictional assignments for testing the tool while collecting expert feedback on it.

The second demonstration was a ten-day sustainability innovation event, where nine early-stage startups were coached by experts to set up a small-scale pilot, implementing new business models addressing sustainability challenges related to a nearby music festival. Sustainability challenges included sustainable food supply, sustainable energy supply, sustainable water supply, and waste management. In this instance, nine workshop sessions of two hours were conducted, in which the nine startups translated initial business ideas into a plan for a small-scale SBM pilot addressing the sustainability challenges. Subsequently, these pilots were also executed.

Research subjects were the nine startups, each led by a novice entrepreneur with one year's experience, supported by four master students from different Dutch universities. Each startup had at its disposal prototyping facilities and a 500 Euro budget for prototyping. The nine startups, their initial business ideas, and relationships to the sustainability challenges of the festival are listed below.

- *Biopack*: supporting the music festival in producing less waste, by using food-packaging products made from biodegradable cellulose.
- *Vegart*: supporting the music festival in providing visitors a sustainable food option, based on an organic chia pudding made from natural ingredients as an alternative to meat.
- *Bakers' Best*: supporting the music festival in providing visitors a sustainable drink option, based on the Genever drink made from leftover loaves of bread.
- *Studio Marc*: supporting the music festival in sourcing water sustainably, by using a plant-based water-filtration system.
- *Zzinga*: supporting the music festival in providing visitors with a sustainable drink option, based on honey wine harvested from sustainable bee keeping.
- *Solar Solutions*: supporting the music festival in producing renewable energy, by using an off-grid solar system integrated with furniture to charge mobile devices.
- *& Cricket*: supporting the music festival in providing visitors a sustainable food option, based on deep-fried finger food made from insects as an alternative to meat.
- *Proper Plates*: supporting the music festival in producing less waste, by providing a dishwashing service to eliminate disposables.
- *Kapitein Flotsam*: supporting the music festival in reducing littering and pollution, by providing visitors with an ashtray designed to prevent cigarettes butts from being thrown on the ground

The third demonstration was a collaboration with a consultancy and a large multinational company as a client. The focus was on supporting the company to set up small-scale pilots to implement and test a new SBM for providing customers with electronic products as a service. Specifically, the aim was extending the service lifetime of an electronic product for personal care through multiple use cycles and refurbishment, thereby reducing environmental impact while generating economic value from waste. Two half-day workshops were conducted. Various alternatives of small-scale pilots for the product were collectively defined and discussed. Research

subjects were 14 employees from the sustainability, design, marketing, and operation departments. They worked in six small groups in collaboration with the researchers and three consultants for a total of six sessions.

3.5 Evaluation

Each demonstration was followed by an evaluation comparing the objective of the tool with the actual results from using it (Peffers et al., 2007). In line with DSR, our evaluation was based on the following framework: explicating the goals of the evaluation, choosing an evaluation strategy, determining the evaluation criteria, and planning the evaluation episodes (Venable et al., 2016). The goal of the evaluation was assessing whether the tool can actually help organizations in setting up small-scale SBM pilots. Our evaluation strategy was to assess the objective results achieved by organizations using the tool as well as their subjective perceptions about it.

There are two criteria for the objective evaluation: first, whether organizations are able to plan a pilot using the tool; and second, whether they can execute such a pilot. To this end, we conducted one evaluation episode after each demonstration, consisting of directly observing if these criteria were met. The subjective evaluation was essential to collecting feedback for improving the tool as well as to verify potential adoption. In line with literature about the factors influencing the adoption of tools to address organizational challenges, our subjective evaluation was based on two criteria: if organizations find the tool useful; and if they find it easy to use (Davis et al., 1989; Legris et al., 2003). To this end, we conducted various evaluation episodes. After the first demonstration, we discussed the results with the fifteen academics. After the second demonstration, we handed out a form to the 45 people involved in the startup challenges, where they could score the usefulness and ease of use on separate scales ranging from 1 to 7, and then provide comments about it. Furthermore, we conducted ten interviews with the young entrepreneurs leading the startups. After the third demonstration, we discussed the results with the 14 employees and gave them the same feedback forms used in the second evaluation. All interviews and discussions were audio recorded and supported by note taking.

In a final evaluation round, the researchers reflected on their experiences, observations, and notes taken throughout the process (Corbin and Strauss, 2008; Miles et al., 2013), to draw implications for SBMI theory by connecting the outcomes with the literature and the research question.

3.6 Communication

Communication about research outcomes, during and after the research process, is a core part of DSR. During the research process, the tool was discussed with several academics and business practitioners. After the research process, communication is represented by this article and by future SBMI projects that we plan to conduct around the tool.

4. TOOL DEVELOPMENT, DEMONSTRATION, AND EVALUATION

4.1 Initial tool

The backbone of the tool is based on the business model canvas (Osterwalder and Pigneur, 2010), a tool for generating business model ideas. The canvas allows to ideate and map the building blocks of the business model, which can be clustered into core elements: value proposition (product/service, customer segments); value creation and delivery (key partners, key activities, key resources, customer relationship, channels); and value capture (costs, revenue streams) (Osterwalder and Pigneur, 2010). Our tool differs from the business model canvas in terms of its purpose, which is not supporting ideation but rather planning and executing small-scale pilots of new business models driven by sustainability. The tool thus takes an existing SBM idea as the starting point, allowing to zoom into the details and specifications needed to implement a pilot. To this end, we integrate the original tool with SBMI, business experimentation, and strategic design theory. From a practical perspective, the tool also significantly differs from the business canvas model by way of its layout and content fields. Specifically, next to the core elements present in the business model canvas, it incorporates sustainability elements, while aiding users in critical reflection about pilot testing and respective success criteria. Given its focus, we call our tool *sustainable business model (SBM) Pilot Canvas.*

SBMI theory is leveraged by integrating three sustainability aspects into the process of setting up a small-scale pilot. First, triple-bottom-line thinking, which refers to conceiving the value proposition of the business model pilot not only in economic terms but also in social and environmental ones (Elkington, 1998; Joyce and Paquin, 2016). Second, sustainability impact assessment, which relates to measuring quantitatively the social and/or environmental value generated by the pilot (Baldassarre et al., 2019; Manninen et al., 2018). Third, a multi-stakeholder perspective, which refers to an active effort to conceive the pilot beyond a traditional firm-centric perspective, taking into consideration the priorities of different stakeholders, their roles in creating and delivering value, as well as how benefits, costs, and profits are shared across them (Bocken et al., 2013; Stubbs and Cocklin,

2008). This is a fundamental aspect of SBMI because sustainability is a system property that can only be achieved through the collaboration of multiple stakeholders (Adams et al., 2016; Stubbs and Cocklin, 2008).

Business experimentation and strategic design theory are integrated as follows. First, effectual reasoning, which refers to an approach to set up the pilot in high uncertainty conditions by leveraging current means, knowledge, and stakeholder contacts in order to iterate forward driven by contingencies (Sarasvathy, 2001). Second, the use of metrics, which consist of quantitative indicators to evaluate if the pilot supports the development and growth of the business (Azabagic and Karpen, 2016; Ries, 2011). These first two aspects are encompassed by a prototyping logic, which refers to quickly materializing an innovation in order to test and further improve it (Calabretta et al., 2017; Ries, 2011). Specifically, the tool allows framing as a prototype – not only the value proposition and the product concept that underlies it, but the entire business model, including the core elements of value creation, delivery, and capture. In other words, the tool supports the materialization of all business model elements needed for executing the pilot.

The coming paragraphs list the core elements of the tool and the building blocks that have to be prototyped for this purpose, explaining in detail how they incorporate triple-bottom-line thinking, sustainability impact assessment, multi-stakeholder perspective, effectual reasoning, use of metrics, and a prototyping logic.

Sustainable value proposition

Prototyping the sustainable value proposition element requires defining and materializing the following building blocks:

- Basic version of a product/service that can be quickly built with available resources.
- Network of available stakeholders needed for the creation and delivery of the product/service prototype, including end users/customers.
- One or more KPIs to measure the sustainability impact generated by the prototype.

The definition of this core element is based on the integration of the building blocks that constitute the value proposition in the business model canvas (i.e., product/service, customer segments) with triple-bottom-line thinking, and a multi-stakeholder perspective derived from existing SBMI tools and frameworks (Baldassarre et al., 2017; Bocken et al., 2013; Joyce and Paquin, 2016). Specifically, triple-bottom-line thinking is reflected by

considering the sustainability impact of the value proposition; a multi-stakeholder perspective is reflected by acknowledging the presence of a stakeholder network to create and deliver the value proposition. Furthermore, effectual reasoning and prototyping logic are reflected by leveraging available means and stakeholders to materialize the product/service immediately. The use of metrics and sustainable impact assessment are reflected by the indication of defining and measuring the sustainability impact of the value proposition with rigor (Manninen et al., 2018; Ries, 2011).

