Master's Thesis Sustainable Business and Innovation

Towards the construction of a sustainable business model in the oil & gas industry

Ratna W. Timmermans - 3514315
MSc candidate Sustainable Business & Innovation
r.w.timmermans@students.uu.nl
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Universiteit Utrecht

FRAMES
a family of oil & gas solutions

Supervisor Utrecht University:
Dr. Ir. Wina Crijns-Graus
Assistant Professor Energy & Resources
Heidelberglaan 2, Room 10.18
3584 CS Utrecht
w.h.j.graus@uu.nl

Second reader Utrecht University:
Ir. Sjors Witjes
s.witjes@uu.nl

Internship organization:
Frames Group B.V.
Raoul Wallenbergplein 29
2404 ND Alphen aan den Rijn

Supervisor Frames:
Jacco Mooijer
Technology Manager
j.mooijer@frames-group.com
+31 172 464217

Abstract

This research addresses the construction of a sustainable business model in the oil & gas industry. Sustainable business models (SBMs) are conceptual models that express the business logic of a firm and how it proposes, creates, and captures economic, social and environmental value for itself and its stakeholders. SBMs can aid companies in redefining their way of doing business and in embedding sustainability in business practices.

Research has addressed several facets of SBMs, including specific markets and industries, but the oil & gas industry has remained unexplored. In this industry, which is experiencing pressures related to oil price volatility and sustainability, it is becoming evident that new approaches to doing business are needed; for the survival of oil & gas companies as well as for sustainable development. Extending the research area of SBMs to the oil & gas industry could provide insights into the ability of the SBM concept to transform a business' unsustainable practices into more sustainable ones.

This research answered the question '*What sustainable business model can be constructed in the oil & gas industry and how can it be achieved*?', by addressing the case study's current business model (value proposition, value creating & delivery, value capture), how it could be innovated for sustainability, and the barriers to SBMs. A case study was performed at Frames, a Dutch B2B company in the international upstream oil & gas industry. Data was collected through interviews and a sustainable business model workshop with the stakeholder network. The main methods used were the SBM archetypes and value mapping.

It was found that oil & gas BMs entail sustainability aspects related to e.g. efficiency and sufficiency, which could be further enhanced. An SBM could be constructed that includes value directed towards maximizing material and energy efficiency, creating value from waste, renewables, and delivering functionality. Furthermore, it was found that factors such as lack of vision, a conservative oil & gas industry, sustainability unawareness, and supply chain position, could be important barriers for the construction of an SBM in the oil & gas industry.

Finally, this research has shown that the combination of the topics value mapping, the SBM archetypes, and barriers can be used as a starting point for constructing an SBM in the oil & gas industry. Furthermore, it was confirmed that SBM construction should be a continuous process, where a proactive sustainability approach and stakeholder engagement are essential.

Key words

sustainable business models; business models; oil & gas industry; business model innovation; value mapping; value proposition; stakeholder network

Preface

Utrecht, October 2016

This Master's thesis was written for the MSc programme 'Sustainable Business & Innovation' at Utrecht University. As the title '*Towards the Construction of a Sustainable Business Model in the Oil & Gas Industry*' implies, this thesis has shed light on how a sustainable business model (SBM) can be formed in the oil & gas industry. It addresses how oil & gas companies can move from a traditional BM centred around economic value creation, towards a multidimensional SBM that creates economic, environmental, and social value for all stakeholders. To many ears, the terms oil & gas industry and sustainability may seem incompatible, but I am convinced that this industry has an indispensable part to play on the road to sustainable development. Working in the oil & gas industry has given me new perspectives on the sector, and how it, with its exceptional knowledge and enthusiastic people, has great potential for sustainability. It has also allowed me gain new knowledge, and develop my skills by hosting a workshop. Hopefully this thesis will inspire others to take on the topic of SBMs in the oil & gas industry, and transform their businesses so these can contribute to sustainable development.

