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A business model design framework for viability; a business ecosystem approach

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Abstract

Purpose: To facilitate the design of viable business models by proposing a novel business model design framework for viability.

Design: A design science research method is adopted to develop a business model design framework for viability. The business model design framework for viability is demonstrated by using it to design a business model for an energy enterprise. The aforementioned framework is validated in theory by using expert opinion.

Findings: It is difficult to design viable business models because of the changing market conditions, and competing interests of stakeholders in a business ecosystem setting. Although the literature on business models provides guidance on designing viable business models, the languages (business model ontologies) used to design business models largely ignore such guidelines. Therefore, we propose a business model design framework for viability to overcome the identified shortcomings. The theoretical validation of the business model design framework for viability indicates that it is able to successfully bridge the identified shortcomings, and it is able to facilitate the design of viable business models. Moreover, the validation of the framework in practice is currently underway.

Originality / value: Several business model ontologies are used to conceptualise and evaluate business models. However, their rote application will not lead to viable business models, because they largely ignore vital design elements, such as design principles, configuration techniques, business rules, design choices, and assumptions. Therefore, we propose and validate a novel business model design framework for viability that overcomes the aforementioned shortcomings.

Keywords: Business model design, energy business model, business model design framework, viable business model

Article Classification: Research paper

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1. INTRODUCTION

New technologies, and dynamic market conditions are making it possible for entrepreneurs and managers to design novel business models (BMs) (Casadesus-Masanell & Ricart, 2011). A viable BM is fundamental to the success and the long-term survival of an enterprise (Magretta, 2002). However, designing a viable BM is a complex task because enterprises operate in a dynamic and fast-paced environment caused by factors such as deregulation, and changing customer preferences. Additionally, the BMs of enterprises may span several organisations, and they have to cope with competing interests of stakeholders in a business ecosystem setting (Moore, 1993). Hence, this increases the complexity of designing viable BMs.

Academics and practitioners alike still do not agree on a common definition of BMs (Jensen, 2014; Osterwalder, Pigneur, & Tucci, 2005). However, some common ground can be found among them (Zott, Amit, & Massa, 2011). A BM describes how business is carried out (Magretta, 2002). It describes the stakeholders, their roles, and the value proposition for each of them (Timmers, 1998). It also describes the value creation, exchange, and capture logic both from a focal actors perspective as well as from the business ecosystem perspective (Chesbrough, Vanhaverbeke, & West, 2006; Osterwalder & Pigneur, 2002). In addition, it defines the business architecture in terms of the building blocks (e.g. value creation activities) that enables the value creation, exchange, and capture logic (Al-Debei & Avison, 2010). Chesbrough et al. (2006) argue that a BM is viable when all the stakeholders participating in it are able to capture sufficient value such that they are motivated to be part of it. For a BM to be viable it also has to be technologically viable (Kraussl, 2011). A BM is technologically viable when an acceptable technological solution enables the provision of the envisioned service. In conclusion, a BM is viable when it is viable in terms of value and technology.

Much has been written about the definition of BMs and their basic building blocks (Fielt, 2014). However, little attention is paid to the design of viable BMs. Most of the literature on the topic originates from the business model ontology domain. Business model ontologies (BMOs) are languages used to conceptualise and communicate BMs. The focus of research here is on defining building blocks of a BM, BMOs, and evaluation criteria. However, the rote application of BMOs will not lead to viable BMs (D'Souza, Beest, Huitema, Wortmann, & Velthuijsen, 2014). Several authors have used BMOs to suggested business model patterns, for example the long tail (Osterwalder & Pigneur, 2010; Tapscott, Ticoll, & Lowy, 2000; Weill & Vitale, 2001). The idea behind identifying business model patterns is to create descriptions of viable business models that are readily implementable for exploiting products/services. However, at best these business model patterns are best practice guides or standardised business models that have to be customised to the individual needs of the organisations. The business model patterns are not directly implementable because organisations have different needs based on different factors, for example industry type, environmental condition (e.g., regulation), customer segments, etc. Additionally, the implementation of pre-defined business model patterns cannot guarantee the viability of the organisations implementing them. The BM literature proposes design elements necessary for a viable BM, such as design principles, configuration techniques, business rules, design choices, and assumptions. (Bouwman, De Vos, & Haaker, 2008; Gordijn, 2002; Timmers, 1998; Weill & Vitale, 2001). However, BMOs largely ignore these design elements because the ontology is usually built on objects (e.g. customers), and not on rules, choices or assumptions. Though some of the abovementioned elements have been used alongside some BMOs, it has been in an inconsistent and fragmented manner. Thus, it is difficult to design viable BMs without the consistent application of the aforementioned design elements. A typical example of a design element is the assumption made about the projected sales of a service. Any change to this assumption directly affects the viability of a BM. Hence, there is a need for a comprehensive business model design framework for viability (BMDFV) that integrates the design elements with BMOs to facilitate the design of viable BMs. Hence, the objective of this paper is to develop a BMDFV to facilitate the design of viable BMs. In order to design the BMDFV, we make use of the design science research methodology (DSRM) framework proposed by Peffers, Tuunanen,

Rothenberger, and Chatterjee (2007).
The research design section shows how the research is structured, and how the BMDFV is developed and validated. The related work section presents a literature review, and highlights the existing problems related to the design of viable BMs. In addition, it defines the scope for improvement, and motivates the need for a BMDFV. The methodology section elaborates on the methods used in this paper. The business model design framework for viability section presents and explains the newly developed framework. The case study that follows demonstrates and validates the framework by applying it to design a viable BM for an enterprise operating in the energy sector. Finally, the paper concludes with a reflection on the BMDFV and a conclusion section.

2. RESEARCH DESIGN

Figure 1 presents the research design. Firstly, we have developed the BMDFV using the design science research framework. We then demonstrate and validate the BMDFV by using it to design a BM. Finally, experts evaluate the designed BM for viability.

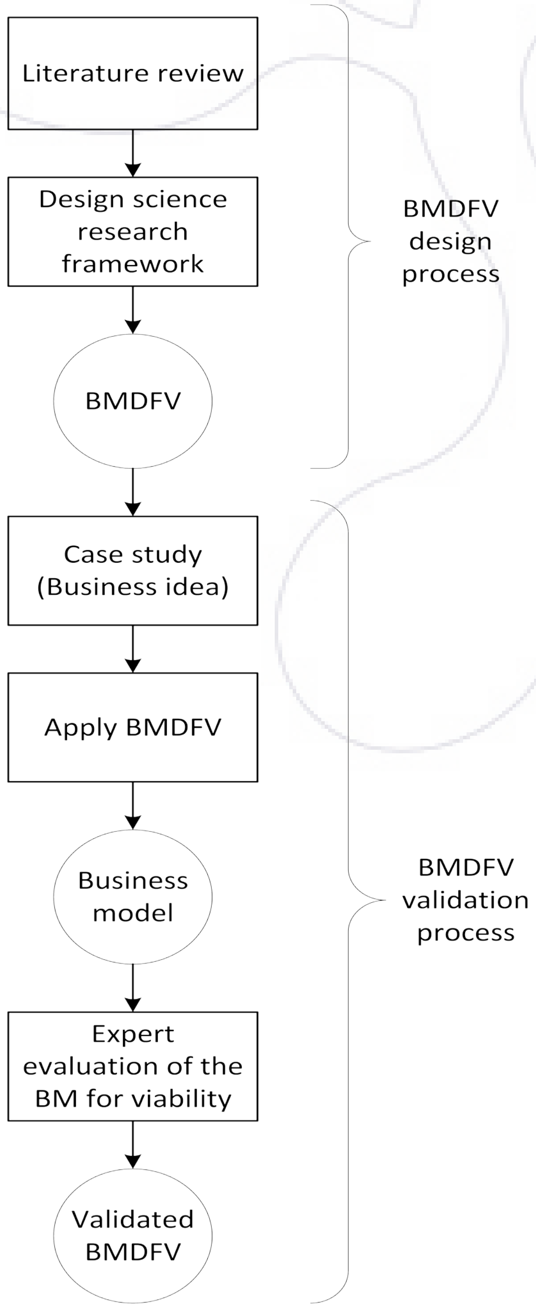


Figure 1 Research design

3. RELATED WORK

This section reviews the literature related to viable BM design, and motivates the need for a BMDFV.