Sustainable value creation and delivery

Prototyping the sustainable value creation and delivery elements requires defining and materializing the following building blocks:

- User journey: sequence of actions that end-users need to do in order to get and use the product/service prototype.
- Supporting processes: sequence of actions that each stakeholder involved in creating and delivering the prototype needs to perform for the user journey to take place.

The definition of this core element is based on replacing the building blocks that constitute value creation and delivery in the business model canvas (i.e., key partners, key activities, key resources, customer relationship, channels) with the service blueprint tool (Stickdorn et al., 2011). The service blueprint tool is used in strategic design practice to apply a prototyping logic to intangible process and service exchanges, which are difficult to materialize and test. The service blueprint supports this by framing them as a sequence of actions that end users and stakeholders need to perform (Bitner et al., 2008; Morelli, 2006). Such an action-based definition, in line with effectual reasoning, provides a business model script that can be acted upon immediately. Finally, the service blueprint tool supports a multi-stakeholder perspective in line with SBMI theory (Bitner et al., 2008; Stubbs and Cocklin, 2008).

Sustainable value capture

Prototyping the sustainable value capture element requires defining and materializing the following building blocks:

- Costs to create and deliver the product/service prototype and an explanation of how such costs are shared across stakeholders.

- Revenue streams generated by the product/service and an explanation of how such revenues are shared across stakeholders.

The definition of this core element is based on the integration of the building blocks that constitute value capture in a business model canvas (i.e., costs, revenue streams) with a multi-stakeholder perspective derived from existing SBMI tools and frameworks, which prescribe to define how costs and profits shall be shared fairly across the involved stakeholders (Bocken et al., 2013; Joyce and Paquin, 2016). Finally, listing all the costs and revenues for executing the small-scale pilot is in line with effectual reasoning, providing a financial metric to quickly assess the viability of the business model (Azabagic and Karpen, 2016; Ries, 2011).

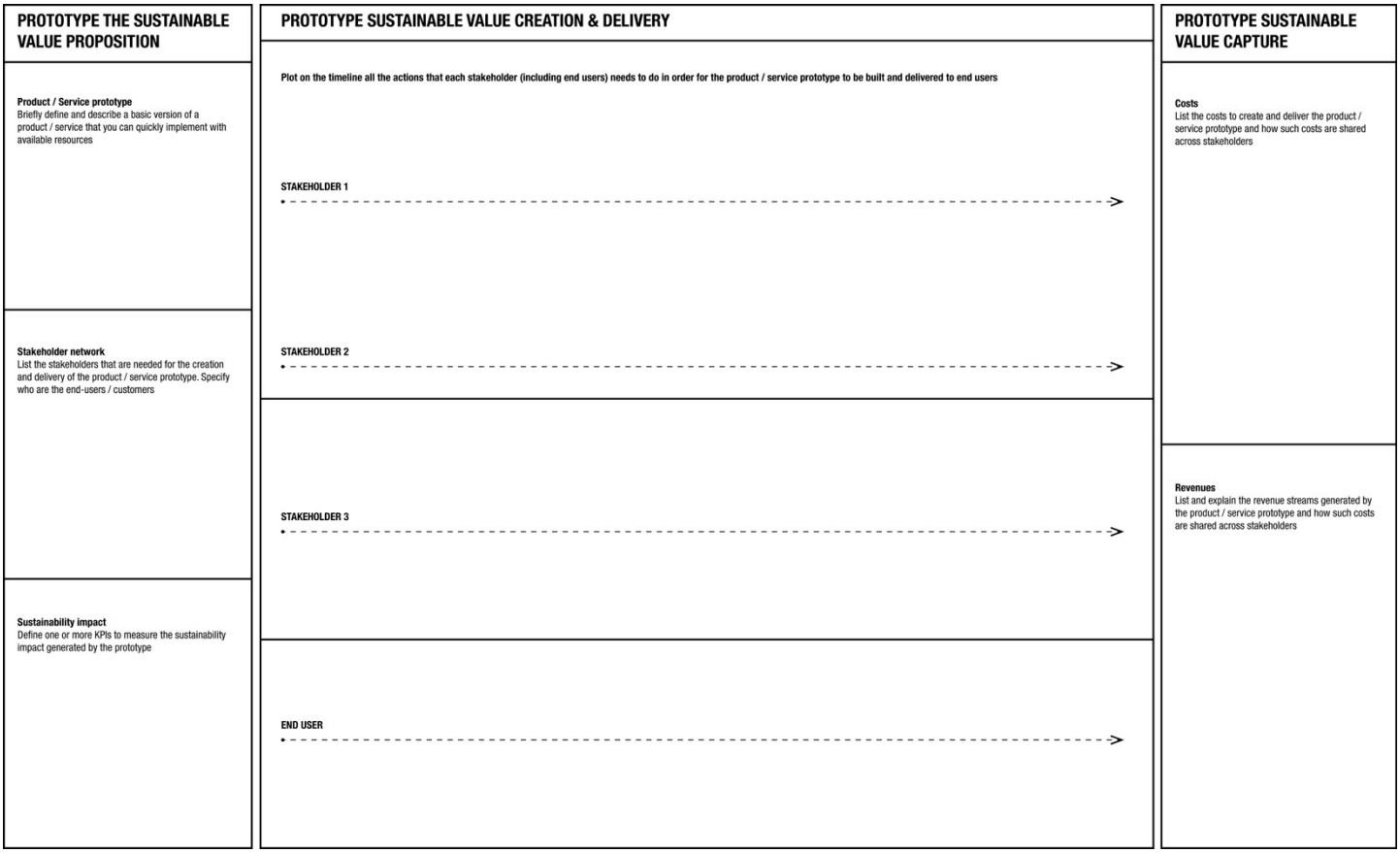

Figure 3. The *SBM Pilot Canvas* tool developed by combining relevant prototyping expertise from business experimentation and strategic design research with elements and knowledge from the sustainable business model innovation field.

4.2 First iteration

Demonstration

The academics defined an SBM pilot as starting from a fictional idea. They had no problems using the tool but struggled when placing value creation and delivery actions on the same timeline because, when setting up a pilot, value creation actions precede value delivery actions. For this reason, some of them disrupted the structure of the tool to arrange the actions more logically according to their needs.

Evaluation

The objective evaluation indicates that the academics could plan a pilot; however, this pilot was not executed as part of the trial run. The subjective evaluation of the academics indicates that the tool may be useful for practitioners: *"This tool could help companies implementing sustainable business models."* Remarks were mostly related to the structure of the value creation and delivery element: *"The user journey and stakeholder actions are challenging to plot. You need a workflow to get through this part. It should start with the customer journey."* Another remark was related to the terminology used to define the business model elements: *"Value creation is a complex term. Outside academia people might not understand what it means."* This feedback is integrated into the tool (Table 1).

4.3 Second iteration

Demonstration

The startups planned and executed a small-scale SBM pilot by means of prototyping. *Vegart, Baker's Best*, and *& Cricket* prototyped the value proposition (i.e., sustainable food and drink products), delivered it, and sold it to customers. *Kapitein Flotsam* and *Solar Solutions* created and delivered a product-service combination (i.e., a floating ashtray to prevent cigarette littering and a bench integrated with a solar panel to charge mobile devices) but did not capture value by monetizing their efforts. *Proper Plates* delivered a dishwashing service to reduce the use of disposables but did so for free. *Biopack* and *Studio Marc* prototyped their value propositions (i.e., a biodegradable food packaging and a water filtration system) and showcased them as concepts. *Zzinga* was the only startup unable to plan and execute a pilot.

Demonstration example

We provide the example of the startup *Solar Solutions* to explain how the tool was used, as well as the related discussions and challenges. Figure 4 illustrates the output of the workshop session.

