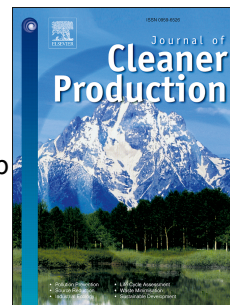


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Martin Geissdoerfer, Nancy M.P. Bocken, Erik Jan Hultink



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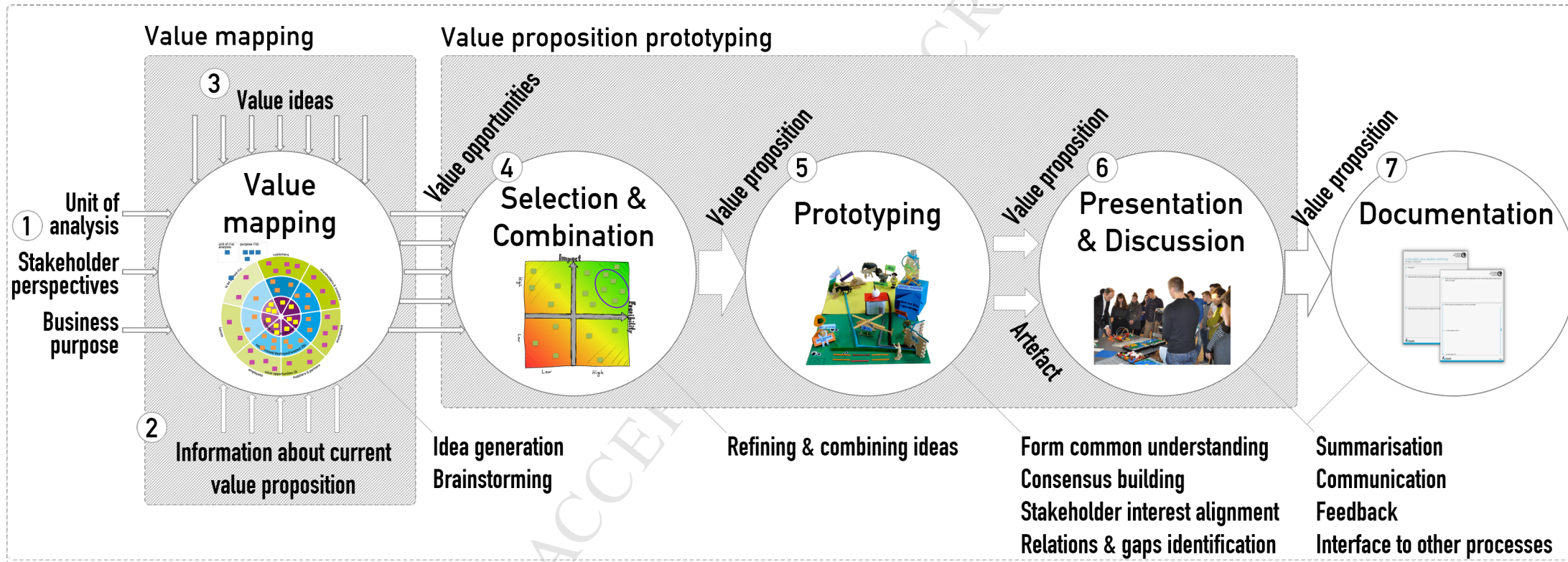
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Value Ideation



Design thinking to enhance the sustainable business modelling process - a workshop based on a value mapping process

Geissdoerfer, Martin^{1,2†}; Bocken, Nancy M.P.^{1,2}; Hultink, Erik Jan¹

¹ *Industrial Design Engineering, Delft University of Technology, Landbergstraat 15, 2628 CE Delft, The Netherlands, Tel. +31 (0) 15 278 45 21*

² *Institute for Manufacturing, Department of Engineering, University of Cambridge, Cambridge, CB3 0FS, United Kingdom, Tel. +44 (0) 1223 766141*

† Email: ml733@cam.ac.uk

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Abstract

Sustainable business model innovation is an emerging topic, but only few tools are currently available to assist companies in sustainable business modelling. This paper works towards closing this gap by bringing together 'design thinking' and 'sustainable business model innovation' to refine the creative process of developing sustainable value propositions and improve the overall business modelling process.

This paper proposes a new workshop framework based on a value mapping process, which was developed by literature synthesis, expert interviews, and multiple workshops. The framework was transferred into a workshop routine and subsequently tested with companies and students.

The resulting 'Value Ideation' process comprises value ideation, value opportunity selection, and value proposition prototyping. The integration of design thinking into the innovation process helps to create additional forms of value and include formerly underserved stakeholders in the value proposition. Thus, the Value Ideation process helps companies to improve their performance while becoming more sustainable.

Workshop evaluations revealed that the Value Ideation process assists companies in enhancing their value proposition by including positive economic, societal, and environmental value and a wider range of stakeholder interests. The 'design thinking' elements stimulate the ideation process and help to harmonise often conflicting stakeholder interests.

Business model innovation; Design thinking; Corporate sustainability; Value creation; Value ideation; Failed value exchanges.

1. Introduction

Organisational strategy and its long-term aims (Bleicher, 2011; Clausewitz, 1832–1834; Mintzberg *et al.*, 2009; Porter, 1996) can benefit from a focus on sustainability. The ‘triple bottom line’ of people, planet, and profit (Elkington, 1999) complements traditional objectives of organisational strategy such as shareholder value (Rappaport, 1998) and customer satisfaction (Vargo and Lusch, 2004). Sustainability is increasingly seen as a new source of competitive advantage (Nidumolu *et al.*, 2009; Porter and Kramer, 2011b), with business model innovation being considered as one of the key tools to make strategic use of sustainability in organisations (Abdelkafi and Täuscher, 2015; Bocken *et al.*, 2014b, 2015; Boons and Lüdeke-Freund, 2013; Boons *et al.*, 2013).

Based on the definitions by Amit and Zott (2001); Baden-Fuller and Morgan (2010); Chesbrough and Rosenbloom (2002); Johnson *et al.* (2008); Magretta (2002); Morris *et al.* (2005) Osterwalder *et al.* (2010); Richardson (2008); Teece (2010); and Timmers, (1998), we describe business models as simplified representations of the elements – and interactions between these elements – that an organisational unit chooses in order to create, deliver, capture, and exchange value. This definition allows for the implementation of the business model concept for analysis, planning, and communication in face of organisational complexity (Doleski, 2015; Knyphausen-Aufseß and Meinhardt, 2002), and consequently, its use as a vehicle for sustainable management in organisations.¹

The notion of sustainable business models builds on the business model concept and combines it with the important concepts of stakeholder management (Donaldson and Preston, 1995; Freeman, 1984; Post *et al.*, 2002), sustainable value creation (Evans *et al.*, 2014; Short *et al.*, 2012), and a long-term perspective. The academic and practitioner interest in sustainable business models has grown recently, culminating in special issues in *Journal of Cleaner Production* (Vol. 45, April 2013), and *Organization and the Environment* (Vol. 29, Is. 1, March 2016), which provide an overview over the topic. There are also a growing number of literature reviews, for instance, by Bocken *et al.* (2014); Boons and Lüdeke-Freund (2013 and Schaltegger *et al.* (2016). Based on this work, we define a sustainable business model as a simplified representation of the elements, the interrelation between these elements, and the interactions with its stakeholders that an organisational unit uses to create, deliver, capture, and exchange sustainable value for, and in collaboration with, a broad range of stakeholders (see Figure 1).²

Sustainable value is generated by environmental, economic, or social effectiveness, efficiency, or resilience. This comprises items as diverse as resource conservation, emission reduction, resilience to external shocks, healthy profit-reinvestment ratios, healthy ownership structures, secure and

¹ for an overview see e.g. Long Range Planning special issue on business models (Vol. 43, Is. 2-3, 2010) and literature reviews by Bieger and Reinhold (2011); George and Bock (2011); Schallmo (2013); and Zott *et al.* (2011)

² for other definitions see e.g. Garetti and Taisch (2012); Lüdeke-Freund (2010); Schaltegger *et al.*, (2011); Stubbs and Cocklin (2008); Wells, (2013)

meaningful employment, and intra- and intergenerational equity (Atkinson *et al.*, 2007; Nielsen *et al.*, 2010; Sachs, 2015).