Business model ontologies : There are several informal and semiformal BMOs that can be used to design BMs such as, Service, Technology, Organisation, and Finance (STOF) (Bouwman *et al.*, 2008; Bouwman & Ham, 2003), Value proposition, Interface, Service platform, Organizing model, and Revenue/cost (VISOR) (El Sawy & Pereira, 2013), Customer, Service, Organisation, Finance, and Technology (CSOFT) (M. Heikkilä, 2010), BMC (Osterwalder & Pigneur, 2010), Value Network Analysis (VNA) (Allee, 2000), and e3-value (Gordijn & Akkermans, 2003) D'Souza *et al.* (2014) reviewed several well-established BMOs from the viability perspective, and found that none of them fully support the design of viable BMs. The BMs lack important viability criteria, such as the ability to conceptualise business models from both the single enterprise perspective as well as the business ecosystem perspective. However, for a viable BM design it is important to combine the single enterprise perspective (focal actor) and the business ecosystem perspective (D'Souza, van Beest, Huitema, Wortmann, & Velthuijsen, 2015). This means that the designer may need to use different BMOs to design BMs from the two perspectives. Therefore, the BMDFV should allow a designer to design the BM from more than one perspective.

Building blocks: BMOs are made up of building blocks such as value proposition (Fielt, 2014). Scholars still do not agree on a common set of building blocks. A trend that can be observed among researchers is that they choose the building blocks based on the aspects they want to highlight and analyse. If there are no BMOs that include the desired building blocks, they define new building blocks and corresponding BMOs that best serves their needs. Hence, the BMDFV should allow the designers to define/choose the building blocks and the BMOs that best suit their needs.

In the context of building blocks, scholars agree that new services and products are an indispensable part of a viable BM; especially services, since they are an growing part of our economy. For a viable BM it is crucial that the BM designer has a clear idea of the service concept, because the consumer is ultimately paying the enterprise for the service (Bouwman et al., 2008; J. Heikkilä, Tyrväinen, & Heikkilä, 2010). In many cases, a service has to be designed before a BM is designed. Despite its importance few researchers have paid explicit attention to service design in the context of BM design (Bouwman *et al.*, 2008).

Design choices : Scholars argue that it is not the rote application of BMOs that leads to a viable BM, but it is the choices a designer makes that leads to a viable BM (Bouwman *et al.*, 2008). There are several frameworks that help designers make choices and evaluate the viability of the BM using a set of success factors (Ballon, 2007; Bouwman et al., 2008; Sharma & Gutiérrez, 2010). However, it is not clear how these design choices lead to a viable business model. It is important to understand how design choices affect the BM in a transparent and traceable manner for a reliable way to design viable BMs (Kraussl, 2011). Hence, the BMDFV should systematically store design choices, motivation behind the design choices, and how they affect the BM.

Design principles: Several scholars have proposed BM design principles (Al-Debei & Avison, 2010; Bouwman *et al.*, 2008). These design principles are essential for a viable BM as they guide the designer in making choices that will lead to a viable BM design. However, these principles are fragmented in the literature. Hence, they need to be consolidated for a reliable way to design viable BMs.

Business rules: Demil and Lecocq (2010) have demonstrated that the external environment puts requirements on the BM that could either lead to a viable or an unviable BMs, such as laws and regulations. Similarly, there could also be internal requirements put on the BM, such as technological limitations, and safety (Eriksson & Penker, 2000). An effective way of handling these requirements is by making them explicit and internalising them in the form of business rules. A business rule is a statement that defines conditions and policies that govern a BM (D'Souza *et al.*, 2014). Therefore, the BMDFV should encompass business rules.

Configuration techniques: Some researchers propose BM configuration techniques to explore the viability of BMs. These techniques are activities that a designer can perform on a BM to arrive at a viable BM. These techniques are important for designing viable BMs because designers often arrive at an unviable BM. These techniques enable the designer to explore alternate configurations of a BM. So far, surprisingly little attention has been paid to these techniques. Our literature review revealed two techniques namely, deconstruction and reconstruction, and combination of atomic BMs(Timmers, 1998; Weill & Vitale, 2001). Hence, the proposed BMDFV should incorporate these configuration techniques.

Assumptions: We interpret the term BM as a simplified model of the complex reality of how business is, or will be carried out (Baden-Fuller & Morgan, 2010; Jensen, 2014). Inherent to models are assumptions (Fowkes & Mahony, 1994) on which the viability of a BM hinges. The literature thus far has ignored assumptions in the context of BM design. Therefore, it is essential that the intended BMDFV explicitly considers assumptions.

Evaluation criteria: The evaluation of the BM depends on the goal of the evaluation. Three main goals for evaluating BMs can be identified in the BM literature namely: comparison with competitor's BMs, evaluating alternate BMs for implementation by the same firm, and evaluating innovative BMs for viability. Since our goal is to facilitate the design of viable BMs, the proposed BMDFV should focus on evaluating the designed BM for viability.

As demonstrated above the literature on design of viable BMs is fragmented, and it ignores important elements necessary for a viable BM design. This has greatly hampered the design of viable BMs. Therefore, there is a need for an artefact that bridges the abovementioned gap.

4. METHODOLOGY

Our goal is to develop a BMDFV (an artefact). Therefore, we frame this research as a design science research problem. We adopt the design science research methodology (DSRM) framework proposed by Peffers et al. (2007). The criticism of DSRM framework stems from the debate on the similarities, differences, and synergies that exist between the design science research domain and the action research domain (Peffers *et al.*, 2007; Sein, Henfridsson, Purao, Rossi, & Lindgren, 2011).

DSRM has been criticised for focusing too much on the design of artefacts and its proof of usefulness in a stage gate manner and ignoring the emergent nature of the artefact (Sein *et al.*, 2011). Some argue that designing an artefact is only the beginning of finding an effective solution to a given problem in an organisational context. An effective artefact emerges over a period of time in interaction with organisational elements, such as end users, use context, users expectations etc., and the subsequent iterations of identifying problem/scope for improvement and motivation, defining objectives of the solution, design and development, demonstration, evaluation, and communication (Ferlie, Fitzgerald, Wood, & Hawkins, 2005; Sein *et al.*, 2011).
However, in context of this research where the goal is to develop an artefact that will facilitate the design of viable business models that is to develop an artefact that addresses a class of problems we find DSRM to be an appropriate method. We do acknowledge the emergent nature of the developed artefact (BMDFV), but it is beyond the scope of this paper. By emergent nature of the BMDFV, we mean exposing the framework to sustained business model design activity, and the subsequent iteration of identifying problem/scope for improvement and motivation, defining objectives of the solution, design and development, demonstration, evaluation, and communication. The DSRM framework consists of six iterative steps, namely identifying problem/scope for improvement and motivation, defining the objective of the solution, designing and developing the artefact, demonstrating the artefact, evaluating the artefact, and communicating the artefact.

The problem/scope for improvement and motivation, and the objective of the solution are defined in the introduction and the related work section. We carried out a literature review, to define the scope for improvement and to define the objective of the solution. The newly designed artefact is presented in the business model design framework for viability section. Furthermore, the BMDFV is demonstrated using a case study. A case study method is appropriate to demonstrate the BMDFV (artefact) (Hevner, March, Park, & Ram, 2004). In order to evaluate the designed artefact (i.e., the BMDFV), the results of applying the BMDFV should be compared with the objective (Peffers et al., 2007). Since our objective is to design viable BMs, the BM designed using the BMDFV is evaluated for viability. A well-established method to evaluate BMs for viability is via expert opinion (Bouwman *et al.*, 2008). Finally, the designed artefact is communicated through this paper.