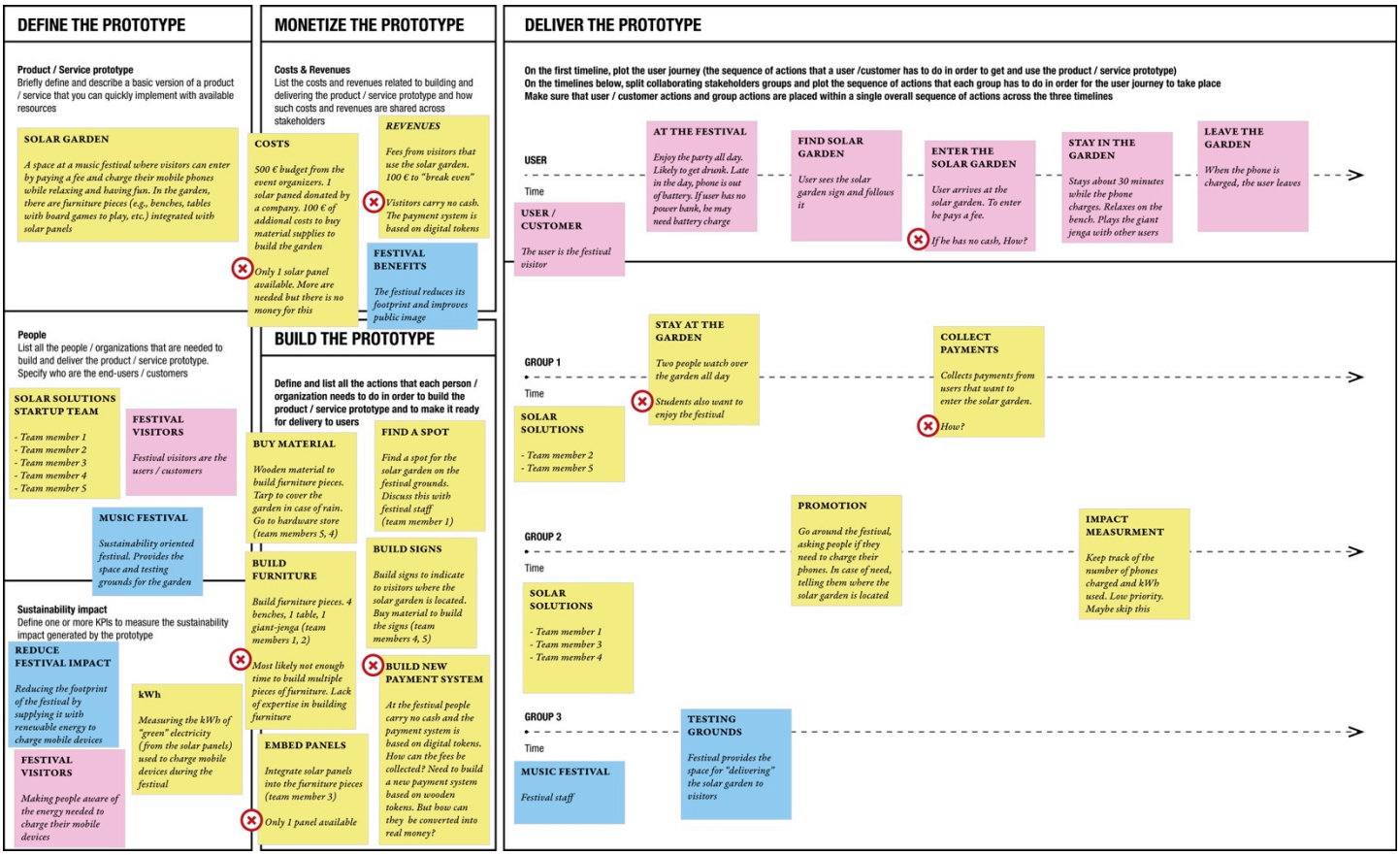

Figure 4. Improved tool after the first iteration and applied in the second iteration. The figure shows how one of nine startups used the tool. Implementation bottlenecks have been mapped ex post by the authors with a "red X."

The starting point of the session was the initial idea of *Solar Solutions*. The intended environmental value was supporting the music festival in producing renewable energy while, on the social side, making people aware of the amount of energy needed to charge their mobile devices. Building upon this, *Solar Solutions* defined a prototype called *Solar Garden*: "A confined space where festival visitors can enter by paying a fee and charge their mobile phones while relaxing and having fun. In the garden there are furniture pieces (e.g., benches, tables with board games to play) integrated with solar panels." As shown in Figure 4, *Solar Solutions* defined the stakeholders involved in the pilot, and mapped them onto the tool using Post-its of different colors to distinguish their roles and specific actions needed to create, deliver, and sell the prototype.

The first stakeholder was the *Solar Solutions* team itself (yellow Post-its). Team members were assigned different actions to build the prototype (e.g., how many pieces of furniture to build, which materials to buy, how to integrate solar panels). They defined the costs of such actions and to what extent customer fees could cover prototyping expenses. Festival visitors were the second stakeholder (pink Post-its). They were framed as customers. Realizing that service delivery and financial returns depend on visitors, Solar Solution plotted their actions on the user journey. Below, they plotted the supporting actions of the team members (e.g., informing visitors about the possibility to reduce their energy footprint at the festival by indicating the location of the *Solar Garden).* The third

stakeholder was the music festival organization (blue Post-its), providing the grounds to run the pilot. To this end, *Solar Solutions* was dependent upon it and framed it as a partner. This required a constant exchange of information (e.g., defining where to execute the pilot without interfering with other festival activities and how such a pilot would benefit the organization). Ultimately, by using the tool and leveraging prototyping with a multi-stakeholder perspective, *Solar Solutions* was able to plan the pilot.

While planning, *Solar Solutions* discovered several bottlenecks (mapped "ex post" by the researchers on Figure 4 using a red "X") related to actions that could not be executed due to lack of expertise, time, and/or budget (e.g., nobody on the team had experience in building furniture and multiple pieces could not be built in a short time; there was no budget for multiple solar panels; festival visitors carried no cash, therefore requiring the creation of a new payment system). Consequently, *Solar Solutions* decided to build only one bench integrated with one solar panel where people could relax and charge their phone. No solution to the payment system was found in the available time; therefore, value was captured only to a limited extent through tips from those people who carried cash. In order to solve these bottlenecks in a short time and with limited money, *Solar Solutions* simplified the value proposition to execute the pilot as best they could, given the circumstances.

Finally, even though *Solar Solutions* had already defined how the pilot would generate environmental and social value for different stakeholders within the *Sustainability Impact* box of the tool, they struggled significantly in defining ways to quantify such impact. In fact, this box was initially filled in superficially, with a vague explanation about reducing the festival footprint by supplying renewable energy and making visitors more aware of their energy consumption. When nudged on the importance of actually keeping track of the *Sustainability Impact* with metrics, *Solar Solutions* came up with the idea of using kWh to measure the "green electricity" supplied to the festival. However, due to lack of time, they did not follow up with this measurement.

Evaluation

The objective evaluation shows that eight startups could plan and execute a small-scale pilot starting from their sustainable business idea. However, next to the use of the tool, the entity of such steps depended on several contextual factors, which are difficult to assess (e.g., team dynamics, abilities of the entrepreneurs, complexity of the idea, etc.). In general, we observed that, while planning the pilot under time and financial pressures, several startups simplified the original value proposition in order to be able to create and deliver it. Furthermore, we

observed that they were reluctant and/or unable to quantify the sustainability impact of their idea and treated sustainability more as an abstract driver rather than a necessary condition to be taken into consideration when executing the pilot. These observations are illustrated in our "demonstration example."

The subjective evaluation was positive. Feedback forms reported an average score of 6 for perceived usefulness. Comments and interviews highlighted that the tool helps to stop ideating and defines concrete actions, but also that many startups did not find the definition of sustainability metrics relevant. They explained that sustainability lies at the core of the idea, and that measuring is not a priority when time and budget pressures impose focus upon other issues. For example, a novice entrepreneur explained: *"We are making a vegan snack to reduce the production and consumption of meat. This is good for people and reduces CO_2 emissions. Our business is sustainable even if we do not measure it. Now there is little time and we have to focus on production."* Concerning ease of use, feedback forms reported an average score of 4. The interviews provided different opinions. Negative remarks related to difficulties in plotting value delivery actions. Other remarks related to the lack of space to define the prototype, which was needed before defining the actions to execute the pilot. This feedback is integrated into the tool (Table 1).

4.4 Third iteration

Demonstration

The six groups of company employees planned various alternatives of small-scale SBM pilots around the electronic product. Two groups focused the pilot on the internal company processes needed to refurbish the product and generate value out of waste. Two groups focused the pilot on how to leverage partner relationships to sell the product as a service and reduce end-user consumption. One group broke down the pilot into a set of multiple hypotheses testing customer acceptance of leasing products for personal care (e.g., hygiene concerns, willingness to pay). The remaining group engaged in divergent thinking and was unable to use the tool to define a specific pilot plan.