Figure 1: The sustainable business model concept

A sustainable business model aims at improving the economic, environmental, and social effectiveness of the business. This improvement can be achieved by enhancing operational efficiency on a technological, by stepping up value generation capabilities on a factory planning, and by performing effective stakeholder management on a corporate strategy level. Consequently, adopting a sustainable business model can enable companies to better adapt to complex environments and achieve sustainable competitive advantages (Choi and Wang, 2009; Hart, 1995; Hillman and Keim, 2001; Nidumolu *et al.*, 2009; Porter and Kramer, 2011; Schaltegger *et al.*, 2011).

Traditionally, tool development for sustainability mainly focused on products or took a broad view on eco-innovation (Baumann *et al.*, 2002; Bocken *et al.*, 2011; Byggeth and Hochschorner, 2006). Tool development around 'business model innovation' is a more recent development. While individual authors such as Bocken *et al.* (2015; 2013), Breuer and Lüdeke-Freund (2014), Joyce *et al.* (2015), and Upward and Jones (2015) made first developments in this area, sustainable business model tools are increasingly in demand but still rare (Evans *et al.* 2014).

The present paper aims to develop a framework, tool, and workshop design that innovatively integrate existing approaches of value mapping and design thinking to support organisations in enhancing their value propositions. This approach supports the two key elements of sustainable business model innovation: the creation of economic, societal, and environmental value; and the collaboration with a wider range of stakeholders.

The main research question that this study addresses is: *How can design thinking enhance the sustainable business modelling process?*

To address this question, we have developed a workshop based tool for improving business model innovation and adding sustainability considerations to the process. To illustrate our approach, this paper first presents the underlying background of value mapping, design thinking, sustainable business model innovation, and highlights the research gap in this field. Subsequently, the method section explains the development procedure for the Value Ideation process. This is followed by a results section, where the findings of each research step to develop the Value Ideation process are presented. Finally, the paper concludes by discussing these findings, giving a detailed description of the final workshop version and providing further insights and lessons learned from the project, and implications for practitioners and academics.

2. Literature Synthesis

This section highlights the theoretical background and illustrates the research gap. The theoretical background on which this research is based comprises three areas: the value mapping approach, the concept of design thinking, and business model innovation. This is followed by an explanation of the research gap and the resulting need for the presented project, respectively its outcome.

2.1 Value mapping

A key leverage point for companies to transform their business model is the value proposition (Osterwalder *et al.*, 2014). It ideally solves problems and satisfies needs of customers in traditional and stakeholders in sustainable business models. It is at the core of every business model and can be hard to imitate, resulting in a high potential for sustainable competitive advantage for organisations (Osterwalder *et al.*, 2010).

The value mapping tool by Short *et al.* (2012) and Bocken *et al.* (2013) shown in Figure 2, assists both start-ups and incumbent organisations in formulating or adapting their value proposition to incorporate economic, social, and ecological value. This tool was selected as the starting point for this research because of its demonstrated uses in practitioner and educational contexts for sustainable business model innovation (Bocken *et al.*, 2013, 2015). The value mapping tool addresses both the concepts of failed value exchanges (Short *et al.*, 2013) and value co-creation (Prahalad and Ramaswamy, 2004; Porter and Kramer, 2011b).

The value mapping tool provides companies with different stakeholder perspectives and a network-centric rather than firm-centric perspective on value. It facilitates an analysis of the current value proposition; the value being destroyed, wasted, and missed; and new value opportunities for a range of possible units of analysis (see Figure 2). In the circular value mapping tool, pie slices represent stakeholder groups and rings represent different forms of value (e.g., missed, destroyed). The tool is intended to facilitate the creation of sustainable value for firms within their existing business models (Bocken *et al.*, 2013).

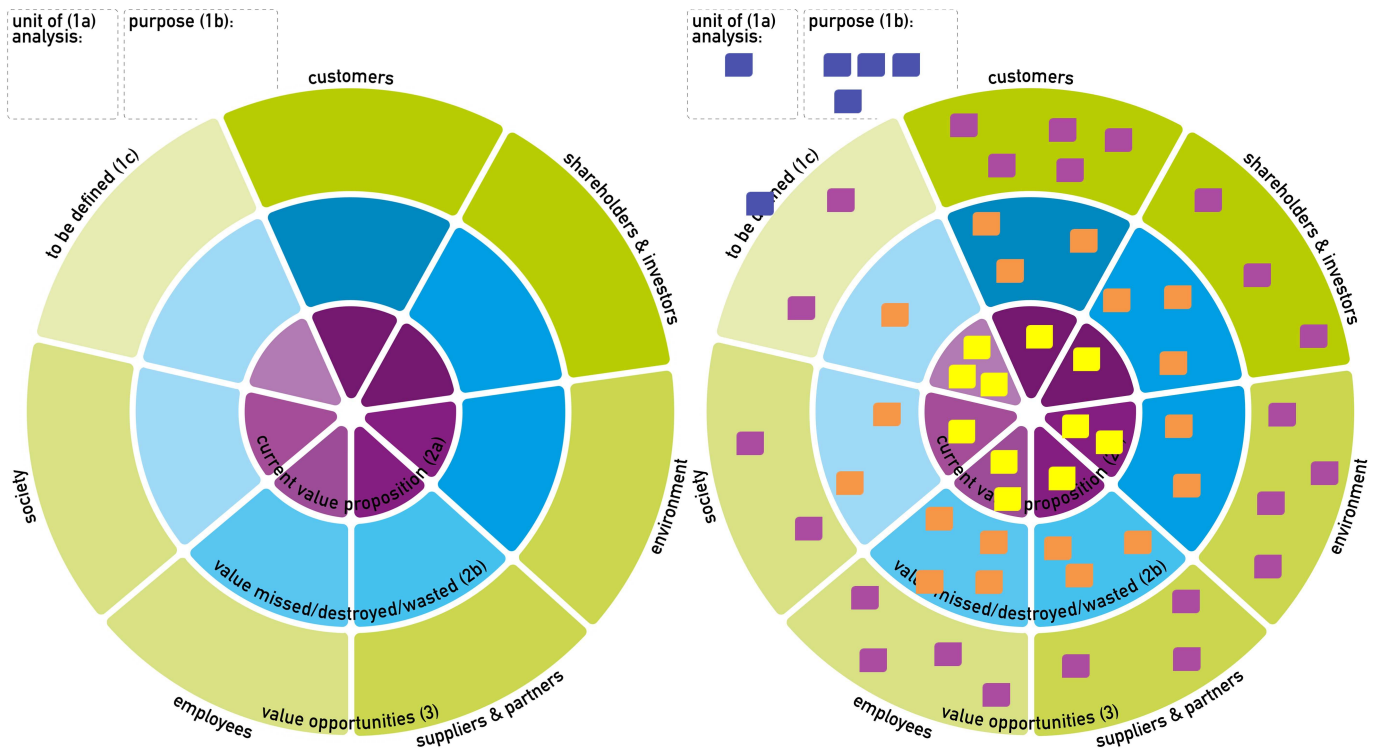


Figure 2: The Value Mapping Tool, unpopulated and populated example (Short et al., 2013; Bocken et al., 2013).

2.2 Design Thinking

Design thinking is a method for developing innovative solutions for complex problems, by deliberately incorporating the concerns, interests, and values of humans into the design process (Brown, 2009; Meinel and Leifer, 2011). Design thinking is deliberately iterative and aims to rapidly develop and test multiple possible solutions to arrive at an optimal one (Brown, 2008; Denning, 2013). The concept originated with the company IDEO, which was founded in 1991 by David Kelley and partner design firms. Kelley further popularised design thinking in academia and design practice by founding the Stanford Design Centre in 2006, and the concept has also gained considerable public attention through successful government projects (Denning, 2013).