For the case study, we have selected an enterprise that has plans to develop a community driven solar farm. In order to carry out the case study, we interviewed ten experts, and potential stakeholders in the BM. We used semi-structured questionnaires for the interviews. The interviews lasted approximately between 45 minutes – 1.30 hours. The interviews were transcribed and the data was used to design the viable BMs using the BMDFV. As a part of the data collection process, a workshop was organised to develop the service concept. The workshop lasted for three hours and had seven participants. Three of the participants were academics, and four participants were experts in the field of energy and ICT.

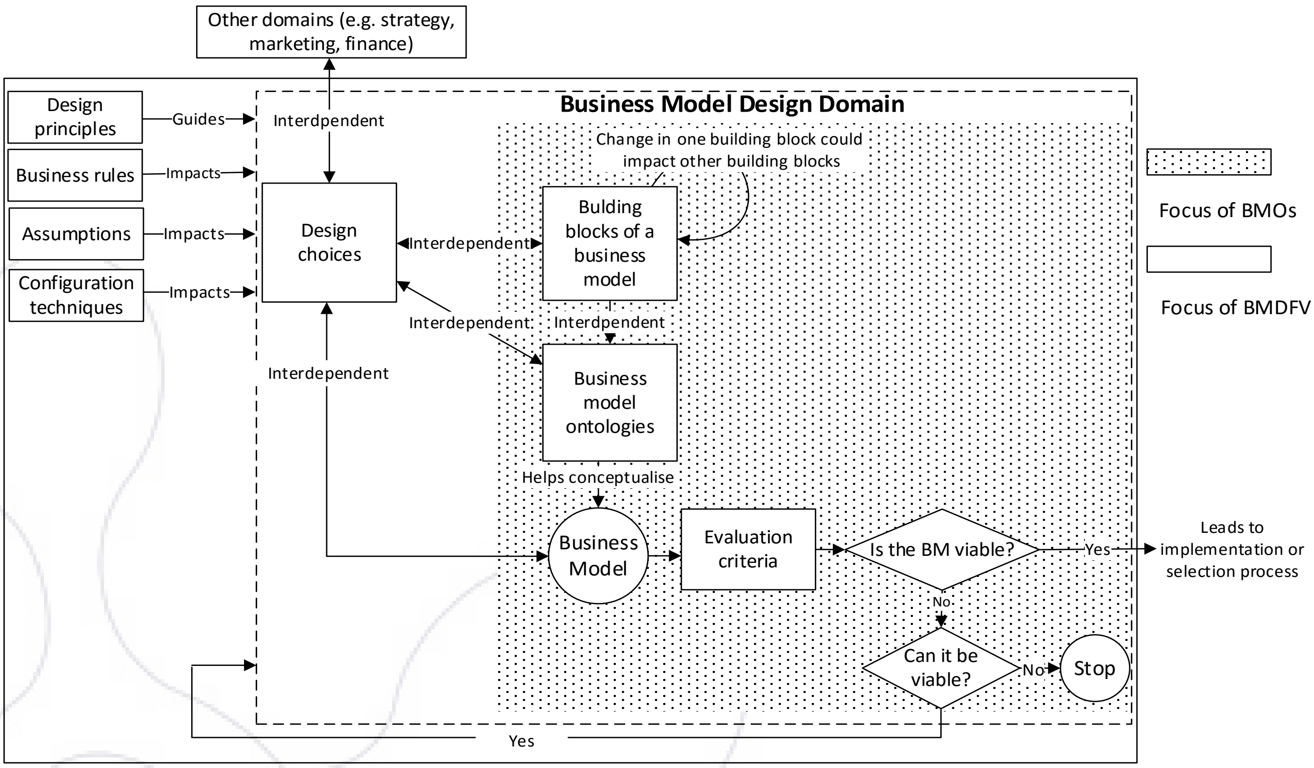
In addition, two researchers also attended a meeting that was organised by the energy enterprise for a group of community members to disseminate information about the solar farm. The researchers were also given access to four important internal documents that described the business idea, and the expected cost structure. Secondary sources of information were used for data triangulation for example, the website of the energy enterprise, and reports related to solar farm published by other research institutions.

5. THE BUSINESS MODEL DESIGN FRAMEWORK FOR VIABILITY

Figure 2 presents the BM design framework. On the left, four elements affect the BM design domain. The BM design domain is represented by the dotted box. The box named as "Other domains" at the top of the figure indicates the influence other domains, such as marketing, and finance, have on BMs. They affect the BMs via the design decisions that a designer takes and vice versa.

Figure 2 Business model design framework

Business model ontologies are languages used to conceptualise BMs. They are useful tools for designing and evaluating viable BMs. To design a viable BMs it is vital to conceptualise BMs both from the focal actors perspective and the business ecosystem perspective



(D'Souza *et al.*, 2014). It is crucial that the focal actor is viable because they play a pivotal role in forming and sustaining the business ecosystem (Fielt, 2014). In the context of this paper, we use BMC to conceptualise the BM of the focal actor (See Figure 6). For the sake of simplicity, the BMs of all the stakeholders are not conceptualised in detail. However, their value capture, roles, value creation activities, and value exchange relationships are conceptualised at the ecosystem level. In order to conceptualise the BM at an ecosystem level we adopt the e3-value BMO (See Figure 7).

Building blocks are the constituent elements of a BM (Al-Debei & Avison, 2010). In addition, design choices and assumptions are made at the level of the building blocks. Further, the building blocks are systemic in nature. This implies that they affect each other, for example the value proposition affects the type of technologies employed which in turn affects the cost structure of the BM.

Table 1 Building blocks of a BM

Building blocks	**Description**	**Source**
Stakeholders	Stakeholders are entities who participate in the BM, for example customer segment (e.g., prosumers), suppliers, and governmental institutions.	(Gordijn & Akkermans, 2003)
Roles	A role is a part that a stakeholder plays in the BM, with certain characteristics and behavioural patterns. Furthermore, these roles are not rigid structures, but they can be defined and redefined based on the value that has to be created, exchanged, and delivered.	(Al-Debei & Avison, 2010)
Value proposition	Value proposition is a set of benefits offered to the stakeholders in the BM. We adopt a multifaceted approach to value proposition. This means that there has to be a clear value proposition for all the stakeholders participating in the BM.	Timmers, 1998)
Technology architecture	The technology architecture describes how the different technological elements fit together to support the BM. The technology architecture is divided in two layers namely the information services layer, and the physical technologies layer	D'Souza et al., 2014)
Service concept	A service concept is the conceptualisation of the intended service. It should describe what is to be done for the end consumer, and how it is to be done.	Bouwman et al., 2008)
Value creation activity	A value creation activity is an activity performed in a system of value creation activities by an actor that creates value for themselves as well as for other stakeholders involved in the BM.	(Osterwalder & Pigneur, 2010)
Value exchange	Value exchange takes place between two actors participating in the BM. Objects of value are exchanged via these relationships, for example money, and services.	(Gordijn & Akkermans, 2003)
Resources	Resources are all the products and services subsumed in the value creation activities. From an ecosystem perspective, it becomes time consuming to account for all the resources subsumed by all the stakeholders in the business ecosystem. Therefore, we focus on the resources directly subsumed by the value creation activities.	Osterwalder & Pigneur, 2010)
Channels	Channels are the medium employed to communicate and deliver value proposition to customers as well as the other stakeholders involved in the BM.	(Osterwalder & Pigneur, 2010)

Revenue streams	Revenue streams describe how the BM intends to, or earns cash. Furthermore, it also describes the revenue streams of the participating actors in the context of the BM in question.	(Osterwalder & Pigneur, 2010)
Cost structure	Describes the cost structure of the BM, and how the costs are distributed among various stakeholders in the BM.	(Osterwalder & Pigneur, 2010)
Relationship type	This describes the nature of relationship among the stakeholders involved in the BM. There are different types of relationships that can be established and maintained , for example personal assistance, dedicated personal assistance, automated services, communities, co-creation, and self-service.	(Osterwalder & Pigneur, 2010)
Value captured	This is the total value retained by each player or stakeholder in the BM	(Gordijn & Akkermans, 2003)

The BMOs conceptualise BMs with the help of these building blocks. Table 1 presents a set of thirteen building blocks that we have defined based on literature (see Table 1). See Appendix A for a description of relationship among the building blocks.