Evaluation

The objective evaluation shows that five of the six groups could plan a small-scale pilot. Nevertheless, these plans were not detailed enough for immediate execution. The employees explained that they would discuss internally how to combine different elements into a single plan to execute it. We could not be involved in this, which is an important limitation of our study, but we observed how, while planning the pilot, the large company evaluated

several options and most groups placed a prominent focus on how the new sustainable proposition could be created and delivered. Furthermore, we observed that the definition of meaningful sustainability metrics was distorted by the need for delineating a compelling business case behind each pilot option.

The subjective evaluation was positive. Feedback forms reported an average score of six for perceived usefulness and five for ease of use. This is confirmed by their request for a printable canvas template, in order to follow up with it autonomously. The main remark on usefulness was related to the lack of space to explain the sustainability relevance of the pilot and the business case behind it. They suggested including such space to support the definition of sustainability metrics in line with it. The main remark on ease of use was related to a lack of clarity on the purpose of the tool, which became evident only after the researchers' explanation: *"Add a title explaining that the tool helps to set up small-scale pilots. The term prototyping applied to a service may lead to misunderstandings."* To further clarify the purpose of the tool, they suggested framing the core elements as questions, such as: *"What is the idea?"* or *"How do you make money?"* This feedback is integrated into the tool (Table 1).

4.5 Final tool

Facilitating sessions and receiving feedback allowed gradually upgrading the *SBM Pilot Canvas*. Specific improvement points are listed in Table 1, as well as their rationales deriving from the three iterations.

	UPGRADES	**IMPROVEMENT POINTS**	**RATIONALE**	
1	**Clarify the purpose of the tool**	1a) Included a title to clarify its purpose (i.e., set up small-scale scale pilots for SBMs)	*Third iteration* Employees mentioned that purpose became clear after the explanations of the researchers and suggested making this explicit on the canvas. They argued that the term prototype might lead to misunderstandings and suggested using the term small-scale pilot instead	
		1b) Included a subtitle to indicate that the pilot should be executed immediately with available resources		
		1c) Adjusted the explanatory text to further specify the purpose of the core elements		
2	**Redefine and rename the core elements of the tool**	2a) Redefined/added the core elements twice across the three iterations by splitting/unbundling current ones	*First iteration* Academics suggested to use simpler names to make the core elements more understandable for practitioners (e.g., *build the prototype* instead of *value creation*)	*Third iteration* Employees suggested to clarify content by framing the elements as questions (e.g., *how do you make money?* instead of *monetize the prototype)*
		2b) Renamed the core elements twice. Final elements: - *What is the idea?* (*Sustainable value proposition*) - *Why is it sustainable?* (New. See 4a, 4b, 4c) - *How do you make money?* (*Sustainable value capture*) - *How do you make it happen?* (New. See 5b) - *How does it work?* (New. See upgrade 5c)		
3	**Improve the *sustainable value proposition* element of the tool (*what is the idea?*)**	3a) Replaced the space for specifying the *stakeholder network* with a space for defining the *user/customer* and his/her *reason to buy/use* the prototype	*Second iteration* Startups struggled to start using the tool. They argued that the process of working with the tool could be more coherent and logically structured, starting from the plotting the initial idea, who would pay for it and why, and thinking about sustainability metrics and stakeholder actions later	
		3b) Unbundled *sustainability impact* from the *sustainable value proposition* (see row 4)		

4	**Add *sustainability impact* as a stand-alone element of the tool (*why is it sustainable?)***	4a) Included *Sustainability impact* as a stand-alone element labeled with the question: *Why is it sustainable?* 4b) Included space to explain the sustainability impact of the pilot and related business case 4c) Next to space for *sustainability metrics* (now in line with the business case), included space to note the actual measurement after the pilot to verify if impact was achieved	*Second iteration* Startups argued that sustainability is their motivation and does not need to be measured. In some cases, this resulted in losing focus and being unable to explain the sustainability impact of the business model pilot. In the third iteration, employees mentioned the importance of having a business case behind sustainability impact and defining metrics accordingly	
5	**Split and improve the *sustainable value creation and delivery* elements of the tool (*how do you make it happen?* and *how does it work?*)**	5a) Split *sustainable value creation and delivery* into two separate elements 5b) Labeled the *sustainable value creation* element with the question: *How do you make it happen?* Next to the label, added a space to specify the execution date of the pilot. Within the element three columns were added for: - Listing the *people* involved in the pilot - Listing *available resources* provided by each person - Listing *building actions* that each person performs (indicating to tick the action when completed) 5c) Labeled *sustainable value delivery* element with the question: *How does it work?* Within the element: - Explicitly named the *user/customer journey* and placed it in the top part. - Replaced the multiple timelines to plot stakeholder actions with a single timeline named *delivery actions*, (leaving below sufficient space to add more timelines)	*First iteration* Academics struggled with plotting value creation and value delivery actions on the same timeline because the first are needed to prepare the pilot and the latter to execute it. They suggested splitting the core elements to allow for more coherent activity planning. They also struggled to define *delivery actions* before plotting the *user/customer journey*, and suggested that the latter should be placed on top to make the process of working with the tool more coherent and structured	*Second iteration* Startups worked toward a pilot execution date; defining the resources needed; splitting tasks across team members and checking whether they had been performed in order to prevent delays. They also explained that using the term *people* instead of *stakeholders* would make the tool more understandable. They also improved the delivery element of the tool by naming items more clearly and removing multiple timelines to avoid confusion
6	**Suggest working with Post-it notes of different colors**	6a) Added in the text the suggestion to work with Post-it notes of different colors to identify different stakeholders and respective actions within *sustainable value creation* and *sustainable value delivery*	*Second iteration* Startups worked with Post-it notes of different colors to visualize at a glance the tasks of different team members, as well as stakeholders involved in the pilot	

Table 1. List of the improvement points defined by applying and evaluating the tool in three iterations.

After the evaluation of the third iteration, all improvement points were condensed into a final version of the tool (Figure 5). This version is structured around five core elements: *What is the idea?* (*Sustainable Value Proposition*); *Why is it sustainable?* (*Sustainability Impact)*; *How do you make money?* (*Sustainable Value Capture*); *How do you make it happen?* (*Sustainable Value Creation*); and *How does it work? (Sustainable Value Delivery).* Each core element is based on several building blocks, as listed below.

What is the idea? (*Sustainable Value Proposition*)

- Description of the main idea for a small-scale pilot around a new sustainable product/service that can be quickly executed with available resources.
- Definition and description of who will be the user/customer of the product/service provided in the pilot.
- Explanation of why the user/customer wants the product/service put forward by the pilot.

Why is it sustainable? (*Sustainability Impact)*

- Explanation of the sustainability impact generated by the pilot and the related business case.

- Definition of one or more indicators to measure the sustainability impact generated by the pilot.
- Assessment of the actual results for each indicator after executing the pilot.

How do you make money? (*Sustainable Value Capture*)

- Definition of the costs needed to execute the pilot and how such costs are shared across stakeholders.
- Definition of the revenues deriving from executing the pilot and how such costs are shared across stakeholders.

How do you make it happen? (Sustainable Value Creation)

- List of all the people/organizations involved in setting up and executing the pilot.
- List of the resources (e.g., knowledge, expertise, network, and infrastructure) that each person/organization brings to the table to set up the pilot.
- List of all the actions that each person /organization performs to set up the pilot.

How does it work? (Sustainable Value Delivery)

- Sequence of actions that a user/customer has to do during the pilot.
- Sequence of actions that the people/organizations working on delivering the pilot have to do in order to support each step of the user/customer journey.