Design thinking has five core characteristics: 1) a human-centred approach, 2) a strong integration of experimenting with artefacts, 3) collaboration in multidisciplinary teams, 4) an integrative and holistic view on complex problems, and 5) a characteristic six-step process (Waloszek 2012, Plattner et al. 2009). This generic process consists of 'understand', 'observe', 'define', 'ideate', 'prototype', and 'test' (see Figure 3).

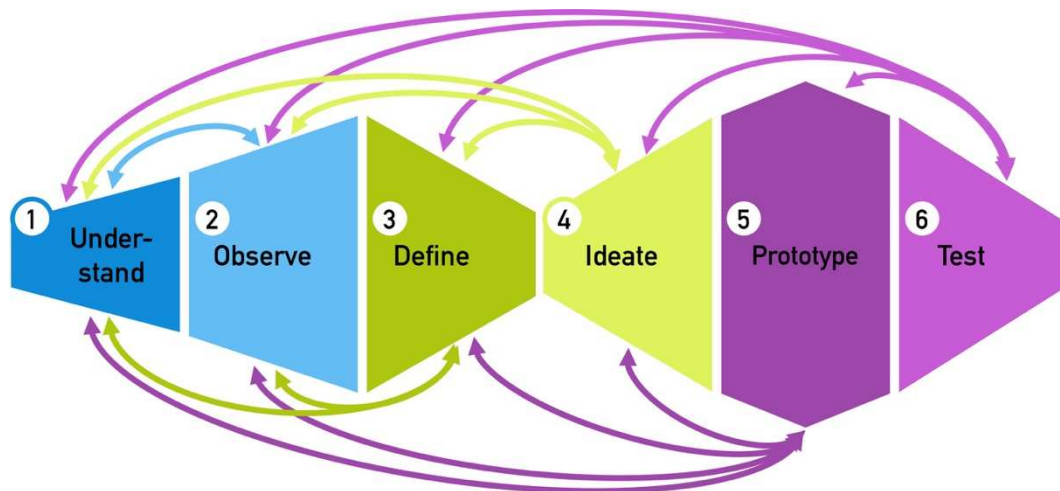


Figure 3: Generic design thinking process (based on Plattner 2009)

Prototyping is concerned with investigating and enriching different solution ideas by repeatedly building and discarding low-resolution and rapid prototypes of early conceptualisations. Various forms and combined elements of prototypes can be used, comprising post-it boards, artefacts, and role-playing activities (Brown, 2009). Design prototypes are tangible artefacts that facilitate thinking, understanding, learning, and communicating concepts and ideas (d.school, 2010). These characteristics of design thinking could be utilised to enhance the sustainable business modelling process by integrating them into the value mapping workshop.

2.3 Business model innovation

Business model innovation describes either a process of transformation from one business model to another within incumbent companies or after mergers and acquisitions, or the creation of entirely new business models in start-ups (e.g. Chesbrough, 2007; Giesen et al., 2007; Johnson, 2010; Labbé and Mazet, 2005; Lee and Shin, 2011; Lindgardt et al., 2009; Mitchell and Coles, 2003, 2004; Osterwalder and Pigneur, 2010; Romero and Molina, 2011; Schallmo, 2013; Skarzynski and Gibson, 2013). This process does not necessarily have to be planned and guided; in fact, organisations can undergo it without even being aware of.

Business model innovation can be an important success factor for companies (Afuah, 2004; Casadesus-Masanell and Ricart, 2010; Chesbrough, 2007; Mitchell and Coles, 2003), and it provides a key leverage point for realising the sustainability ambitions of organisations. *Sustainable* business innovation processes specifically aim at incorporating sustainable value and a pro-active management of a broad range of stakeholders into the business model (Birkin et al. 2009a, b; Bocken et al. 2013; Boons and Lüdeke-Freund, 2013; Iles and Martin, 2013; Roome and Louche, 2016; Stubbs and Cocklin 2008; Schaltegger et al. 2012, 2016).

A wide range of business model innovation or business modelling processes and frameworks exist, for instance, Chesbrough and Rosenbloom (2002); Richardson (2008); Teece (2010); Osterwalder and Pigneur (2010); Zott and Amit (2010). However, sustainable business model innovation approaches,

like the ones by Breuer and Lüdeke-Freund (2014), Joyce *et al.* (2015), Evans *et al.* (2014); Tukker and Tischner (2006); and Upward and Jones (2015), are still rare and focus only on individual phases of the innovation process or specific types of business models such as Product Service Systems (PSS). One exception identified is the work of Evans *et al.* (2014), which provides a first conceptual attempt for a sustainable business model innovation process that covers all phases to implementation.

An approach that aims to integrate sustainability into the value proposition of organisations could facilitate the design of sustainable business models in two ways. First, through the integration into a business modelling process that explicitly addresses sustainability, like the five-step process by Evans *et al.* (2014); and, second, by bringing sustainability considerations into conventional business innovation processes, such as the generic process by Schallmo (2013).

The framework of Evans *et al.* (2014) is presented in Figure 4. This approach was developed to provide guidance for the sequential use of several tools like value mapping (Short *et al.*, 2012; Bocken *et al.* 2013,2015), the business model canvas (Osterwalder and Pigneur 2010), and road-mapping (Phaal 2004, 2007) and can be used as a starting point for planning and conducting a sustainable business model innovation workshop process. Sustainable Value Ideation, as developed in this paper, can be used as a primary tool in the first three steps of the process: setting the scene, value mapping, and idea generation.

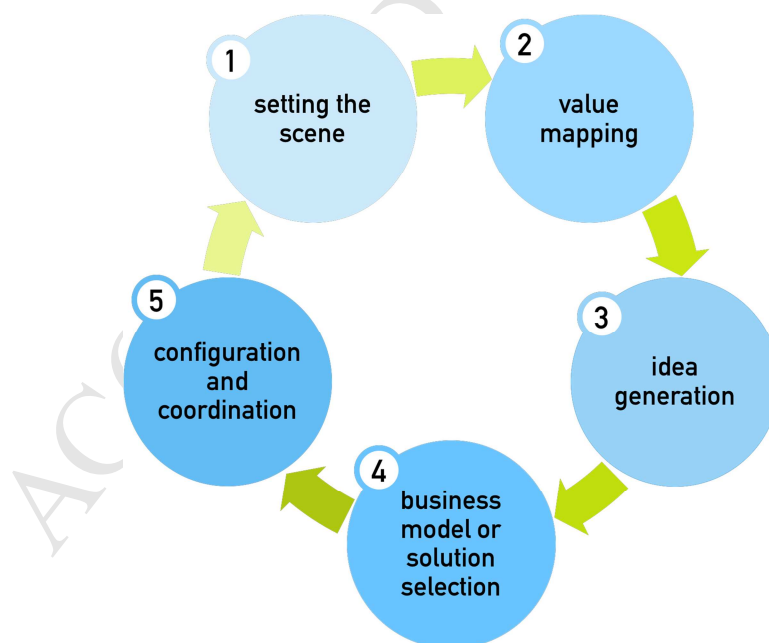


Figure 4: Sustainable business innovation process (Evans *et al.*, 2014)

The generic business model innovation process by Schallmo (2013) is illustrated in Figure 5. This process is based on an extensive review of existing business model innovation processes. As such, it can be viewed as

arguably the most comprehensive generic business model innovation process to date, which is why it was chosen as an example.

The Value Ideation process developed in this paper could replace activities proposed for the first step, ideation, and would thus integrate a multiple stakeholder view and the creation of sustainable value early on into the process, where sustainable considerations are most effectively addressed (Bocken *et al.*, 2014b; Tyl *et al.*, 2015). Adapted in this way, it would be suitable for the design and implementation of sustainable rather than “conventional” business models, resulting, when implemented, in a more sustainable venture.