Design choices are the choices made about the design of a BM. These choices affect all the building blocks, and include all the decisions that need to be made in the context of applying the BMOs. Furthermore, it is through this construct that other domain such as strategy, and finance exert their influence on BMs, and vice versa. For example, on the one hand the strategy adopted could influence which customer segment to serve, but on the other hand, the enterprise may have to change its strategy based on the customer segment's needs.

Design principles are rules that guide the designer through the process of designing viable BMs. A BM design should,

- enable each stakeholder to capture enough value such that they are viable (Chesbrough *et al.*, 2006)

- be coherent (Al-Debei & Avison, 2010; Casadesus-Masanell & Ricart, 2011). For example, if the value proposition to the target segment is low cost, then the other building blocks, such as cost structure, customer relationships, resources should also reflect low cost.

- have a clear value proposition in terms of cost efficiency, and or superior value (Amit & Zott, 2001)

- it should incorporate relevant feedback

Business rules are statements that affect the structure and the functioning of a BM (D'Souza *et al.*, 2014; Eriksson & Penker, 2000). Business rules internalise the external requirements put on the BM, for example regulation. They also help ensure that the BM complies with the internal requirements put on the BMs, for example technological limitations. Furthermore, a business rule directly affects the viability of the BM by either constraining or facilitating a BM. For example, a government policy that subsidises solar energy may facilitate new BMs that exploit solar energy. However, if the policy is retracted it could lead to unviable BMs.

Configuration techniques are actions a designer can take to make a BM viable. Following are the configuration techniques we recommend:

- *Deconstruction and reconstruction of BMs:* The value chain should be deconstructed into constituent value creation activities. The value chain should then be reconstructed in novel combinations in a way that it enables viability. This activity usually involves leveraging latest technologies for creating novel combinations (Timmers, 1998).

• *Combination of atomic BMs:* Weill and Vitale (2001) have proposed eight atomic BMs, such as shared infrastructure, and content provider. They argue that a designer should explore combinations of these atomic BMs to arrive at a viable configuration of a BM.

• *Eliminate waste:* Inspired by lean manufacturing we suggest that the designer should eliminate waste in the business model. This can be achieved by eliminating stakeholders who do not add sufficient value and redistributing their roles to other stakeholders in the business model. This may also require defining new roles or redefining existing roles in a way that creates additional value and or minimises value slippage to enable viability. While distributing roles close attention should be paid to the stakeholders capability to perform the assigned roles.

Assumptions are data or information believed to hold (De Kleer, 1986). While designing a BM, a designer makes assumptions that directly affect the viability of the BMs. Hence, this design element makes such assumptions explicit.

Evaluation criteria are a set of criteria that are used to evaluate BMs. To evaluate the viability of a BM we have distilled the following set of criteria based on literature:

• *Viability in terms of value:* A BM is viable when all the stakeholders are able to capture such that they are motivated to be part of the BM (Chesbrough *et al.*, 2006). The easiest way to do this is to assess the profitability of each stakeholder. Furthermore, for stakeholders not interested in profit we assess their value capture qualitatively in terms of benefits realised (D'Souza *et al.*, 2014; Gordijn & Akkermans, 2003). It also involves assessing the sensitivity of the value capture to the business rules and assumptions.

• *Technological viability:* For a BM to be viable it has to be technologically viable (Kraussl, 2011). Therefore, we ask experts to evaluate if the proposed technical architecture is viable.

• *Validity, coherence, and completeness of the business rules and assumptions:* Since the business rules and assumptions directly affect the viability of the BM, they are evaluated on their validity, coherence, and completeness. Evaluating them for validity involves assessing the elements on how realistic they are. Evaluating them for coherence involves checking whether the assumptions and business rules are consistently applied. Evaluating them for completeness is not about listing each and every possible business rule and assumption, but it is about making sure that none of the business rules and assumptions that have an major impact on the viability of the BM are missed. Since BM design is an iterative process, the feedback and the assessment results are used to fine tune the BM.

6. CASE STUDY

Grunneger power (GrgP) is an energy cooperative in the north of the Netherlands. Their goal is to stimulate local production of green energy, stimulate local economy, and to reduce dependence on fossil fuels. Their actions are guided by their core values of local, fair, personal, and green. Their strategy is to offer energy products and services that are not only affordable, but also to create social and environmental benefits, such as reduction of CO_2, and create local jobs.

GrgP wants to provide a service that involves the setup and management of small-scale solar farms for local communities. The solar farm will be setup in close proximity to the communities. They want to make use of unused municipal real estate to setup the solar farms. The people living around these unused parcels of real estate will be approached for investments. They can participate in the solar farm by purchasing one or more solar panels.

Stakeholders: Seven stakeholders and their corresponding roles are identified. Some of these stakeholders have been defined only as roles as multiple actors can take them on. The roles are specified within parenthesis. Following is the list of stakeholders:

• *Investor/Consumer (prosumer):* A prosumer produces goods and services entering their own consumption (Kotler, 1986). GrgP will be targeting prosumers who are innovators/early adopters and environmentally conscious.

• *Municipality of Groningen (local governing body):* The municipality of Groningen is a local governing body. They play an important role in facilitating this BM. They facilitate the BM by providing all the necessary permits, licenses, and in some cases cheap or free access to real estate. For this particular case, they are providing free real estate.

• *Enexis - Distribution system operator (DSO):* The DSO is a key partner who provides the transportation service. They transport electricity from the solar farm to the end consumer.

• *(Energy retailer):* The energy retailer supplies energy to the customer. They buy energy from producers or wholesale markets and retail it to the prosumers. In the context of this BM, they buy energy from the solar farm and retail it back to the prosumers. Furthermore, the subsidising agency uses them to deliver subsidies to the prosumers in the form of reduced energy bills.

• *(Information systems suppliers):* This is a collection of information systems suppliers, such as accounting software, website providers, and CRM providers. Their goal is to make profit. Sourcing via local information systems suppliers will help stimulate the local economy.

• *(Hardware supplier):* Any company that supplies solar farm hardware and provides installation services can fulfil this role. Sourcing from the local suppliers will help stimulate the local economy.

• *(Accounting firm):* This role is assigned to a local accounting firm. They provide services, such as book keeping.

• *(Subsidising agency):* The subsidising agency is a governmental body that provides subsidies based on government policy.

Table 2 BM design elements in the context of stakeholders

Design elements	**Design parameter**	**Motivation /Description**
Design choices	Prosumer	*Description:* The chosen prosumers is environmentally responsible and are early adopters. *Motivation:* The chosen prosumers segment has a need to be sustainable, they are eager to adopt new services especially when it targets sustainability issues, and they are more tolerant towards service failure risks (Rogers, 2003, pp. 248-261). In addition, they provide valuable input to refine the service.
	Suppliers and service providers	*Description:* Local suppliers and service providers are chosen *Motivation:* The choice of local suppliers and service providers aligns with the strategic goals and the value proposition of stimulating the local economy

	Municipality and subsidising agencies	*Description:* The municipality of Groningen, and the subsidising agency (Netherlands enterprise agency) were included in the BM. *Motivation:* The municipality and the subsidising agency were included, because their goals directly align with the goals of GrgP, i.e., sustainability and stimulation of the local economy. In addition, the municipality provides free or very cheap access to real estate. Furthermore, the subsidising agency provides subsidies.
Business rules	(DSO)	*Description:* The role of the DSO is allocated to Enexis, because they own and operate the electricity grid in the area where the solar farm is being planned. Therefore, Enexis is the default DSO.
	Prosumers	*Description:* The policy stipulates that only the prosumers residing in the same postcode area as the solar farm, or residing in one of the immediate neighbouring postcode areas are eligible for subsidy.
Assumptions		No relevant assumptions

Value proposition: Table 3 presents the value proposition for all of the stakeholders participating in the BM. Table 4 presents the design choices and the assumptions made in the context of designing the value propositions for the stakeholders.