Ratna Timmermans

Source: Tom Toro (n.d.) New Yorker, available at www.newyorker.com/cartoons/a16995

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List of abbreviations

B2B	Business-to-business
B2C	Business-to-consumer
BM	Business model
Capex	Capital expenditure
SBM	Sustainable business model
SME	Small and medium-sized enterprise
Frames	Frames Group B.V.
FES	Frames Energy Systems
FRES	Frames Renewable Energy Solutions
OGP	Frames Oil & Gas Processing
Opex	Operating expenditure
TCoO	Total cost of ownership
VMT	Value mapping tool

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1. Introduction

1.1. Background

May 2014 marked the beginning of the lowest oil prices since 2009: Brent crude oil prices had dropped from 112$ a barrel to 52$ a barrel at the end of 2014. In 2015 the price of a barrel reached a high of 67$, but had decreased to 31$ a barrel in January 2016 (Nasdaq, 2016). Brent Crude oil prices, which are seen as the benchmark for world oil prices (Wang & Li, 2016), had thus dropped to nearly a quarter of their original value in the course of a year and a half. According to (Baumeister & Kilian, 2016, p. 1) these low oil prices "have put severe economic stress on oil producers around the world, … and have undermined the fiscal stability of countries such as Iran, Russia and Venezuela". For businesses in the oil & gas industry, these current trends in and volatility of the oil price are also proving to be challenging for the continuation of core business.

In addition, factors such as diminishing economical reserves, and climate targets confirm the question whether the oil & gas industry should continue business as usual. Especially the pressure of sustainability-related issues is increasing on the oil & gas industry. The ratification of the COP21 Paris Agreement, that was set up in December 2015 to significantly reduce the impacts of climate change, will induce a wide range of policies and processes that will greatly impact the oil & gas industry (International Energy Agency, 2016; J. Mitchell & Mitchell, 2016).

The oil part of the industry will need to adjust to the increasing impact of the current trends in declining demand. In the longer term, it is expected that adjustment will be even more crucial, when policies become tougher, and alternatives such as cheap electricity, battery technology, and gas in vehicles could gain momentum (J. Mitchell & Mitchell, 2016).

For the gas sector, the authors reason that "companies need to understand that the expected golden age of gas as the cleaner, transitional fuel may not materialize as hoped" (J. Mitchell & Mitchell, 2016, p. 7). Global gas demand has failed to react to steep fall in prices, and is facing challenges on the demand side that are related to structural changes in the power sector. Due to slower generation growth, cheap coal, and deployment of renewables gas's ability to grow faster are constrained. It is even estimated that the long-standing trend in gas usage will be reversed, because it is projected that gas usage in power generation will grow more slowly than total power demand (International Energy Agency, 2016)

All in all, it is becoming clear that, with the pressures of fluctuating oil prices and sustainability it, oil & gas companies need to rethink their way of doing business. This way of doing business can be reflected in a business model, which is, as described by Osterwalder (2004, p. 15) "an abstract conceptual model that represents the business and money earning logic of a company". A business model is also referred to as a model that defines "how the enterprise creates and delivers value to customers, and then converts payments received to profits" (Teece, 2010, p. 173), and a concept that "refers to the logic of the firm, the way it operates and how it creates value for its stakeholders" (Casadesus-Masanell & Ricart, 2010, p. 196).

Business models can and should be subdued to experimentation, especially in difficult times, when revenues and profits are falling and it is becoming clear that the 'old' traditional business model is failing (Chesbrough, 2010). Chesbrough, (2010) provided examples of industries with failing business models. The first one is the music industry, where the dominant form of music distribution through CD sales has been overthrown the past decade, by alternative formats such as iTunes (Chesbrough, 2010) and Spotify. Another business model in crisis is that of the pharmaceutical industry, where increased R&D spending and regulations on new drug development have called for experimentation (Chesbrough,

2010). With volatile oil prices, increased regulations and the call for sustainable development, the oil & gas industry could also be seen as an industry where the traditional business model is failing and in need of innovation.