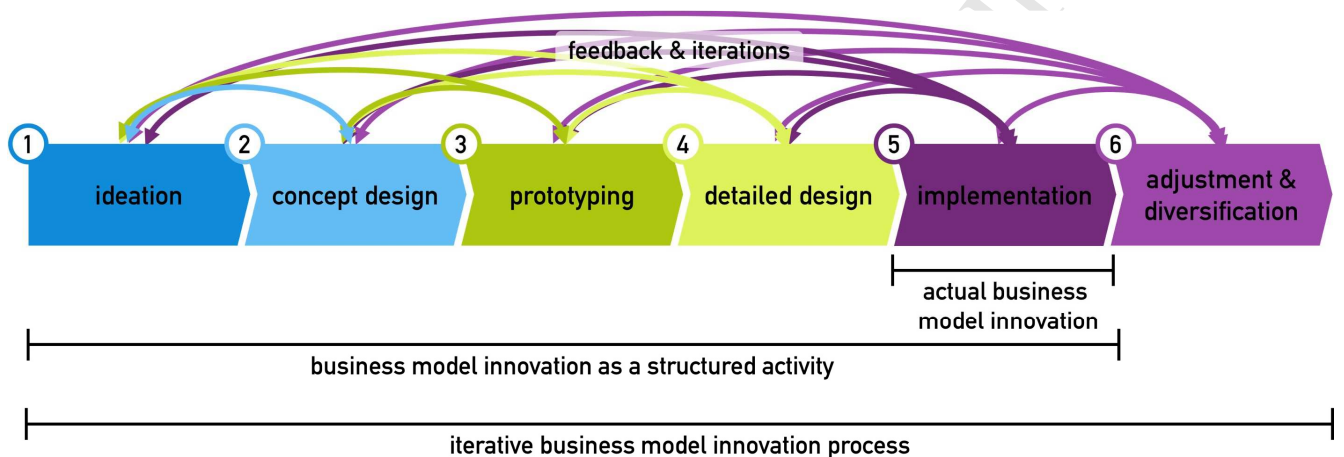


Figure 5: Generic business innovation process, developed from Schallmo (2013)

2.4 Need to combine Sustainable Business Model Innovation with Design Thinking

There is a need for comprehensive but easy to use *sustainable* business modelling frameworks, as current frameworks are complex and require extensive guidance (Bocken *et al.*, 2013; 2015). Design thinking, with its broad and generic applicability, could provide an effective alternative (Brown, 2008). However, in comparison with the existing framework of Evans *et al.* (2014), design thinking as a broad approach is resource-intensive, requires special workspaces and consumes a considerable amount of time, which is especially problematic when multiple stakeholders are involved (Hasso Plattner Institut, 2014).

Nevertheless, design thinking has several qualities that could benefit sustainable business modelling processes. In particular, a potential weakness of the value mapping workshop is the difficulty of communicating ideas and forming a common understanding of the created value propositions in multidisciplinary teams (Tyl *et al.*, 2015), which appears to be a central strength of design thinking (Brown, 2009).

While design thinking is moving beyond its original implementation in new product development and has been successfully applied in an ever-wider spectrum of areas, such as the development of strategies, business models, and organisational structures (Eneberg and Holm, 2015; Leavy, 2012), it has

not yet been successfully applied to corporate sustainability and sustainable business model innovation in the literature.

3. Method

To develop, test and design the Value Ideation process, the stepwise approach illustrated in Figure 6 was applied. Building on the method in Bocken *et al.* (2011), a mix of literature review and practitioner input through interviews and workshops to develop the Value ideation process was combined with rigorous testing and subsequent improvements. This was done by conducting a survey, which was embedded in the existing literature on design thinking and value mapping.

Figure 6 provides an overview of the research methods used in this study, whose sequential application can be structured in four phases: (1) exploration, (2) conceptualisation, (3) identification of gaps and improvements, and (4) the evaluation of the effectiveness and value of the tool, accompanied by a continuous improvement cycle.

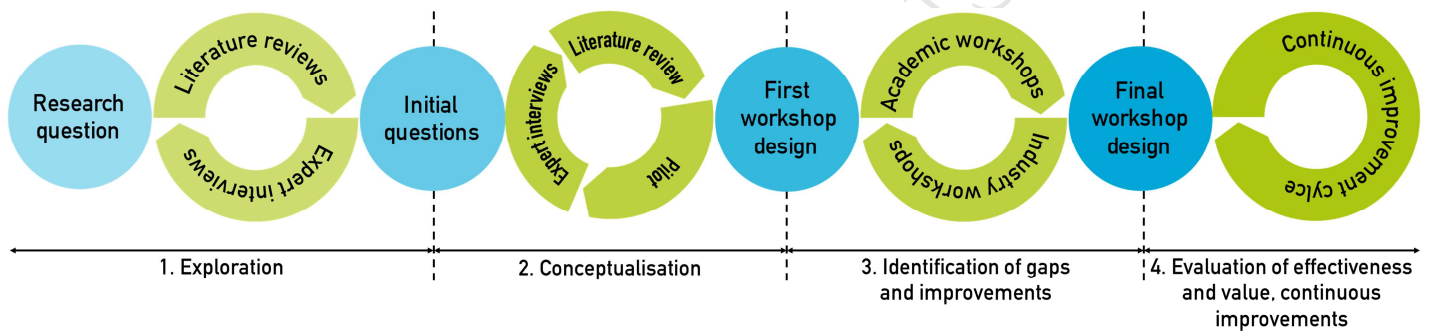


Figure 6: Overview of research methods

This section presents these four steps in chronological order. An introduction of the implemented approaches for each step is followed by an explanation of the respective methods and a description of the sample. Table 1 provides an overview of the different test sessions of phases two to four. It further illustrates which activities were conducted in the different development phases, what tools have been used in these activities, what participants took part in each step, and what the respective inputs and outputs were.

Step number	Step	Activities	Tools	Participant type	Inputs	Outputs
1.	Exploration	Literature reviews Expert interviews	Un- and semi-structured interviews	Academic researchers	Research question	First ideas about the nature, purpose, and configuration of the tool.
2.	Conceptualisation	Literature reviews Expert	Un- and semi-structured interviews	Academic researchers Management	First ideas about the nature, purpose, and configuration of	First workshop design

		interviews A pilot workshop	Discussion	consultants	the tool.	
3.	Identification of gaps and improvements	Academic workshops Industry workshops	Questionnaires based on literature Discussions	Graduate students Company employees	First workshop design	Final workshop design
4.	Evaluation of effectiveness and value, continuous improvements	Academic workshops Industry workshops	Questionnaires based on literature Discussions	Graduate students Company employees	Final workshop design	Workshop design improvements Data of effectiveness and benefits of the workshop

Table 1: Overview of steps, methods, actions, and outputs

3.1 Phase 1: Exploration

The first step was to identify suitable tools for sustainable business modelling and to explore how design thinking could benefit them. The methods employed in this step were an extensive literature synthesis and several rounds of expert interviews building upon each other. The literature synthesis started by screening 125 journal articles on sustainable business models, business model innovation, and design thinking. These literature sources were identified in the Web of Science database by using the search terms 'sustainable business model', 'business model innovation', and 'design thinking' for English-language articles and reviews from 1990 to 2014. Further literature was identified through cross-reference searches and peer and expert feedback.

Parallel to the literature search, the authors conducted informal expert interviews with 11 researchers from the University of Cambridge (UK), the Technical University of Berlin (Germany), and the Delft University of Technology (The Netherlands). The interviewees were experts in strategic management, sustainable manufacturing, design thinking, and sustainable business model innovation. The interviews focused on sustainable business model innovation and design thinking based on the interviewee's field of expertise, and the purpose, configuration, and implementation of a potential sustainable business modelling process. Results from the informal interviews were used to advance, broaden, and further guide the literature review as well as the framework and workshop development process. The process yielded answers to initial questions on the nature, the purpose, and the rough configuration of the developed tool.