Table 3 Value proposition

Stakeholder	**Value proposition**
Prosumer	Sustainable living experience , stimulation of local economy, convenience, reliable, reasonable ROI, positive self-image
GrgP	Profit, green energy, stimulate local economy, and reduce dependence on fossil fuels
Municipality	Reduction of CO2, stimulation of local economy
DSO	Profit, sustainability
Energy supplier	Supply of green energy, reduction of CO2, sourcing local energy, reliable suppliers for green energy, profit
Hardware suppliers	Profit
Information systems provider	Profit
Accounting firm	Profit
Subsidising agency	Reduction of CO2, stimulation of local economy

Table 4 BM design elements in the context of value proposition

Design elements	Design parameter	Motivation /Description
Design choices	Value proposition for the prosumer	*Description:* see Table 3 *Motivation:* The above value propositions were chosen, because they directly align with the prosumers requirements, and with GrgP's goals and strategy. Furthermore, the service is positioned as a sustainable living experience rather than an investment vehicle because the ROI is not very high. The sustainable living experience is about stressing the benefits of decentralised green energy systems. However, this does not imply that the ROI is not an important part of the value proposition.
	Value proposition for other stakeholders	*Description:* see Table 3 *Motivation:* The value proposition for the other stakeholders was based on their goals.
Business rules		No relevant business rules
Assumptions		No relevant assumptions

Service concept: In order to conceptualise the service concept we have used the service blue print technique. The service blue print technique is a well-established technique that is used to outline the most important aspects of the intended service in a clear and concise manner (Stickdorn & Schneider, 2012).

Figure 3 presents the service concept. The service evidence layer shows the tangible evidence (deliverables) that the prosumer expects to see, or experience in a consistent manner, for example reduced energy bills. The prosumers action layer presents a set of actions that the prosumer will have to take to co-create or consume the service, such as participate in the cooperation.

The front stage layer depicts the touch points through which the prosumer will interact with the service for example the prosumers will log on to the website of GrgP for information about the solar farm. The back stage layer depicts all the necessary value creation activities that have to be performed to support the interactions and to deliver the service evidences to the prosumers.

Table 5 BM design elements in the context of service concept

Design elements	**Design parameter**	**Motivation /Description**
Design choices	Value creation activities	*Description:* See Figure 3. *Motivation:* The value creation activities were identified by asking the question Which value creation activities are necessary to create and deliver the intended value proposition?
	Price vs quality	*Description:* See Figure 3 for a list of channels. *Motivation:* Price versus quality was one of the main decision variables that guided our choice of channels and value creation activities
Business rules	-	No relevant business rules
Assumptions	Communicating value proposition to the stakeholders (prosumers and other stakeholders)	An effective way to communicate the benefits to the prosumers and other stakeholders is by providing them relevant reports, for example CO2 emissions avoided, number of jobs created, and self sufficiency

Service evidence (deliverabels)	Information through social media, advertisements, and word of mouth	Information through website, and sales personnel	Purchase online, or via sales personnel, documentation, sales comfirmation/ welcome emails	welcome package, reduced energy bills, reports, participate in management meetings, customer portal, cusmomer support, energy	Social media, newsletters, mobile apps, investment certificates
Prosumor action	Read messages on electronic channels, interact with family and friends	Browse website, talk to sales personnel, decision to buy	Register, pay, receive document	Receive welcome package, co-create (e.g., participate in the cooperation, and online community) benefits, reports, energy	Receive news letter, check app
Line					

Of interaction Frontstage Line	Print media, electronic channels (e.g., social media),sales personnel, word of mouth, events	Print media, electronic channels (e.g., social media),sales personnel, word of mouth, events	Eletronic channels (e.g., website), sales personnel	Eletronic channels (e.g., website, and apps), customer support personnel	Print media, eletronic channels (e.g., customer portal, and apps)
Of visability Back stage (Value creation activities)	• Marketing/ Advertising • IS infrastructure (e.g.,website, and social media apps)	• IS infrastructure • Sales •Marketing/ Advertising	•Sales • Accounting • Customer relationship management • IS infrastructure (e.g., accounting systems)	• Customer relationship management • Solarfarm setup • Solarfarm operation • Partner management • Technologyinfrastructure (IS and physical technology infrastructure) • Marketing • HRM • Accounting • Adminstration •Energy retail • Energy transport	• Marketing/ Advertising • IS infrastructure • Customer relationship management

Figure 3 Service Blueprint

Technology architecture: Figure 4 shows the information services architecture necessary to support the BM. To design the information services architecture, we first designed business processes that are necessary to execute the BMs. This is a necessary logical step in designing the information services architecture (Lankhorst, 2012). However, discussing these business processes is beyond the scope of this paper. Based on these business processes eight information services were conceptualised:

• *Product/service information service* provides potential customers and partners with information about the service, and how to purchase it.

• *Sales/reservation service* facilitates the transaction process that is the process of buying or reserving the product/service.

- *Customer information service* provides customers with timely and relevant information (e.g., reports), and access to the online community. Further, it is also used to store relevant customer relationship management information.

- *Operation support information service* provides GrgP with all relevant information about services of their partners, for example contract expiration date, and status on maintenance orders.

- *Billing information service* helps GrgP generate timely and correct bills that will be sent to the prosumers.

- *Accounting information service* is split in two parts, and they will be owned and operated by GrgP and the accounting firm respectively. The service on GrgPs' end allows for transmitting bookkeeping data to the accounting firm and receiving timely and relevant accounting information. The service on the accounting firms end receives the data and transforms it into relevant information.

- *Metering information service* provides relevant metering information to the DSO and GrgP. The DSO measures the amount of energy delivered to the grid by the solar farm, and the amount of energy consumed by the prosumer. This data is then made available to GrgP.

- E*nd user contract information service* helps GrgP maintain all the different contracts a prosumer has with GrgP. Furthermore, this service helps relay relevant information about new customers signing up for their energy retail services. This is necessary, because the DSO meters the energy usage and relays this information to GrgP. This information is necessary to send out correct and timely bills to GrgP's customers.

Figure 5 shows a high-level physical architecture of the solar farm. Table 6 presents the BM design elements that affect the technology architecture building block.

Table 6 BM design elements in the context of Technology architecture

Design elements	**Design parameter**	**Motivation /Description**
Design choices	PV panels	*Description:* The technology chosen for decentralised production of energy are PV panels *Motivation:* The PV panels can scale as per demand provided there is enough space and connection capacity. Furthermore, they can be easily integrated into the city landscape.
	Grid connected solar farm	*Description:* Grid connected solar farm. *Motivation:* At present, it is cheaper to connect to existing grid rather than lay a private grid or implement energy storage solutions.
Business rules		The DSO is required by the regulator to facilitate production and consumption of green energy.
Assumptions		No relevant assumptions