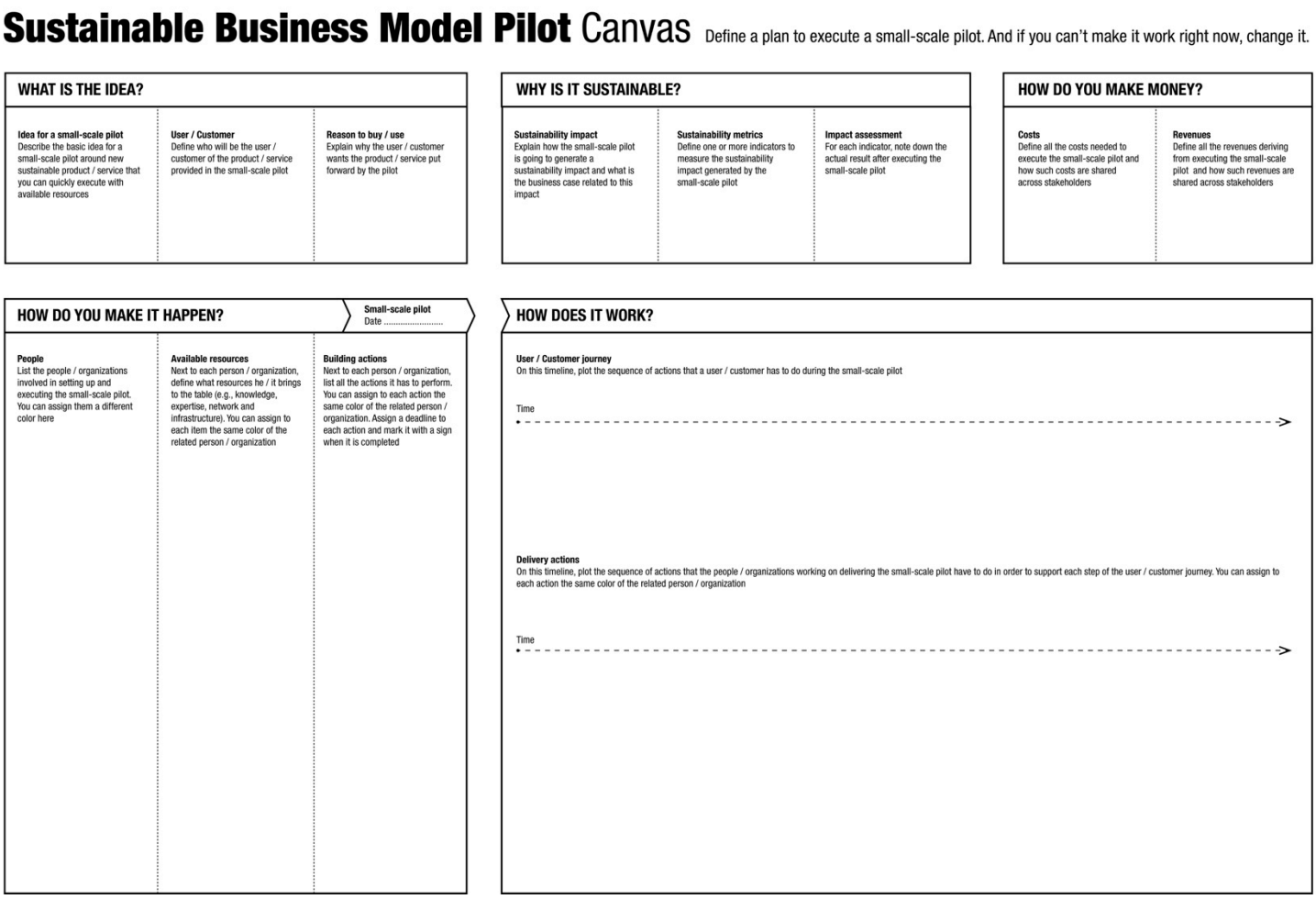

Figure 5. The *SBM Pilot Canvas* updated and improved after applying it and evaluating it in three iterations.

5. DISCUSSION

5.1 Contribution to Sustainable Business Model Innovation theory

This research focuses on the design-implementation gap of SBMs. Indeed, this gap indicates that many promising SBM ideas are not implemented successfully (Geissdoerfer et al., 2018; Ritala et al., 2018). Addressing this issue is highly relevant to achieving the sustainable impacts promised by SBMI research (Abdelkafi and Täuscher, 2016). In fact, SBMI literature is driven by the argument that a more strategic and managerial perspective can be used to derive positive sources of value from negative impacts (Stubbs and Cocklin, 2008; Yang et al., 2017), which may be reduced by up to 90% (Tukker, 2004). Scholars outside the "sustainability niche" increasingly discuss the relevance of such a perspective in fostering the necessary transition toward sustainable development. For example, Massa et al. (2017) present sustainability as a future avenue for business model innovation research, while others maintain that management research should focus on grand sustainability challenges (George et al., 2016), such as achieving growth without depleting natural resources (George et al., 2015). Nevertheless, SBMI

research focusing on how to address the design-implementation gap of SBMs is currently limited (Geissdoerfer et al., 2018; Tukker, 2015).

From a theoretical perspective, our main contribution lies in identifying and combining multiple literature streams advancing current theorizing around SBMI. We purposefully integrate insights of business experimentation (e.g., Weissbrod and Bocken, 2017) and strategic design (e.g., Baldassarre et al., 2019) literatures to inform SBMI. Drawing on these literature streams and our empirical study, we demonstrate how prototyping is central to linking insights across these literatures, while explaining how it can be leveraged to start addressing the design-implementation gap of SBMs. Indeed, we argue that prototyping can bridge the design-implementation gap by allowing the materialization of an SBM, setting up a small-scale pilot as a first critical step toward implementation.

More specifically, as part of this contribution, we specify that piloting a prototype forces organizations to consider from an early stage the desirability (i.e., whether users or customers are interested in the value proposition) and the sustainability (i.e., a multi-stakeholder perspective, triple-bottom-line thinking, and impact assessment orientation) of a new business model, in parallel with its feasibility (i.e., whether the organizations involved can create and deliver such value propositions) and viability (i.e., whether they can translate this effort into a financial return). By planning the pilot, the startups encountered several bottlenecks that forced early reconsideration of their sustainable value propositions, trading off desirability with feasibility and viability toward execution. Similarly, when planning pilot options to be executed early, the multinational put a major focus on feasibility and viability, besides thinking about the wishes of customers. Furthermore, in this process, both the startups and the multinational were confronted early on with their inability to properly quantify the intended sustainability impact, which is an important recognition step when dealing with this critical aspect highlighted in the SBMI literature (Manninen et al., 2018).

Ultimately, our empirical work challenges current assumptions within SBMI theory; namely, that it is necessary to first conceptualize a sustainable value proposition that is desirable, and then move on to thinking about sustainable value creation, delivery, and capture (Baldassarre et al., 2017; Bocken et al., 2013, 2018. Conversely, we argue that focusing only on desirability and sustainability upfront and accounting for feasibility and viability at a later stage results in operational and financial bottlenecks, which are exacerbated by sustainability impact requirements, ultimately leading to a design-implementation gap (Geissdoerfer et al., 2018). We thus suggest that

before detailing SBM ideas, piloting prototypes are crucial to considering simultaneously their desirability, sustainability, feasibility, and viability, and to verify early on if they can be implemented.

Finally, an important part of the contribution is the empirical development of a tool to support thinking in this direction, as visualized in Figure 6. By developing this tool through a design science research method, we advance normative theory on SBM implementation. Normative theory is important in providing a solid foundation for business practice and in offering prescriptive managerial considerations, ultimately guiding both ethical and/or rational thought (Hunt, 2011). While many normative frameworks consider *either* ethical (e.g., morally appropriate behaviors) *or* rational (e.g., goal-oriented decisions) drivers (Hunt, 2011), we argue that the proposed SBMI tool combines both aspects into one framework. Indeed, the developed and validated tool links sustainability concepts with the business-oriented concepts of desirability, feasibility, and viability.

Building upon these reflections in line with Whetten (2016), we briefly summarize our theoretical contribution to the SBMI field in terms of the what, how, and why questions. *What* – we have introduced the concepts of desirability, feasibility, viability, and sustainability by drawing from different theoretical domains. *How* – we have explained that through prototyping it is possible to shift the focus away from generating new sustainable business model ideas (that might remain "on paper"), and propose a tool to leverage these concepts simultaneously in order to set up small-scale pilots (that take place in reality). *Why* – we have justified how doing so is relevant for advancing our conceptual understanding and normative theory in the context of SBMI, bridging the design-implementation gap of new sustainable business models, and ultimately reducing the environmental impacts of organizations.