3.2 Phase 2: Conceptualisation

The second step focused on designing and piloting a framework, tool, and workshop design for use in subsequent testing. The pilot workshop was designed based on the findings on type, purpose, and configuration of the tool from the previous steps. Pilot testing allowed the authors to identify gaps in the concept and integrate improvements into the next version. Table 2

provides an overview of the date, location, type of participants, number of present individuals, and additional tool and process elements tested in the pilot and the subsequent testing sessions.

Development step	Questionnaire version	Session number	Date	Participating organisation and location of the workshop	Type of participants	Number of workshop participants (not authors)	Additional tool or process elements tested
2. Conceptualisation	No questionnaire was used	Pilot	23/07/2014	University of Cambridge, Cambridge, UK	Researchers	3	Semi-structured pilot
3. Identification of gaps and improvements	1st questionnaire version, see Appendix A	1.	12/08/2014	Technical University of Berlin, Berlin, Germany	Graduate students	28	One group was provided with case study
		2.	30/10/2014	Vietnamese German University, Ho Chi Minh City, Vietnam	Graduate students	23	Groups had conceptualised case companies before the workshop
		3.	24/11/2014 25/11/2014 28/11/2014	Company A Siglufjordur, Iceland	Pharma-ceutical SME	5	Divided in three sessions, Conceptualisation of a sustainable value proposition for the company
4. Evaluation of effectiveness and value, continuous improvements	2nd questionnaire version, see Appendix B	4.	19/03/2015	Technical University of Berlin, Berlin, Germany	Graduate students	11	
		5.	08/05/2015	Company B The Hague, Netherlands	White goods MNC	23	
		6.	24/09/2015	Company C&D; Royal Institute of Technology Kronach, Germany	Consumer electronics SME; design consultancy; academic researchers	5	Ideation for upcoming reorientation of corporate strategy of the OEM
		7.	01/10/2015	Delft University of Technology, Delft, Netherlands	Graduate students	18	
		8.	18/12/2015	University of	Graduate students,	13	

				Hamburg	researchers, sustainability consultancy		
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Table 2: Overview of test workshop settings in phases 2-4 of the development process

The conceptualisation phase was based on three different methods. First, another round of iterative literature reviews and expert interviews was conducted to conceptualise a tool and workshop routine based on the framework drafted in the preceding exploration phase.

The literature review was based on the answers to the initial questions in phase one and input from the expert interviews described below. The authors screened 192 journal articles on tools related to business model innovation. These articles were identified in the Web of Science database by searching English-language articles and reviews from 1990 to 2014 using the search string ‘business model’ AND ‘tool’. In addition, the body of literature identified in the previous steps was screened again for tools, tool elements, and frameworks.

Similar to the first step, the authors conducted several expert interviews with 16 researchers from Delft University of Technology (The Netherlands) and the University of Cambridge (UK) and three consultants affiliated with the latter. The interviews focused on tool development and implementation, and the results fed into the iterative literature review and vice versa. Thus the findings could be complemented, verified, and detailed for implementation.

Based on the results of the literature review and the expert interviews, the authors developed an initial conceptual framework and integrated it into a first workshop design, the “pilot”. This pilot was run with two fellow researchers and one consultant. The conceptual framework and its aims were presented to the participants after a short introduction into sustainable business model innovation. This was followed by an overview of the planned workshop activities, before these activities were conducted by using the value mapping tool as well as office and handicraft materials. Thus, the feasibility and duration of the workshop steps were assessed and gaps in the design were identified by recording the participants’ comments and a subsequent group discussion. All insights were used to improve the workshop and design a working version for subsequent testing under real workshop conditions with an authentic target audience.

3.3 Phase 3: Identification of gaps and improvements

The third step consisted of iterative testing of the developed workshop and implementation of improvements in sessions 1 to 3. First, the workshop and consequently the underlying tool and framework were evaluated for gaps and improvement possibilities. Such improvements were subsequently incorporated. This cycle was repeated until no further major improvement needs could be identified.

The main method employed in this step was testing the concepts by conducting workshops with academic and company participants, facilitated either by the authors themselves or by an instructed colleague. In the

workshops, data were gathered in three different ways: by an assistant, a group feedback session, and participant questionnaires.

First, the workshops were supported by an assistant who interviewed and observed participants and filled out a prepared data sheet with improvement questions identical to the ones in the participant questionnaires. Secondly, questionnaires were handed out to the participants after the workshop, requesting them to evaluate each workshop step on a five-point Likert-type scale ranging from 'very bad' to 'very good' to identify strengths and improvement possibilities. The initial questionnaire version was used in this step (Phase 3). It contained a five-point Likert-type scale and is presented in Appendix A. The feedback forms also sought to elicit concrete improvement proposals for every step and the overall workshop by asking for aspects to start, continue, consider, and stop. Finally, after the participants returned the questionnaires, a feedback session was held where improvement suggestions and other items important to the participants were discussed in the group to obtain additional information on the workshop design.

3.4 Phase 4: Evaluation of effectiveness

In the fourth phase, additional testing was performed to evaluate the effectiveness and benefits of the workshop design, and several smaller improvements were identified and incorporated. To this end, the improved and final version of the questionnaire, shown in Appendix B, was used in this step (Phase 4). It includes a seven-point Likert-type scale to allow for more variation in responses and is based on the expected benefits of both value mapping and design thinking, as stated by Bocken *et al.* (2015; 2013), Evans *et al.* (2014); Brown (2009), d.school (2010), Plattner *et al.* (2009), Short *et al.* (2013) and Waloszek (2012). Due to time constraints on what post-workshop feedback can be reasonably expected from participants, the evaluation focused on the most important items, namely:

- Inclusion of multiple stakeholder perspectives;
- Detection of conflicts between stakeholders;
- Resolution of conflicts between stakeholders;
- Better understanding of the current value proposition within the value network;
- Identification of value currently missed and destroyed within the value network;
- Elimination of negative outcomes for stakeholders; and
- Identification of value proposition opportunities that facilitate developing more sustainable business models.

for the value mapping, and:

- Enriched information content of communication;
- Common understanding between the participants;
- Uncovering of disagreements on aspects important to each individual;
- Additional direct feedback from people outside the group compared to a presentation without prototype;
- Identification of gaps in the ideas;
- Creation of additional ideas; and

- Improvement of the ideas from the value mapping.

for design thinking and prototyping elements.

The first session of this phase (which is comprising sessions number “4” to “8” in Table 1) was held at the Technical University of Berlin; eleven graduate production engineering students of the university participated, and all returned the questionnaires. The fifth session, arranged at a conference venue in The Hague, the Netherlands, involved 23 senior employees of a white goods manufacturing company (“Company A” in the table) who filled in the questionnaire. The participants in the sixth session, held at a company site in Kronach, were two senior employees of a consumer electronics SME, two design consultants, and one researcher of the Royal Institute of Technology, of whom four completed the questionnaire. In the seventh session, 18 graduate students at the Delft University of Technology took part and 17 of them filled in the questionnaire. Finally, the eight and last session was held at the University of Hamburg with five graduate students, six academic researchers, and two sustainability consultants, all of whom completed the questionnaire.

4. Results

This section presents the results for each of the four phases of the development process. It illustrates the evaluation by the participants, the identified gaps, and the suggested improvements and benefits. Table 3 provides an overview of the test session results of phases three and four. The results of the literature reviews, expert interviews, and the pilot workshop are not covered in the table due to their comprehensiveness and qualitative nature.