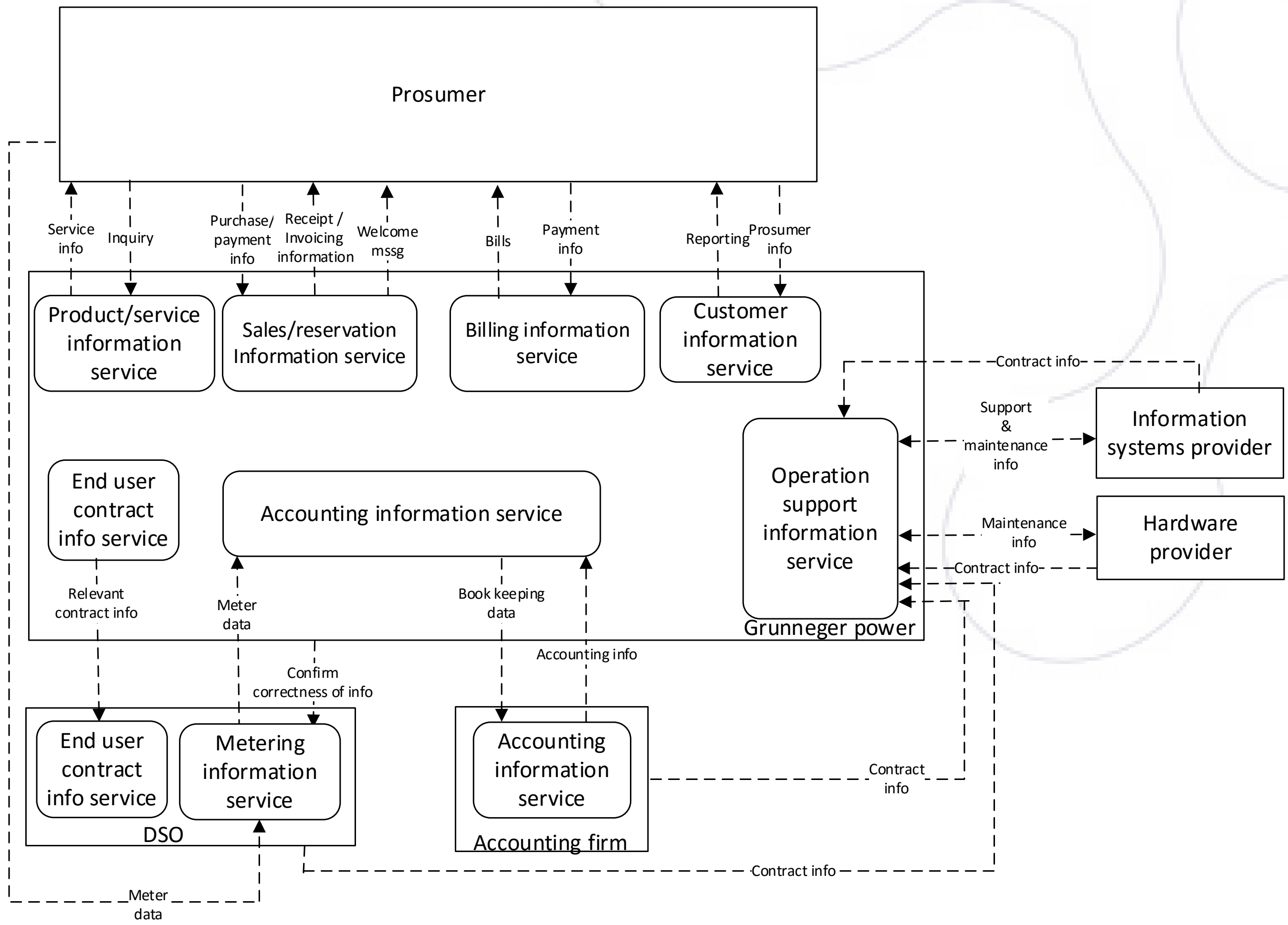


Figure 4 Information service architecture

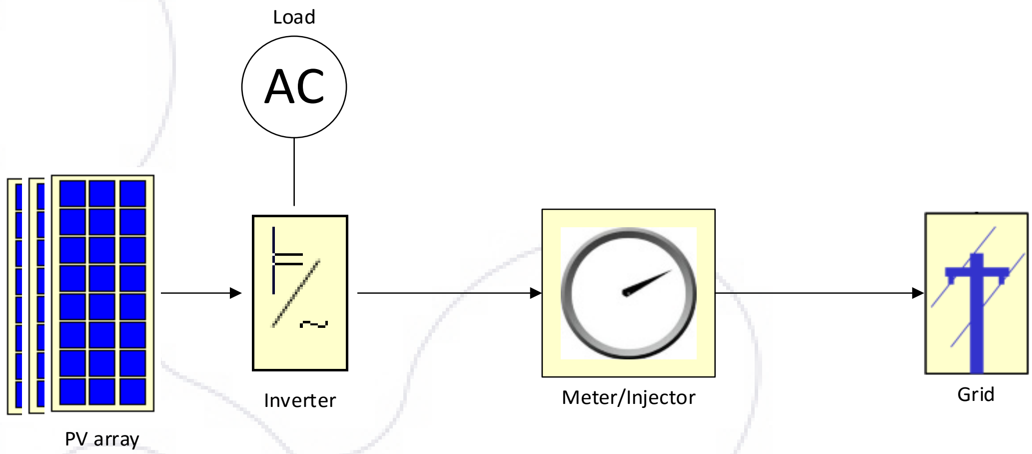


Figure 5 Physical architecture

BM from the focal actor's perspective: Figure 6 depicts the BM from the focal actors' perspective (GrgP). Since the BMC is used to depict the BM it implies that the BM is depicted using nine BM building blocks namely key partners (stakeholder), key activities (value creation activity), value proposition, customer relationship (relationship type), customer segment (stakeholder), key resources (resource), channels, cost structure, and revenue streams. Figure 6 shows that if GrgP implements the BM as depicted it will suffer a loss of 512 euros per annum. The costs, revenue, and profitability of the business model are based on the information available at the time of the research. However, this could change when the business model is being implemented.

Table 7 shows BM design elements in the context of BM from the focal actor's perspective. Since the focal actor is making a loss, the traditional BM design efforts would stop here because the business model is unviable. However, using an ecosystem approach and the configuration techniques there is a chance that GrgP can satisfy its customers' needs profitably. Furthermore, the viability of other stakeholders can also be assessed using a business ecosystem approach.

Therefore, the following section focuses on the business ecosystem perspective of this business model.

Table 7 BM design elements in the context of the focal actor

<table>
<tr>
<td rowspan="2">Key Partners (Stakeholders)
Municipality
Distribution system operator (DSO) – Enexis
Suppliers
- IS suppliers
- Hardware suppliers
Investors/customers (prosumer)
Energy retailer
Netherlands enterprise agency (subsidising agency)</td>
<td>Key Activities (value creation activities)
Marketing/advertising
Sales
Setup solar farm
Operate solar farm
Customer/investor relationship management (CRM)
Partner management</td>
<td rowspan="2">Value Proposition
Sustainable living experience
Stimulation of local economy
Reasonable ROI
Reports
Convenience
Reliable
Positive self image</td>
<td>Customer Relationship (Relationship type)
Communities
Personal
Automated
Co-creation</td>
<td rowspan="2">Customer Segment (Stakeholders)
Customers who are interested in a sustainable lifestyle, and without the possibility of installing solar panels on thier own roof. Furthermore, customers in this segment are also interested in creating social benefits.

Energy retailers who want to buy green energy and retail it.</td>
</tr>
<tr>
<td>Key Resource (resources)
Finance
Knowledge
Human resource
Information systems
Hardware (e.g. solar panels)
Accounting capability
Billing capability
Energy transport capability
Realestate</td>
<td>Channels
Sales personnel
Website
Internet communities
Community resprentatives
Social media</td>
</tr>
</table>

Cost Structure	
Capital expense (CAPEX)	
Investment in solar farm	€37.7773
Operating expense (OPEX)	
Average annual opex	€3.178
Average annual dividend paid to prosumer	€452
Total OPEX	€3.630

Revenue Stream	
Transaction Revenue	
Sale of shares in the solar farm	€37.7773
Recurring revenue	
Average annual revenue through sale of electricity	€1.785
Average operational expenses charged to the prosumer	€1.333
Total recurring revenue	€3.118
Average annual revenue before taxes (revenue -cost)	€-512

Figure 6 BM from Grunneger powers (focal actor's) perspective

BM from the ecosystem perspective: Figure 7 presents the BM that was found to be viable. From Figure 7, it can be observed that the traditional energy retailers are eliminated from the business ecosystem because they are not creating sufficient value. The role of energy retailer is now reallocated to GrgP. This allows GrgP to make approximately 78€ profit per household per annum through energy retailing activity (Eneco, 2014; Essent, 2013; OFGEM, 2014). Therefore, GrgP needs at least seven households to participate in the abovementioned project to cover their operational costs.