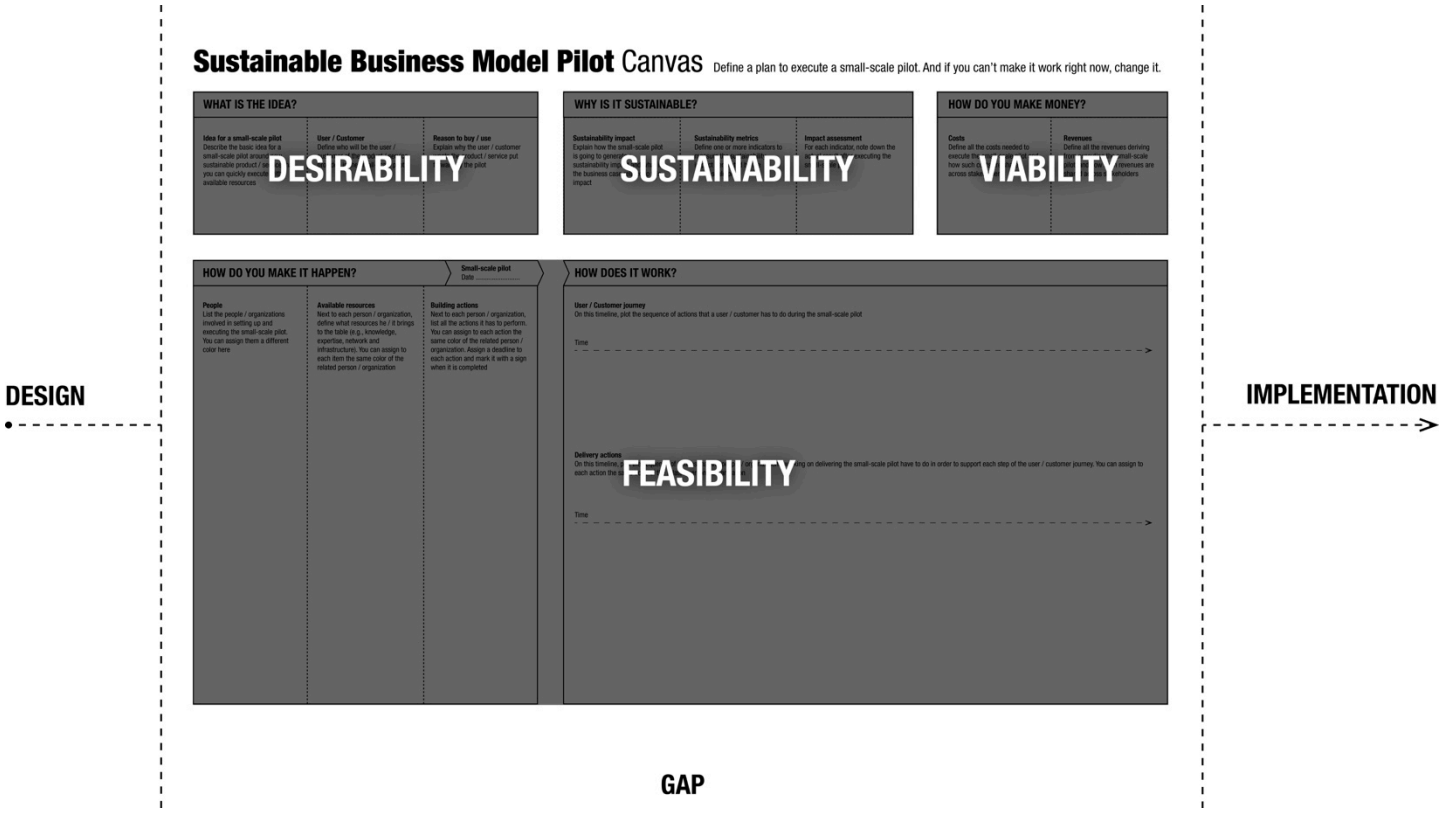

Figure 6. The *SBM Pilot Canvas* supports bridging the design-implementation gap of sustainable business models by leveraging and integrating simultaneously four constructs: desirability, feasibility, viability, and sustainability.

5.2 Contribution to Sustainable Business Model Innovation practice

The *SBM Pilot Canvas* aims to support small and large organizations interested in bridging the design-implementation gap of their SBM ideas, helping them to turn negative impacts into positive sources of value. Specifically, the tool supports building prototypes and planning specific actions needed for executing small-scale pilots by simultaneously taking into consideration four main concepts: the desirability of the business idea, its sustainability, operational feasibility, and financial viability. The tool that we propose has been applied and evaluated by working in business practice with both startups and a multinational company. Its versatility and validity are important to highlight, as previous frameworks have been criticized for not providing empirical evidence and related reflections about how they can be used in practice (Bragd et al., 2002).

The *SBM Pilot Canvas* complements an existing collection of SBMI tools for ideating, implementing, and evaluating new SBMs (Bocken et al., 2019; Breuer et al., 2018). An analysis of this collection shows that currently no tool places a specific focus on the design-implementation gap. Accordingly, organizations may use the *SBM Pilot Canvas* starting from an existing SBM idea, and then work towards a first small-scale implementation. In addition, it is important to reiterate that this tool differs from the business model canvas (Osterwalder and Pigneur, 2010),

which is frequently used by practitioners to ideate and work with new business model ideas. As pointed out by previous research (Joyce and Paquin, 2016), this tool does not provide any support to incorporate sustainability thinking in the ideation of a new business model. Furthermore, it is mostly geared toward mapping and analyzing business models rather than defining details of the specific actions and success criteria that are needed for their implementation (Joyce and Paquin, 2016). The *SBM Pilot Canvas* addresses these issues by integrating features derived from SBMI, business experimentation, and strategic design (i.e., triple-bottom-line thinking, sustainability impact assessment, multi-stakeholder perspective, effectual reasoning, and the use of metrics – a prototyping logic). In doing so, the model also provides better support for practitioners aiming to go beyond ideation and confront all details and potential difficulties entailed with implementing a sustainable business model.

Our demonstration with nine startups indicates that using the tool can support small organizations in quickly establishing if customers and stakeholders are interested in the business model idea; whether such an idea is sustainable or not; if it can work from an operational point of view; and if it is possible to immediately generate money from it – an aspect that is essential to reach the market (Ries, 2017). Our demonstration with the multinational company context points out that using the tool can support large organizations in defining multiple pilot options and, consequently, in deciding how to move forward depending on various considerations mainly influenced by the business case, which must be aligned with the current business model of the company to ensure feasibility and viability (Azabagic and Karpen, 2016; Karpen et al., 2017; Schaltegger et al., 2012).

We further note that the tool may require facilitation from experts (i.e., researchers and/or consultants). In our cases, we saw that novice entrepreneurs and MSc students required facilitation in order to move beyond the definition of features of the value proposition and plan all the actions needed to create, deliver, and monetize the small-scale pilot. On the other hand, the employees of the multinational company, who have more experience in navigating the innovation process, encountered few difficulties in using the tool. After receiving a preliminary explanation, they were able to use it autonomously, which is further supported by their request to be provided with a printable template of the tool to support internal work.

6. CONCLUSION

6.1 Limitations and future research

The main limitation of this study relates to its exploratory nature. First, we applied and evaluated our tool by working with a limited sample of organizations for a limited period. The type of subjects we worked with and the short duration of the research influenced the generalizability of our findings, which require further validation. Nevertheless, our study shows that investigating how prototyping can be leveraged to set up small-scale pilots is a promising avenue to advance research about the design-implementation gap in SBMI (Geissdoerfer et al., 2018). Consequently, we encourage future SBMI research along this trajectory by working with a larger sample of companies and for a longer period through longitudinal case studies, to pinpoint with more accuracy how small-scale SBM pilots can be planned and executed successfully. To this end, we suggest that the tool, and the four concepts of desirability, feasibility, viability, and sustainability put forward in this research may provide practical and conceptual guidance on the core criteria that have to be considered when planning and executing such pilots.

A second limitation relates to the issue of evaluation. Our study focused the evaluation on the tool itself, assessing from a subjective standpoint if the organizations found it useful and easy to use, and from an objective standpoint if it could help them to plan and execute sustainability-driven business model pilots. However, we did not evaluate the outcomes from using the tool. Advancing the evaluation to the outputs proved to be problematic in practice. Given the exploratory nature and short duration of our study, neither the organizations nor we evaluated if the executed pilots would be successful from a sustainability and/or a financial point of view. Nevertheless, this study paves the way for future work in this direction. Specifically, we suggest that future SBMI research, besides focusing on how prototyping can be leveraged to plan and execute pilots, should also investigate how such pilots can be rigorously assessed from a financial and sustainability standpoint. These two aspects are important if the design-implementation gap of SBMI is to be bridged with proper solutions that deliver tangible sustainability impacts.

6.2 Concluding remarks

SBMI plays a crucial role in integrating environmental and social concerns into the objectives and operations of firms aiming to transition towards sustainable development (Stubbs and Cocklin, 2008; Tukker, 2004). To this end, it is necessary not only to ideate new SBMs but also to implement them successfully in markets (Tukker, 2015). To date, this remains a major challenge (Ritala et al., 2018). This exploratory study proposes theoretical and practical contributions to start bridging this critical design-implementation gap so that organizations can make an actual difference.