1.2. Problem description

The background has shown that businesses in the oil & gas industry and their business models call for innovation. However, due to their current negative sustainability impacts, from which the oil & gas BM itself suffers, incorporating sustainability is of vital importance. Schaltegger, Lüdeke-freund, & Hansen (2011) found that, rather than creating a business case for sustainability now and then, sustainable development requires a more fundamental change in and development of the company's business model. Bocken, Short, Rana, & Evans (2013) confirm this, by arguing that the key to radically improving sustainable performance may be in redesigning business models. Innovating business models for the changes sustainability requires, entails re-conceptualising the purpose of the firm, its value creating logic, and reconsidering perceptions of value (Bocken, Short, Rana, & Evans, 2014). Boons et al. (2013) address business models from the perspective of sustainable innovations. They indicate that sufficient theoretical and practical knowledge is currently lacking to move towards sustainable production and consumption systems, but that the concept of business models can help to more effectively shape the sustainable innovations necessary to achieve this movement (Boons et al., 2013).

Business models that are redesigned for sustainability are so-called sustainable business models (SBMs). The importance of SBMs is emphasized by Bocken et al. (2014), as they are drivers of corporate innovation for sustainability, a key driver of competitive advantage, and important for embedding sustainability in business purpose and processes. In contrast to conventional business models that focus on delivering economic value, SBMs take a holistic perspective by combining social, environmental and economic value in business planning (Bocken et al., 2013).

Although the literature on SBMs is evolving, it has not yet dealt with the oil & gas industry. It has addressed the conceptualisation of business model innovation for sustainability (e.g. Boons & Lüdeke-Freund, 2013; Breuer & Lüdeke-Freund, 2014; Lüdeke- Freund, 2010; Stubbs & Cocklin, 2008), SBM innovation tools (e.g. Bocken et al., 2013, 2014; Bocken, Rana, & Short, 2015), renewable energy (e.g. Richter, 2012, 2013a, 2013b; Wüstenhagen & Boehnke, 2006); sufficiency (see Bocken & Short, 2015), electric vehicles (see Bohnsack, Pinkse, & Kolk, 2014), and the furniture and automotive industry (e.g. Høgevold, 2011; Wells, 2006),

The oil & gas industry is currently missing in this SBM literature, but is worth addressing. Due to the inherently unsustainable, fossil fuel core business of the oil & gas industry, it is valuable to study how the research area of SBMs could be applied to the oil & gas industry. Some industries may seem more compatible with sustainability, and therefore perhaps more logical to subdue to SBM research. However, considering the oil & gas industry's power, its large role for worldwide energy security, its necessity for transport fuels (in e.g. the shipping and aviation sector), and its role as an input for the chemical and plastics industry, it will continue to be an essential industry. Therefore, it is important to consider how SBMs can help oil & gas companies to minimize their negative sustainability impacts and contribute to sustainable development.

1.3. Aim & research question

Through the use of SBMs, oil & gas companies could seize the opportunity to create economic, as well as societal and environmental value. This could not only be essential for this industry in rough times, but also for converting the industry's negative impact on sustainable development into a positive one. Since it is unclear however, how the industry could define and deploy such an SBM, this issue will be addressed through the following research question:

'What sustainable business model can be constructed in the oil & gas industry and how can it be achieved?'

To help answer the research question the following sub-questions were formulated:

1. What business models are currently used in the oil & gas industry?
2. How can the business model be innovated for sustainability?
3. What barriers influence SBMs in the oil & gas industry and how can they be overcome?

These sub-questions each contribute to answering part of the research question. The first part of the research question: '*what sustainable business model can be constructed in the oil & gas industry*', focusses on the properties an SBM in the oil & gas industry could possess. To determine this, it is necessary to identify what business models are currently used, which is the focus of sub-question 1: '*what business models are currently used in the oil & gas industry?'*. Next should be determined in what way such an existing business model can be innovated for sustainability, which is the focus of sub-question 2: '*how can the business model be innovated for sustainability?'*. Part 2 of the research question *'and how can it be achieved'* focusses on how this SBM construction can be accomplished. This is also covered by sub-question 2: '*how can the business model be innovated for sustainability?'*, since it focusses on what needs to be done to collect the SBM properties. Finally, it should be looked at what can obstruct the accomplishment of the construction process, which is reflected in sub-question 3: 'what barriers influence SBMs in the oil & gas industry and how can they overcome barriers'. Together these sub-questions will help answer the research question.