Figure 7 and Table 8 shows the profitability of the different stakeholders in the business ecosystem. Furthermore, stakeholders such as the municipality, and subsidising agencies are looking to reduce CO2 emissions and stimulation local economy. They are also able to capture the intended benefits. It is estimated that a total of 151,26 tons of CO2 will be avoided, and 1297 hours of local work will be created at minimum wage. Figure 7 shows that the benefits are divided equally among three stakeholders. This was done in order to avoid double counting or over estimation of these benefits.'

Table 8 Average profit of stakeholders

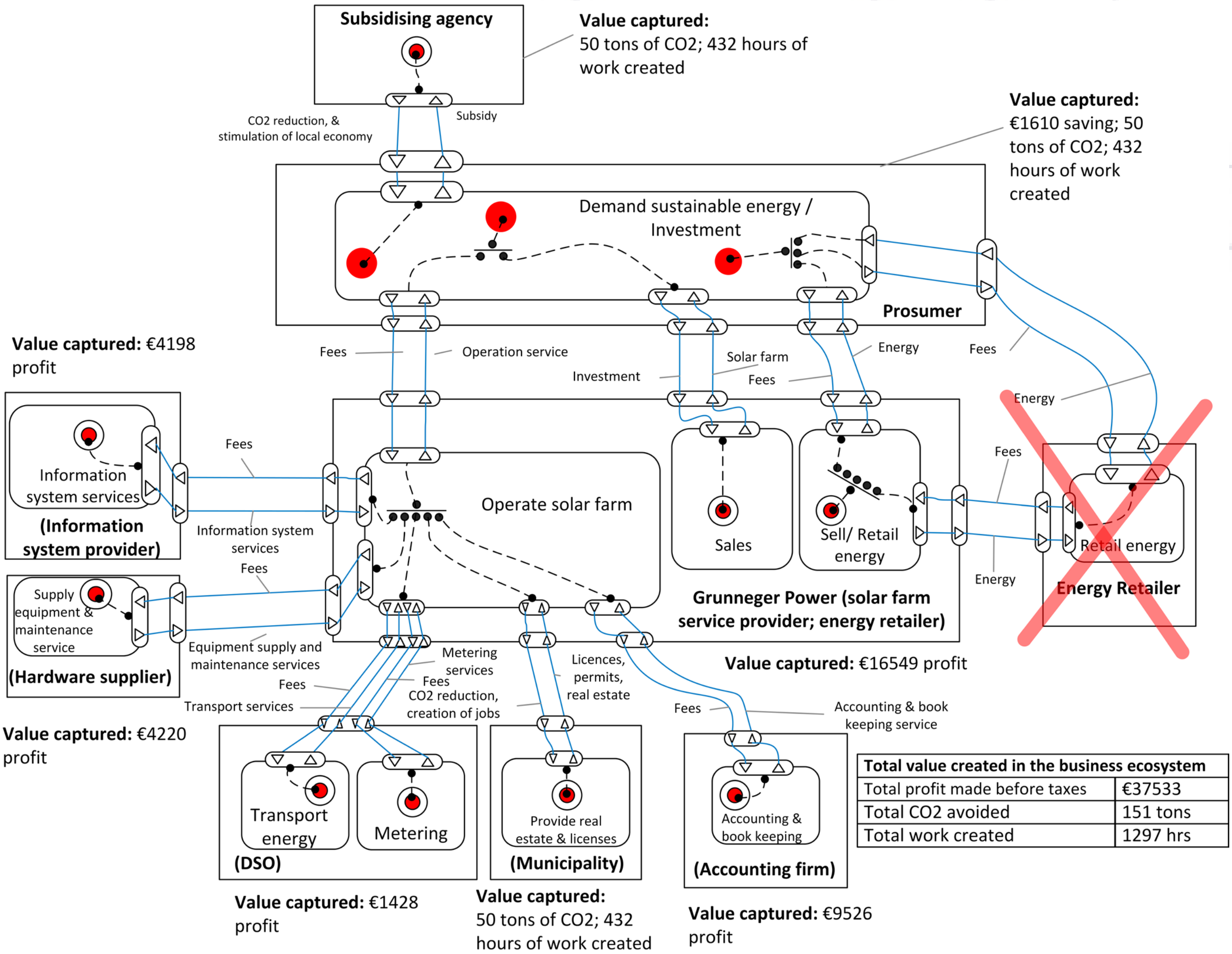
Actor	**EBTDA /cost saving in Euros (20 years)**
GrgP	16549
Prosumer	1610
(DSO)	1428
(Hardware supplier)	4220
(Accounting firm)	9528
Information systems provider	4198

Table 9 BM design elements in the context of business ecosystems

Design elements	**Design parameter**	**Motivation /Description**
Design choices	Elimination of traditional energy retailer	*Description:* The traditional energy retailers are eliminated from the business ecosystem. *Motivation:* They are eliminated because they are not creating sufficient value in the context of this BM.
	Activities to be outsourced by GrgP	*Description:* See Figure 7 for outsourced value creation activities. *Motivation:* Resources, capabilities, cost, and strategy played an important role in deciding which value creation activities should be performed by GrgP, and which ones should be outsourced.

<table>
<tr><td>Business rules</td><td>Allocation of value creation activities</td><td>The value creation activity of electricity transport has to be allocated to a DSO because they own and operate the electricity transport grid.</td></tr>
<tr><td>Assumptions</td><td>Figures</td><td>
<table>
<tr><td>Actor</td><td>Revenue/cost saving €</td><td>Profit margin</td><td>Source</td></tr>
<tr><td>GrgP</td><td>1.311.741</td><td>4.33%</td><td>(GrgP; Eneco 2014; ECN 2012)</td></tr>
<tr><td>DSO</td><td>31.728</td><td>4,5%</td><td>(Enexis 2013)</td></tr>
<tr><td>Accounting firm</td><td>11.910</td><td>80%</td><td>(GrgP)</td></tr>
<tr><td>Hardware supplier</td><td>43.960</td><td>9%</td><td>GrgP)</td></tr>
<tr><td>ICT supplier</td><td>26.235</td><td>16%</td><td>(Guevara, Stegman, & Hall, 2013; Yardeni & Abbott, 2015)</td></tr>
</table>

Annual household energy bill: 1087 € (CBS 2009; ECN 2012; PBL 2013), emission 454gCO2/kWh in the netherlands (IEA, 2012, 2014), annual average electricity produced by the solar farm 33318 kWh, 1297 hours of local work will be created (includes jobs created at GrgP, local suppliers,IT suppliers, and accounting firm), prosumers required rate of return: 1%, number of prosumers households: 30
</td></tr>
</table>



Total value created in the business ecosystem	
Total profit made before taxes	€37533
Total CO2 avoided	151 tons
Total work created	1297 hrs

Figure 7 The solar farm business ecosystem

The BM was presented to four experts and they were asked to evaluate the BM based on the above criteria. They were asked to score the BM on the following scale ++ (very positive), + (positive), +/- (neutral), - (negative), - - (very negative).