ACKNOWLEDGEMENTS

The authors would like to acknowledge financial support through the ZERO BRINE project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730390.

REFERENCES

Adams, R., Jeanrenaud, S., Bessant, J., Denyer, D., Overy, P. (2016). Sustainability-oriented Innovation: A Systematic Review. *International Journal of Management Reviews*, *18*(2), 180–205. https://doi.org/10.1111/ijmr.12068

Abdelkafi, N., Täuscher, K. (2016). Business Models for Sustainability From a System Dynamics Perspective. *Organization and Environment*, *29*(1), 74–96. https://doi.org/10.1177/1086026615592930

Antikainen, M., Aminoff, A., Paloheimo, H., Kettunen, O. (2017). Designing circular business model experimentation - Case study. In *ISPIM Innovation Forum* (pp. 1–14). Retrieved from https://www.researchgate.net/profile/Maria_Antikainen/publication/316046098_Designing_circular_business_model_experimentation_-_Case_study/links/58ef28e50f7e9b37ed16e72b/Designing-circular-business-model-experimentation-Case-study.pdf

Azabagic, N., Karpen, I. O. (2016). Making it count: Linking design and viability. In *Strategic design: Eight essential practices every strategic designer must master* (pp. 168–193). Amsterdam: BIS Publishers.

Baldassarre, B., Calabretta, G., Bocken, N., Jaskiewicz, T. (2017). Bridging sustainable business model innovation and user-driven innovation: A process for sustainable value proposition design. *Journal of Cleaner Production*, *147*, 175–186. https://doi.org/10.1016/j.jclepro.2017.01.081

Baldassarre, B., Schepers, M., Bocken, N., Cuppen, E., Korevaar, G., Calabretta, G. (2019). Industrial Symbiosis: towards a design process for eco-industrial clusters by integrating Circular Economy and Industrial Ecology perspectives. *Journal of Cleaner Production*, *216*, 446–460. https://doi.org/10.1016/j.jclepro.2019.01.091

Baldassarre, B., Calabretta, G., Bocken, N., Diehl, J. C., Keskin, D. (2019). The evolution of the Strategic role of Designers for Sustainable Development. In *Academy for Design Innovation Management* (Vol. 2, pp. 807–821–807–821). London.

Baldassarre, B., Bocken, N., Calabretta, G., Diehl, J., & Keskin, D. (2019). Track 4.f Introduction: Strategic Design of Sustainable Business Models. *Academy for Design Innovation Management*, *2*(1), 803–806–803–806. https://doi.org/10.33114/adim.2019.4f

Bitner, M. J., Ostrom, A. L., Morgan, F. N. (2008). Service Blueprinting: A Practical Technique for Service Innovation. *California Management Review*, *50*(3), 66–94. https://doi.org/10.2307/41166446

Blank, S. (2006). *The Four Steps to the Epiphany: Successful Strategies for Products that Win*. San Francisco: CafePress.com.

Blank, S. (2012). *The startup owner's manual: The step-by-step guide for building a great company*. San Francisco: BookBaby.

Bocken, N., Boons, F., Baldassarre, B. (2019). Sustainable business model experimentation by understanding ecologies of business models. *Journal of Cleaner Production*, *208*, 1498–1512. https://doi.org/10.1016/J.JCLEPRO.2018.10.159

Bocken, N., Schuit, C., Kraaijenhagen, C. (2018). Experimenting with a circular business model: Lessons from eight cases. *Environmental Innovation and Societal Transitions*. https://doi.org/10.1016/j.eist.2018.02.001

Bocken, N., Short, S., Rana, P., Evans, S. (2013). A value mapping tool for sustainable business modelling. *Corporate Governance: The International Journal of Business in Society*, *13*(5), 482–497. https://doi.org/10.1108/CG-06-2013-0078

Bocken, N., Short, S. W., Rana, P., Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, *65*, 42–56. https://doi.org/10.1016/j.jclepro.2013.11.039

Bocken, N., Strupeit, L., Whalen, K., Nußholz, J. (2019). A Review and Evaluation of Circular Business Model Innovation Tools. *Sustainability*, *11*(8), 2210. https://doi.org/10.3390/su11082210

Boons, F., Lüdeke-Freund, F. (2013). Business models for sustainable innovation: State-of-the-art and steps towards a research agenda. *Journal of Cleaner Production*, *45*, 9–19. https://doi.org/10.1016/j.jclepro.2012.07.007

Bragd, A., Baumann, H., Boons, F. (2002). Mapping the green product development field: engineering, policy and business perspectives. *Journal of Cleaner Production*, *10*(5), 409–425. https://doi.org/10.1016/S0959-6526(02)00015-X

Breuer, H., Fichter, K., Lüdeke Freund, F., Tiemann, I. (2018). Sustainability-oriented business model development: principles, criteria and tools. *International Journal of Entrepreneurial Venturing*, *10*(2), 256. https://doi.org/10.1504/IJEV.2018.10013801

Brown, T. (2008). Design thinking. *Harvard Business Review*, *86*(6), 84–92.

Brundtland, G. (1987). *Our common future: Report of the 1987 World Commission on Environment and Development*. Oslo.

Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, *8*(2), 5–21.

Calabretta, G., Gemser, G., Karpen, I. (2016). *Strategic design: eight essential practices every strategic designer must master*. Amsterdam: BIS Publishers.

Calabretta, G., Gemser, G., Wijnberg, N. M. (2017). The Interplay between Intuition and Rationality in Strategic Decision Making: A Paradox Perspective. *Organization Studies*, *38*(3–4), 365–401. https://doi.org/10.1177/0170840616655483

Chesbrough, H. (2010). Business model innovation: Opportunities and barriers. *Long Range Planning*, *43*(2–3), 354–363. https://doi.org/10.1016/j.lrp.2009.07.010

Collatto, D. C., Dresch, A., Lacerda, D. P., Bentz, I. G. (2018). Is Action Design Research Indeed Necessary? Analysis and Synergies Between Action Research and Design Science Research. *Systemic Practice and Action Research*, 239–267. https://doi.org/10.1007/s11213-017-9424-9

Corbin, J., Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, California: Sage.

Davis, F. D., Bagozzi, R. P., Warshaw, P. R. (1989). User Acceptance of Computer Technology : A Comparison of Two Theoretical Models. *Management Science*, *35*(8), 982–1003. https://doi.org/10.1287/mnsc.35.8.982

Dorst, K. (2011). The core of "design thinking" and its application. *Design Studies*, *32*(6), 521–532. https://doi.org/10.1016/j.destud.2011.07.006

Elkington, J. (1998). Partnerships from Cannibals with Forks: The Triple Bottom Line of 21st Century Business. *Environmental Quality Management*, *Autumn 199*, 37–51. https://doi.org/10.1002/tqem.3310080106

Geissdoerfer, M., Bocken, N., Hultink, E. J. (2016). Design thinking to enhance the sustainable business modelling process: A workshop based on a value mapping process. *Journal of Cleaner Production*, *135*, 1218–1232. https://doi.org/10.1016/j.jclepro.2016.07.020

Geissdoerfer, M., Vladimirova, D., Evans, S. (2018). Sustainable business model innovation: A review. *Journal of Cleaner Production*, *198*, 401–416. https://doi.org/10.1016/j.jclepro.2018.06.240

George, G., Howard-Grenville, J., Joshi, A., Tihanyi, L. (2016). Understanding and Tackling Societal Grand Challenges Through Management Research. *Academy of Management Journal*, *59*(6), 1880–1895. https://doi.org/10.5465/amj.2016.4007

George, G., Schillebeeckx, S., Liak, T. L. (2015). The management of natural resources: An overview and research agenda. *Academy of Management Journal*, *58*(6), 1595–1613. https://doi.org/10.5465/amj.2015.4006

Grenha Teixeira, J., Patrício, L., Huang, K. H., Fisk, R. P., Nóbrega, L., Constantine, L. (2017). The MINDS Method: Integrating Management and Interaction Design Perspectives for Service Design. *Journal of Service Research*, *20*(3), 240–258. https://doi.org/10.1177/1094670516680033

Hunt, S. D. (2011). On the intersection of marketing history and marketing theory. *Marketing Theory*, *11*(4), 483–489. https://doi.org/10.1177/1470593111418802

Joyce, A., Paquin, R. L. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, *135*, 1474–1486. https://doi.org/10.1016/j.jclepro.2016.06.067

Karpen, I. O., Gemser, G., Calabretta, G. (2017). A multilevel consideration of service design conditions. *Journal of Service Theory and Practice*, *27*(2), 384–407. https://doi.org/10.1108/JSTP-05-2015-0121

Keskin, D. (2015). *Product Innovation in Sustainability-Oriented New Ventures*.