Development phase	Session number	Type of participants	Number of workshop participants (not authors)	Received feedback forms/response rate	Average evaluation by participants on a five-point scale *calculated from seven-point scale	Number of mutually exclusive improvement proposals made in the questionnaire
3. Identification of gaps and improvements	1.	Graduate students	28	27 / 96%	4	27
	2.	Graduate students	23	22 / 96%	4	13
	3.	Pharmaceutical SME	5	5 / 100%	4	6
4 Evaluation of effectiveness and value, continuous improvements	4.	Graduate students	11	11 / 100%	4*	9

5.	White goods MNC	23	23 / 100%	4*	5
6.	Consumer electronics SME; design consultancy; academic researchers	5	4 / 80%	4*	1
7.	Graduate students	18	17 / 94%	4*	3
8.	Graduate students, researchers, sustainability consultancy	13	13/100%	4*	3

Table 3: Overview of test workshop results

4.1 Exploration

Three pertinent questions that helped in initiating tool development emerged from the initial rounds of literature research and expert interviews:

1) What is the nature of the required tool or framework? The tool focused on sustainable business modelling; hence, a key element to include was the communication of sustainable value propositions to ensure clarity in conceptualising sustainable value propositions.

2) What should the tool be used for? The tool aimed to support better understanding and communication of sustainable value propositions for companies, and potentially academic engineering and management education.

3) How can the tool be used? A workshop process adapted from Evans *et al.* (2014) and Bocken *et al.* (2013) was found to be suitable. After a value mapping process, participants were asked to choose the most important value proposition for their business. This value proposition was prototyped and then presented (e.g. to other student groups, non-participant/senior managers, or the facilitator team).

4.2 Conceptualisation

The literature synthesis and expert interviews resulted in the decision to develop a workshop design that combines the existing approaches of value mapping (Bocken *et al.*, 2013; Evans *et al.*, 2014; Short *et al.*, 2013) and design thinking (Brown, 2009; d.school, 2010; Plattner *et al.*, 2009) in a novel way to assist companies in enhancing their value proposition with regard to the creation of sustainable value for additional stakeholders. The workshop should be suitable for use as a standalone tool for value proposition ideation for sustainability, or to complement a sustainable business modelling process as developed by Evans *et al.* (2014) or a traditional business model innovation process as created by Schallmo (2013).

The resulting workshop design consisted of five steps: three steps of value mapping, a prototyping phase, and an evaluation phase with a presentation and discussion of the results. Value mapping followed the approach by Bocken *et al.* (2013), Evans *et al.* (2014), and Short *et al.* (2013) as a guided value idea brainstorm. Prototyping consisted of the creation of a conceptual prototype of the previously identified value idea elements and their interactions by utilising office and handicraft materials as well as figurines (e.g. little plastic animals or Lego dolls). Analogue to Brown (2009), these prototypes comprise symbols and associated explanations that defined their meaning. The prototype was then presented, discussed, and evaluated either among the participants and the facilitator or externals such as superiors or clients.

The pilot helped to improve the workshop process by generating useful suggestions from the participants and experiences for the authors. This resulted in a number of changes to the workshop's content and process that increased feasibility and outcome quality. The key changes are:

- Clusters of complementary ideas may often be more operational than individual value opportunities on their own; consequently, a selection and combination step was introduced
- The sustainable business model archetypes of Bocken *et al.*'s (2014a) - generic sustainable business model strategies or building blocks that were synthesized by investigating common patterns in sustainability leaders of different industries – were used as examples during the workshop. These could serve as a checklist to see which ones were covered by the ideas generated in the workshop
- The time and resources needed compared to the impact of the generated ideas on achieving the business purpose can serve as a proxy for evaluation of idea clusters
- A documentation step was added at the end of the workshop; a document that prompted the participants to record the scope of the analysis, the most important findings, and a short roadmap for implementation

4.3 Identification of gaps and improvements

The feedback response rate was 98% and the overall workshop was rated 'good' to 'very good', with six 'neutral' ratings from participants and one single 'bad' one. This assessment is consistent with the pilot, and no major gaps in the process were identified.

The number of improvement suggestions decreased from 27 in the first workshop to 13 in the second and 6 in the third (Table 2). These numbers suggest that the quality and effectiveness of the workshop is continuously improving. The implemented suggestions included:

- Case studies helped to stimulate the creativity of student groups by providing more detailed initial examples and rich units of analysis to work with;
- Introduction of an impact-feasibility matrix facilitated prioritisation and selection of value opportunities;

- Utilisation of stakeholder name tags helped discussion; and
- Allocating more time for the last two steps, discussions and documentation, facilitated the selection and recording of relevant results.

These suggestions were mainly procedural and focused on process improvements rather than questioning the viability of the overall approach.

4.4 Evaluation of effectiveness and value; continuous improvements

On a seven-point Likert scale ranging from 'completely disagree' (1) to 'completely agree' (7), nine of the fourteen *benefits* were rated '5' on average and five were rated '6'. Consequently, the participants confirmed all proposed benefits. Figure 7 shows the average evaluation of the proposed benefits in the fifth workshop of all participants.

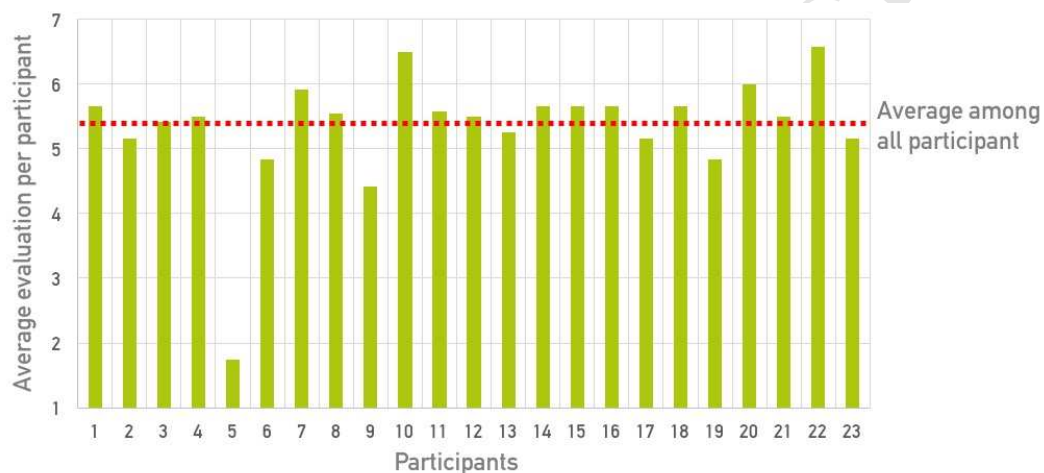


Figure 7: Average evaluation per participant of the fifth workshop

Five of the seven *process steps* were rated '6' on average on a seven-point Likert-type scale from 'very bad' (1) to 'very good' (7) and two were rated '5'. This translates into a '4' for all steps on the five-point scale used in the last step, suggesting that no major gaps remain unaddressed and no significant improvements are needed for any of the steps.

Nine different ideas for improvement were proposed in the first workshop of this phase, four ideas in the second, one in the third, and three in the last one. The key suggestions were:

- More detailed explanation of 'business purpose' in the first step facilitates getting started;
- Prompting people to work on their own rather than in a group during the first three steps of value mapping accelerates the process;
- Allocating more time to step four, the selection and clustering, further clarifies its importance in the process.

5. Discussion and conclusions

The concluding section of this paper summarises the key findings and describes the Value Ideation process with a detailed step-by-step description

of how it can be implemented as a workshop. This is followed by a short illustration of other insights and lessons learned that are potentially relevant for our audience but were not the initial focus of this study. Subsequently, the academic, managerial, and societal contributions and implications of this research are discussed, followed by its limitations and future research directions in the field.