Table 10 Expert evaluation of the BM

Evaluation criteria	Expert 1	Expert 2	Expert 3	Expert 4
Viability in terms of value	++	+	+	+
Technological viability	++	++	++	++

Table 11 Expert evaluation of the applied design elements

Evaluation criteria	Expert 1	Expert 2	Expert 3	Expert 4
Validity of assumptions	++	+	+/-	+
Completeness of assumptions	+	+	++	+
Coherence of assumptions	++	++	++	++
Validity of business rules	+	++	++	++
Completeness of business rules	+	+	++	+
Coherence of business rules	++	+	++	++

From Table 10 the experts found the BM to be viable. Table 11 depicts expert evaluation of the application of the BMDFV to design the business model. Expert 3 had doubts about the assumption that GrgP would be able to retail energy at same profit margin as the traditional energy suppliers. The expert had doubts because on the one hand GrgP is a lean start up without the overheads of a large traditional energy retailer; on the other hand, they do not have the economies of scale. The experts were also positive about the completeness, validity, and coherence of the BM. From Figure 7 it can be observed that the application of the configuration technique (eliminate waste) lead to the viable business model design. Furthermore, the design principles were followed closely. From Figure 7 each stakeholder is able to capture the value they are interested in. Further, the coherence of the BM was ensured by applying the design elements in a coherent manner. In addition, the applied design elements were also evaluated for their completeness. Table 3 shows that there is a clear value proposition of each of the stakeholder in terms of superior value and or cost efficiency. Furthermore, the feedback loop of the BMDFV framework facilitated the incorporation of relevant feedback into the design process. Based on the above evaluation it can be said that the BM is viable.

The viability of the BM is highly sensitive to the subsidy. If the government retracted the policy, it would lead to the prosumers becoming inviable. Their viability also depends on the sale price of electricity. Assuming all the other assumptions stay the same and if the wholesale price falls below .043 €/kWh the prosumers will not be viable in terms of value. Further, their viability also depends on the required rate of return; the lower the required rate of return the higher the profitability of the prosumers. The viability of GrgP obviously depends on their cost structure, their profit margins as energy retailer, and on the number of households participating in the solar farm. Furthermore, for simplicity we have assumed fixed profit margins for other stakeholders therefore their viability largely depends on the assumed profit margins and their revenue streams. Furthermore, the technological viability is insensitive to the business rules and assumptions, because the technologies under consideration are fairly stable and mature.

7. REFLECTION

It is very hard to design viable BMs. Part of the reason for this difficulty is because BMOs ignore vital design elements necessary for a viable BM design. To address the abovementioned problems we proposed a BMDFV. We used DSRM do develop the BMDFV. The BMDFV is validated by using it to design a viable BM for an energy enterprise. However, the newly design BM was evaluated for viability using expert opinion, and experts are limited by bounded rationality. We have tried to counter this limitation by relying on several experts and leveraging their experience in the energy domain.

The process of designing the BM using BMDFV was an iterative process. The BM design elements make the designed BM transparent and traceable and easy to tweak with each iteration. Furthermore, considering the focal actors perspective and the business ecosystem perspective was crucial in designing the viable BM. In addition, the configuration techniques played an important role in the design of a viable BM by eliminating stakeholders who were not creating sufficient value in the business ecosystem. Furthermore, the validation process is limited by its theoretical nature.

The premises that influenced the design and application of the framework are, the BM cannot be operationalised without technology (both information services, and physical technologies), and that the BMs span several organisations.

8. CONCLUSION

Viable BMs are vital for the long-term success of enterprises. However, existing literature on the design of viable BMs is fragmented, and it ignores crucial elements necessary for a viable BM, such as business rules. To address this gap, we propose a BMDFV. We adopt a design science research approach to develop the BMDFV. The BMDFV consolidates existing literature, and adds missing elements necessary for designing a viable BM such as business rules. Furthermore, the BMDFV is demonstrated by applying it to design a BM for a community-driven solar farm. The evaluation of the framework is carried out by evaluating the designed BM for viability. The designed BM was evaluated using a number of expert opinions, and it was found to be viable in theory.

Future research should focus on rigorously testing, and evaluating BMDFV in practice. It should also focus on incorporating scenario planning into BM design with the help of BMDFV. Doing so will help enterprises to develop BMs for future scenarios. In addition, it will also help them identify capabilities necessary for implementing BMs for future scenarios.

This information was deleted in line with instructions to ensure blind review. The plan is to submit it if the manuscript is accepted. However, if necessary they can be supplied earlier.

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APPENDIX A

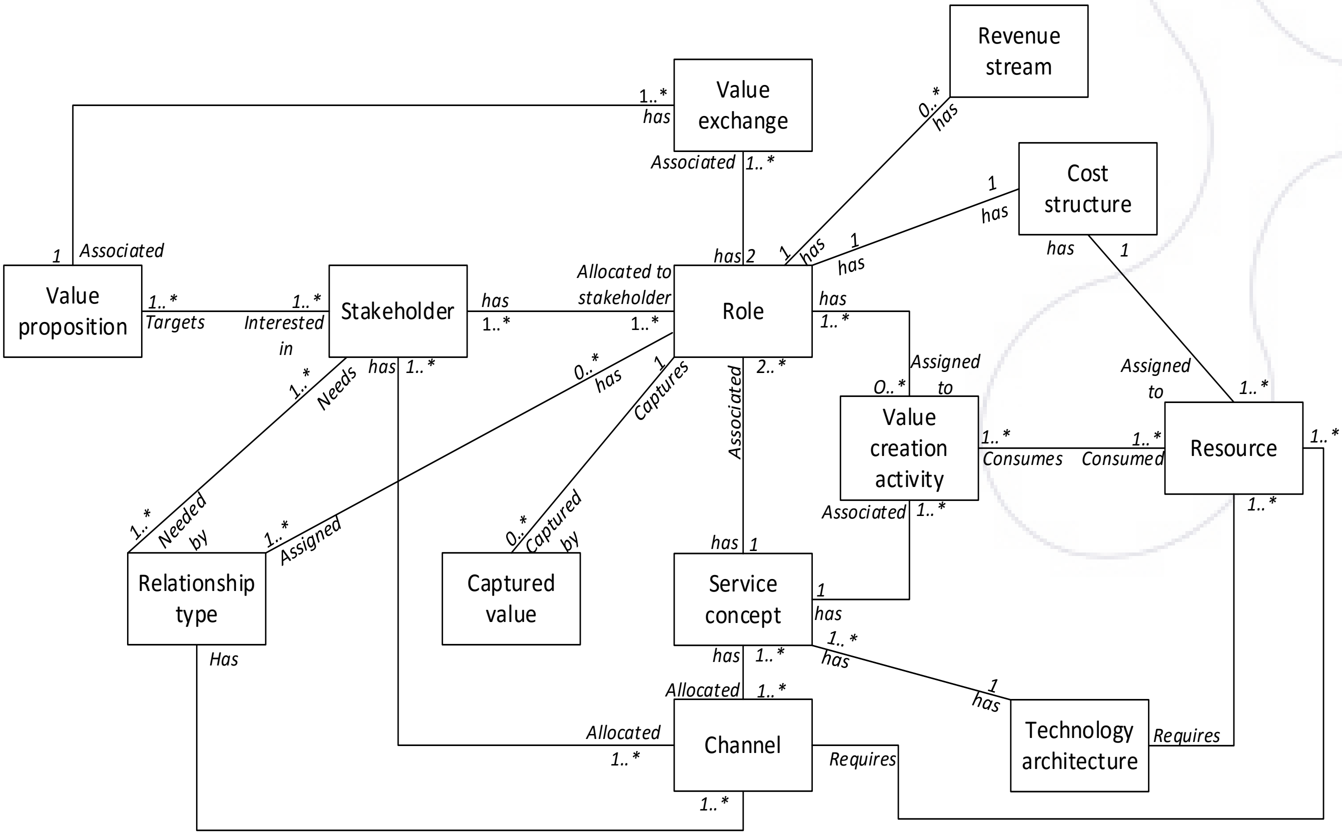

Figure 8 Relationship among the building blocks

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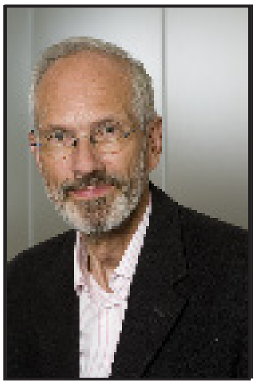

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