Kimbell, L. (2012). Rethinking Design Thinking: Part II. *Design and Culture*, *4*(2), 129–148.

Legris, P., Ingham, J., Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, *40*(3), 191–204. https://doi.org/10.1016/S0378-7206(01)00143-4

Liedtka, J., Ogilvie, T. (2012). Helping Business Managers Discover Their Appetite for Design Thinking. *Design Management Review*, *23*(1), 6–13. https://doi.org/10.1111/j.1948-7169.2012.00165.x

Lüdeke-Freund, F., Bohnsack, R., Breuer, H., Massa, L. (2019). Research on Sustainable Business Model Patterns: Status quo, Methodological Issues, and a Research Agenda. In A. Aagaard (Ed.), *Sustainable Business Models: Innovation, Implementation and Success* (pp. 25–60). Palgrave Macmillan, Cham.

Lüdeke-Freund, F., Dembek, K. (2017). Sustainable business model research and practice: Emerging field or passing fancy? *Journal of Cleaner Production*, *168*, 1668–1678. https://doi.org/10.1016/j.jclepro.2017.08.093

Lüdeke-Freund, F., Massa, L., Bocken, N., Brent, A. C., Musango, J. (2016). *Business Models for Shared Value - Main Report*.

Manninen, K., Koskela, S., Antikainen, R., Bocken, N., Dahlbo, H., Aminoff, A. (2018). Do circular economy business

models capture intended environmental value propositions? *Journal of Cleaner Production*, *171*, 413–422. https://doi.org/10.1016/j.jclepro.2017.10.003
Massa, L., Tucci, C. L., Afuah, A. (2017). A Critical Assessment of Business Model Research. *Academy of Management Annals*, *11*(1), 73–104. https://doi.org/10.5465/annals.2014.0072
McGrath, R. G. (2010). Business Models : A Discovery Driven Approach. *Long Range Planning*, *43*(2–3), 247–261. https://doi.org/10.1016/j.lrp.2009.07.005
Miles, M., Huberman, M., Saldaña, J. (2013). *Qualitative data analysis: a Methods Sourcebook*. Thousand Oaks, California: Sage.
Morelli, N. (2006). Developing new product service systems (PSS): methodologies and operational tools. *Journal of Cleaner Production*, *14*(17), 1495–1501. https://doi.org/10.1016/j.jclepro.2006.01.023
Osterwalder, A., Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers*. *John Wiley & Sons*. https://doi.org/10.1111/j.1540-5885.2012.00977_2.x
Peffers, K., Tuunanen, T., Rothenberger, M. A., Chatterjee, S. (2007). A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, *24(3)*(September), 45–78. https://doi.org/10.2753/MIS0742-1222240302
Richardson, J. (2008). The business model: an integrative framework for strategy execution. *Strategic Change*, *17*(5–6), 133–144. https://doi.org/10.1002/jsc.821
Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses.* United States: Crown Books.
Ries, E. (2017). *The Startup Way: how modern companies use entrepreneurial management to transform culture and drive long-term growth*. United States: Crown Books.
Ritala, P., Huotari, P., Bocken, N., Albareda, L., Puumalainen, K. (2018). Sustainable business model adoption among S&P 500 firms: A longitudinal content analysis study. *Journal of Cleaner Production*, *170*, 216–226. https://doi.org/10.1016/j.jclepro.2017.09.159
Romme, A. G. L., Reymen, I. M. M. J. (2018). Entrepreneurship at the interface of design and science: Toward an inclusive framework. *Journal of Business Venturing Insights*, *10*(July), 1–8. https://doi.org/10.1016/j.jbvi.2018.e00094
Rylander, A. (2009). Exploring Design Thinking as Pragmatist Inquiry. In *25th EGOS Colloquium* (pp. 2–4). Barcelona, Spain.
Sanders, L., Stappers, P. J. (2012). *Convivial design toolbox: Generative research for the front end of design*. Amsterdam: BIS Publishers.
Sarasvathy, S. (2001). Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency. *Academy of Management*, *26*(2), 243–263. https://doi.org/10.5465/amr.2001.4378020
Schaltegger, S., Lüdeke-Freund, F., Hansen, E. G. (2012). Business cases for sustainability: The role of business model innovation for corporate sustainability. *International Journal of Innovation and Sustainable Development*, *6*(2), 95–119. https://doi.org/10.1504/IJISD.2012.046944
Schumpeter, J. A. (1934). *The Theory of Economic Development*. Routledge.
Simon, H. A. (1973). The Structure of Ill Structured Problems. *Artificial Intelligence*, *4*(1973), 181–201. Retrieved from http://www.public.iastate.edu/~cschan/235/6_Simon_Ill_defined_problem.pdf
Stickdorn, M., Schneider, J., Andrews, K. (2011). *This is service design thinking: Basics, tools, cases*. Hoboken, NJ: Wiley.
Stubbs, W., Cocklin, C. (2008). Conceptualizing a "Sustainability Business Model." *Organization & Environment*. https://doi.org/10.1177/1086026608318042
Swann, C. (2002). Action Research and the Practice of Design. *Design Issues*, *18*(2). https://doi.org/10.1162/07479360252756287
Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, *43*(2–3), 172–194. https://doi.org/10.1016/j.lrp.2009.07.003
Tukker, A. (2004). Eight types of product-service system: Eight ways to sustainability? Experiences from SusProNet. *Business Strategy and the Environment*, *260*, 246–260. https://doi.org/10.1002/bse.414
Tukker, A. (2015). Product services for a resource-efficient and circular economy - A review. *Journal of Cleaner Production*, *97*, 76–91. https://doi.org/10.1016/j.jclepro.2013.11.049
Tukker, A., Tischner, U. (2006). Product-services as a research field: past, present and future. Reflections from a decade of research. *Journal of Cleaner Production*, *14*(17), 1552–1556. https://doi.org/10.1016/j.jclepro.2006.01.022
Upward, A., Jones, P. (2016). An Ontology for Strongly Sustainable Business Models: Defining an Enterprise Framework Compatible With Natural and Social Science. *Organization and Environment*, *29*(1), 97–123. https://doi.org/10.1177/1086026615592933
Van Aken, J. E., Romme, G. (2009). Reinventing the future: Adding design science to the repertoire of organization and management studies. *Organisation Management Journal*, *6*(1), 5–12. https://doi.org/10.1057/omj.2009.1

Venable, J., Pries-Heje, J., Baskerville, R. (2016). FEDS: A Framework for Evaluation in Design Science Research. *European Journal of Information Systems*, *25*(1), 77–89. https://doi.org/10.1057/ejis.2014.36

Weissbrod, I., Bocken, N. (2017). Developing sustainable business experimentation capability – A case study. *Journal of Cleaner Production*, *142*, 2663–2676. https://doi.org/10.1016/j.jclepro.2016.11.009

Whetten, D. A. (2016). What Constitutes a Theoretical Contribution? Published by : Academy of Management Linked references are available on JSTOR for this article : What Constitutes a Theoretical Contribution? *Academy of Management*, *14*(4), 490–495.

Womack, J. P., Daniel, T. J. (1997). Lean thinking: banish waste and create wealth in your corporation. *Journal of the Operational Research Society*, *48*(11), 1148–1148. https://doi.org/10.1057/palgrave.jors.2600967

Yang, M., Evans, S., Vladimirova, D., Rana, P. (2017). Value uncaptured perspective for sustainable business model innovation. *Journal of Cleaner Production*, *140*, 1794–1804. https://doi.org/10.1016/j.jclepro.2016.07.102

Yip, A. W. H., Bocken, N. M. P. (2018). Sustainable business model archetypes for the banking industry. *Journal of Cleaner Production*, *174*, 150–169. https://doi.org/10.1016/j.jclepro.2017.10.190

Zhao, X., Hwang, B. G., Lu, Q. (2018). Typology of business model innovations for delivering zero carbon buildings. *Journal of Cleaner Production*, *196*, 1213–1226. https://doi.org/10.1016/j.jclepro.2018.06.018

Zott, C., Amit, R. (2010). Business model design: An activity system perspective. *Long Range Planning*, *43*(2–3), 216–226. https://doi.org/10.1016/j.lrp.2009.07.004