5.1 Key findings

The key research question – how sustainable business modelling could be enhanced by design thinking – was addressed by developing a design thinking-based prototyping phase and integrating it with a value mapping process. As a result, a workshop design could be developed and tested with students and company representatives. This process was found to be useful in addressing the objectives the tool set out to accomplish. Important benefits found by Bocken *et al.* (2013, 2015), Evans *et al.*, 2014, and Short *et al.* (2013) for the value mapping tool and by d.school (2010), Plattner *et al.* (2009), and Waloszek (2012) for the prototyping activities of design thinking could be confirmed by the workshop participants. Thus, as aspired, the new concept helped with issues such as:

- Inclusion of the perspectives of multiple stakeholders and the detection and resolution of conflicts between them;
- Understanding the current value proposition within the value network of the business;
- Identification and elimination of negative and development of positive outcomes for stakeholders;
- Enhanced communication, common understanding, and uncovering of disagreements between the participants;
- Additional direct feedback; and
- Identification of gaps in and creation of additional ideas, and refinement of ideas from the value mapping through prototyping.

While no major gaps in the workshop concept could be identified, a range of smaller improvement possibilities were identified and implemented as a result of the tests.

The positive feedback and the potential saturation in improvement suggestions indicate that further improvements will likely be incremental. Consequently, the tool is assumed to be in a working state. Furthermore, the established benefits suggest that the new concept is at least as good as the sum of its parts (value mapping and design thinking) and, consequently, also more effective than both underlying concepts in isolation.

5.2 The resulting workshop

A workshop design for sustainable Value Ideation, illustrated in Figure 8, was developed and successfully tested.

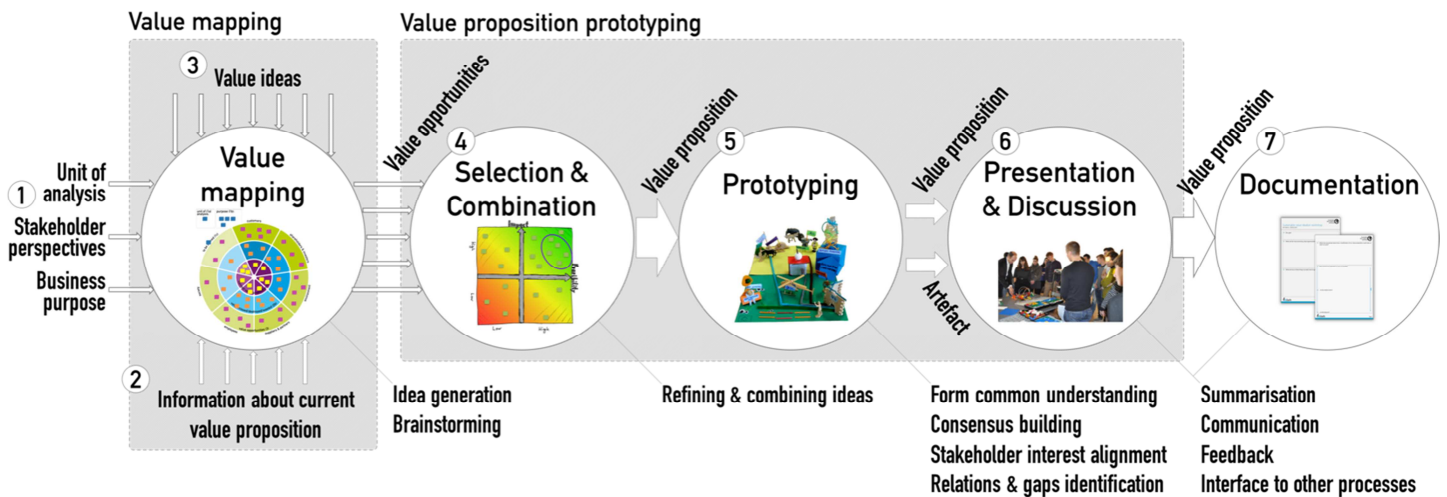


Figure 8: Overview over the Value Ideation process

The process consists of seven steps. After a short introduction to the concepts and background of the workshop, the process starts with three value mapping steps, where (1) the unit of analysis, the investigated stakeholders, and the business purpose are defined, (2) the currently generated, missed, and destroyed value is identified, and (3) new value opportunities are ideated. This is followed by three steps of value proposition prototyping, starting with (4) the selection and combination of value ideas, followed by (5) the building of a conceptual prototype, which is subsequently (6) presented, evaluated, and discussed. The workshop ends with (7) the formulation of an action plan that documents the most important results and forms an interface for subsequent processes.

A step-by-step description of the process is provided in Table 4, with a detailed description of how each step can be implemented in a workshop setting of around three hours. In this setting, four to seven participants form one group, in which each participant represents one or more of the stakeholder groups. It is desirable but not necessary to invite stakeholder representatives – such as environmental NGOs for the environment or unionists for employees – or proxies – like sales people instead of customers, or purchasing staff instead of supplier representatives (see Bocken *et al.*, 2013).




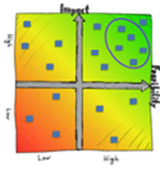



No. Step	Tool	Time	Description
1 Setting the scene		ca. 20 min	After a short introduction into the background and the procedure of the workshop, the workshop begins with using the value mapping tool. The unit of analysis (product, service, business unit, company, industry, etc.) is defined, any missing stakeholders are added or the existing stakeholder groups modified to ensure that the ones relevant for the business are covered, and the business purpose of the unit of analysis is formulated.
2 Mapping of the current value situation		ca. 20 min	The second step is concerned with determining the current value captured as well as the value missed and destroyed by the unit of analysis for each stakeholder group.
3 Ideation for value opportunities		ca. 20 min	This phase aims at eliminating the value destroyed by the business by identifying and solving conflicts between stakeholders, utilising the value currently missed for the business, and searching for opportunities to create entirely new value. This step is usually followed by a 15 min coffee break, which also allows for some buffer for groups lagging behind.
4 Clustering and selection of value opportunities		ca. 30 min	In this step, several value ideas are selected and clustered to value proposition innovations which can complement the current value proposition by discussing how stakeholders' needs can be satisfied and problems be solved most effectively and efficiently (Osterwalder et al. 2010). This can be accomplished by using a simple impact feasibility matrix and additional sticky notes to discuss, combine, and choose value ideas.
5 Prototyping of the selected value proposition		ca. 45 min	In the course of this phase, a conceptual prototype of the extended value proposition chosen in the previous step is build out of office and handicraft materials. It can be complemented by acting and storytelling. The elements of the prototype are usually not self-explanatory but consist of symbols and their explanation.
6 Presentation of the results and feedback		ca. 5 min per group	The sixth step refers to presenting and discussing the prototype to the audience. The elements and their interactions are explained, the business and its purpose are delineated, and major problems for implementation of the value proposition are discussed, before questions of the audience are answered and feedback is provided.
7 Documentation of results for further processing		ca. 20 min	In the last step, the results considered most important by the participants are recorded for further processing. This can be realised by a documentation sheet comprising record of the target outcomes, the identified value opportunities, major challenges for implementation, lessons learned about the potential value proposition innovation, and a short roadmap for implementation.

Table 4: Detailed description of workshop steps

5.3 Other insights and lessons learned

Three other insights are relevant, although they are outside the focus of the present study.

First and arguably most importantly, a generic tool, toolkit, and workshop design process were developed within the project. The four-step process for developing the Value Ideation workshop (see Figure 6) can also be proposed as a generic process for developing workshop-based management tools. In a generic approach, evaluations of effectiveness and value can also be combined with the identification of gaps and improvements, and thus be conducted one phase earlier. The process aimed at balancing effort, rapid applicability, and scientific rigour, and seems suitable for conceptualising a broad range of tool-based workshops in academic and industry contexts.

It is difficult to track what changes will actually happen after such a workshop was conducted. However, anecdotal evidence from informal interviews a couple of months after one of the workshops (number 6 in Table 3) indicated that the senior staff involved in the workshop really engaged with the topic and are now exploring new business models. The workshop setting was thought to bring disparate ideas and groups in the business together and grow interest for new business model ideas. The most important outcome, we were told, is top management buy-in for sustainable solutions and, in this case, ideas of the Circular Economy. This was also confirmed by employees of another case company (Company C in Table 2), whom the workshop helped to catalyse new ideas, communicate them to their superiors, and get the long needed management support for an on-going European research project on resource efficiency.