1.4. Case study: Frames

For this research a case study was performed using Frames Group B.V. (from here on Frames) as a case. A case study approach was chosen because it allowed for a detailed description of the construction of an SBM, which was necessary since a business model is specific to one company. Having a case allowed for describing the case's specific business model, and including the company's stakeholder network for investigating the sustainable innovation opportunities and the corresponding barriers.

Frames, located in Alphen aan den Rijn, the Netherlands, is a business-to-business company operating in the upstream oil & gas industry. The upstream oil & gas industry concerns the exploration and production of oil & gas; for Frames this concerns being active in the business 'from well to pipeline'. Frames was selected because of its new relationship with sustainability. In contrast to large firms in the oil & gas industry like Shell, ExxonMobil and BP, it has no history of active involvement with sustainability, e.g. issuing energy outlooks and sustainability targets. Therefore, it is a somewhat blank

slate, for creating an SBM and innovating the BM for sustainability. Furthermore, Frames is one of the many small to medium enterprises (SMEs) in the oil & gas industry. Researching the construction of an SBM for an SME like Frames could therefore serve as an example for a large part of the oil & gas industry, possibly benefiting the oil & gas industry's contribution to sustainable development. Frames is divided into five business units and a holding, of which the latter acts as an overarching organization that supports and guides the business units. This research primarily focused on the Frames holding, but included perspectives from representatives of the Frames holding as well as the business units Frames Energy Systems (FES), Frames Renewable Energy Solutions (FRES), and Oil & Gas Processing (OGP).

1.5. Reading guide

The next section of this thesis, chapter 2, will discuss the theory that can help answer the research question. This theory is then combined and presented in the form of a research framework. Chapter 3 addresses the methods, by elaborating on the research design, and the methods for data collection and data analysis. Chapter 4 addresses the findings, by elaborating on each sub-question, and the case study's potential SBM. Chapter 5 is concerned with a discussion of the research, and presents the research's limitations, its theoretical implications, suggestions for further research, its practical implications, and the advice that can be given to the case study Frames. Finally, chapter 6 will provide conclusions to the research, and answer the research question.

2. Theory

This chapter discusses the theoretical concepts related to the research question. First the concept of business model innovation is discussed, followed by business model innovation for sustainability, (including an SBM's sustainability characteristics), and the construction process of an SBM. The latter requires elaboration on stakeholder identification, redefining the value proposition and barriers to SBM innovation.

2.1. Business model innovation

In order to innovate one's business model, it is important to consider what a business model is composed of. Several authors consider different business model elements. Boons & Lüdeke-Freund (2013) distinguish the elements *value proposition, supply chain, customer interface,* and *the financial model* for a generic business model concept. The value proposition describes the value embedded in the offered product or service; the supply chain concerns the management and structure of upstream supplier relationships; customer interface concerns the structure and management of downstream customer relationships; the financial model describes the former elements' costs and benefits, and how these are distributed across the companies' stakeholders.

Bocken et al. (2014) focus more on the concept of value, by addressing the three elements v*alue proposition, value creation & delivery,* and *value capture* (**Error! Reference source not found.**). These components were first described in the business model framework of Richardson (2008). This framework is organized around the concept of value, because value is said to be a recurring theme in discussions about business models as well as strategy. These three major components of the business model framework "reflect the logic of strategic thinking about value" (Richardson, 2008, p. 138). In the framework in figure 1, the *value proposition* describes what value is provided and to whom, *value creation & delivery* addresses how value is provided, and value capture encompasses how to capture value or earn revenues from the goods and services provided (Bocken et al., 2014). This reasoning is also in line with Teece (2010, p. 179), who considers a business model as "the benefit the enterprise will deliver to customers, how it will organize to do so, and how it will capture a portion of the value that it delivers".