Last but not least, the workshop appeared to serve as an effective teaching tool. Participants reported that the workshop helped them understand industrial sustainability and its implementation in companies. The workshop was successfully integrated into two graduate modules on industrial sustainability and resource efficiency strategies at Technical University of Berlin and Vietnamese-German University, Ho Chi Minh City and two modules on innovation (executive education) and entrepreneurship at TU Delft in the Netherlands.

5.4 Contributions and Implications

Although design thinking has already been applied to such fields as product innovation and business strategy formulation (Holloway, 2009; Lindberg *et al.*, 2011; Skogstad *et al.*, 2011), the present study was the first attempt to integrate elements of design thinking into sustainable business model innovation.

While a wide range of tools support conventional business model innovation, such as those by Hamel (2000), Johnson (2010), and Osterwalder *et al.* (2010), Bocken *et al.* (2013) revealed a lack of tools that integrate sustainability considerations. This research addresses this concern and adds to the few tools that are currently available, such as those by Bocken *et al.* (2015; 2013), Breuer and Lüdeke-Freund (2014), Joyce *et al.* (2015), and Upward and Jones (2015). It also provides a structured approach to develop tool-based workshop processes (Section 3.4 and Figure 4) and evaluate workshop effectiveness by extracting and assessing key elements of the process, which can serve as a promising avenue to develop future work and tools in this area.

The authors developed a set of novel tools aimed at integration into workshops. The method was successfully used to develop a management workshop based on design thinking, value mapping, and the sustainable business model innovation literature. The concept assists to innovate business' value propositions, refining its quality, or building sustainability into it. In doing so, Value Ideation supports both incumbents' diversification and start-ups' business conception processes.

The authors found that design thinking can stimulate the creative process and helps to harmonise often disparate stakeholder interests. The workshop can support ideation, understanding, and communication of opportunities to enlarge the value proposition of businesses to comprise additional forms of value and include formerly neglected stakeholders. As a result, it can form a valuable step in both conventional and sustainable business innovation processes. It can facilitate the creation of viable and sustainable business models, even for small companies and would-be entrepreneurs.

Consequently, the workshop could contribute to the design of pragmatically improved business models and better integration of sustainability into the value propositions of businesses. By more comprehensively integrating stakeholder interests as well as creating and realising additional forms of value, the method enables a company to make a significant difference in areas as diverse as resource consumption, emissions, or intra- and intergenerational equity, while also realising new opportunities to mitigate risks and utilise opportunities in its environment.

5.5 Limitations and recommendations for further research

Concerning limitations of the research, due to the small sample size, the possibility exists that the participants do not represent the larger population of the concept's target customers. Furthermore, the concept was tested in the field with little control over influences on the participants. Particularly favourable conditions might have led to higher evaluations and fewer improvement suggestions. And, last but not least, the workshop was mainly tested within an educational context as there were only four company workshops.

The workshop is conceptualised as a generic management tool, similar to the tools of the positioning school of strategic management like the BCG matrix (Henderson, 1973) or Porter's five forces (Porter, 2004). As such, it is intended to be independent of industry, size, or maturity of the company. Although the free choice of unit of analysis, business purpose, and stakeholders aims to ensure generic suitability, the tool was only tested with one MNC and three SMEs from the biotech, consumer electronics, and design consultancy industry. Future research may test the workshop with larger groups of company representatives from other industries.

Design thinking was found to be a suitable approach for sustainable business modelling in combination with value mapping. The authors encourage research into the use of design thinking (and other design methods) to further stimulate sustainable business model innovation. The positive experiences of the conceptual prototyping of design thinking also point at its potential benefit

for a broad range of other management tools, toolkits, and workshops. Designers of these processes may investigate if adding prototyping can be a valuable complement to their particular concept.

Finally, the workshop has now entered the continuous improvement phase. Further testing can yield additional improvements and validate the concept in other industries and contexts. Also of interest is the development of additional one-of-a-kind workshops to complement this one. For instance, while the current workshop is suitable for the ideation and creation of value propositions, following the framework of Bocken *et al.*(2014a), the process still lacks the 'value creation and delivery' and 'value capture' building blocks of a business model. Designing future workshops incorporating these building blocks could yield additional improvements to sustainable business innovation processes.

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Appendix A: Phase 3 questionnaire design

(Scale used for Parts 1 and 2: ○very good ○good ○neutral ○bad ○very bad)

1. Overall workshop (steps 1 – 7) process evaluation:

What specific recommendations would you give concerning the:

- Usability and ease of use of the tool?
- Effectiveness of the tool to generate ideas?
- Effectiveness of the tool to capture sustainability/ business model innovation?
- Workshop settings/ process?

Anything else that seems important to you?

2. Value proposition prototyping (steps 4 – 7) process evaluation:

What specific recommendations would you give concerning the:

- Feasibility of refining and combining value ideas after the value mapping?
- Usability and ease of construction of the artefacts/prototypes?
- Effectiveness of the tool to form common understanding?
- Effectiveness of the tool uncover disagreements and build consensus?
- Effectiveness of the tool to identify relationships and gaps in the value opportunities?
- Usefulness of presentation and feedback?
- Anything else that seems important to you?

3. Recommendations/ changes:

What should be started/ stopped/ continued to be done?

Start:

Continue:

Consider:

Stop?

Appendix B: Phase 4 questionnaire design

1. Evaluation of the overall workshop:

(Scale used for part I, I and II a-g):

<i>completely disagree</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<i>completely agree</i>
	1	2	3	4	5	6	7	

I. The value mapping facilitates the following:

- a) Including the perspective of multiple stakeholders
- b) Detecting conflicts between stakeholders
- c) Solving conflicts between stakeholders
- d) Better understanding of the current value proposition within the value network
- e) Identification of value currently missed and destroyed within the value network
- f) Elimination of negative outcomes for stakeholders
- g) Identification of value proposition opportunities that facilitate developing more sustainable business models

II. The prototyping facilitates the following:

- a) Enriched information content of communication
- b) Common understanding between the participants
- c) Uncovering of disagreement on aspects that are important to each individual
- d) Additional direct feedback from people outside the group compared to a presentation without prototype
- e) Identification of gaps in the ideas
- f) Creation of additional ideas
- g) Improvement of the ideas from the value mapping

2. Evaluation of the individual workshop steps:

(Scale used for part 2, a-g):

<i>very bad</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<i>very good</i>
	1	2	3	4	5	6	7	

How would you assess the quality of each of the seven workshop steps?

- a) **First Step: Setting the scene** (Defining unit of analysis, business purpose, and missing stakeholders)

- b) Second step: Mapping of the current value situation** (Determining the current value captured as well as the value missed and destroyed by the business for each stakeholder)
 - c) Third step: Ideation for value opportunities** (Eliminating the value destroyed by the business, utilising the value currently missed and searching for opportunities to create entirely new value)
 - d) Fourth step: Clustering and selection of value opportunities** (Selecting and clustering value ideas to value proposition innovations by discussing how stakeholders' needs can be satisfied and problems be solved most effectively and efficiently)
 - e) Fifth step: Prototyping of the selected value proposition** (Building a conceptual prototype of the extended value proposition chosen in the previous step)
 - f) Sixth step: Presentation of the results and feedback** (Presenting and discussing the prototype)
 - g) Seventh step: Documentation of results for further processing** (Recording of the most important results for further processing)
-

3. Open questions

What should be started, stopped, considered, and continued to be done in the workshop?

Highlights

Few tools to date support sustainable business modelling
Value ideation can support sustainable business modelling
It was developed from value mapping and design thinking
Design thinking stimulates the ideation process
It also helps to harmonise conflicting stakeholder interests

ACCEPTED MANUSCRIPT