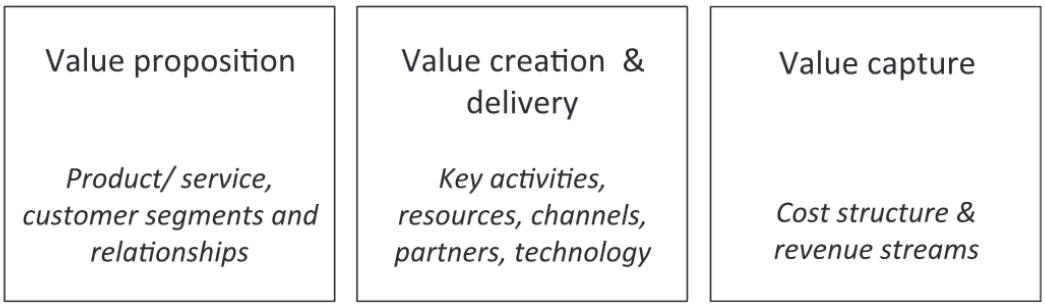


Figure 1: The conceptual business model Framework (Bocken et al., 2014, p. 43)

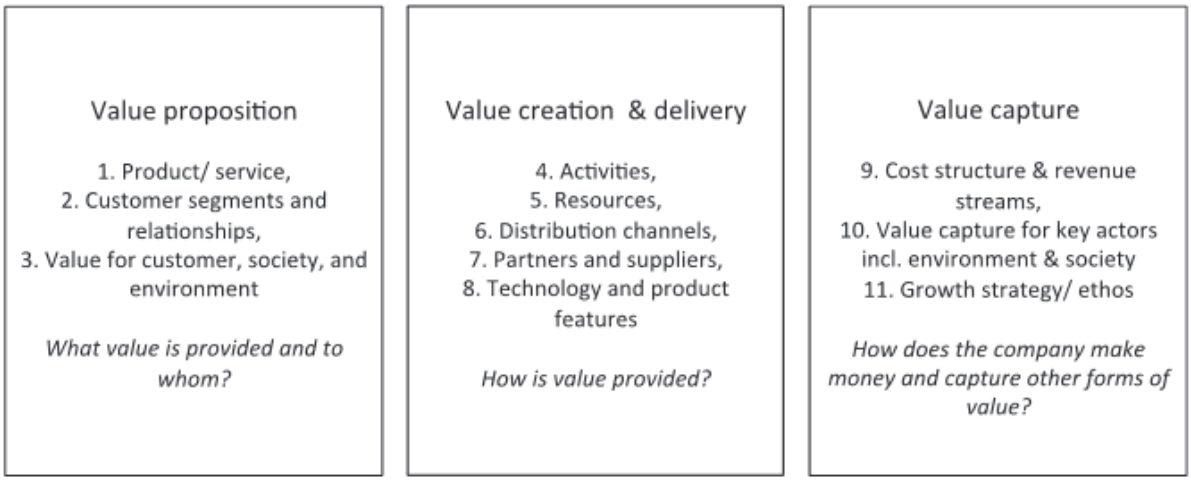
The business model elements in Figure 1 are subdivided into further topics. First, for value proposition these are the business' product or service, and its customer segments and relationships. Second, when determining value creation & delivery one should look at the key activities, resources, channels, partners, and technology. Third, value capture looks at cost structure & revenue streams.

2.2. Business model innovation for sustainability

Companies can innovate their business model in many ways, but this research addresses how innovating the BM for sustainability can take place. This involves an adaptation to the way of doing business, whereby a company provides superior customer value, and creates competitive advantage, while simultaneously contributing positively to the company, society, the environment, and minimizing harm (Bocken et al., 2015). In short this revolves around creating a BM that contributes to sustainable development: a sustainable business model.

The main difference between BMs and SBMs is that the latter not only focusses on delivering economic value, but also on societal and environmental value. This is visualized in the SBM framework in Figure 2 by Bocken et al. (2015), which builds upon the business model framework from Bocken et al. (2014) in **Error! Reference source not found.**. In the value proposition and value capture, value for key actors such as customer, society and environment are explicitly mentioned.

Figure 2: Sustainable business model framework (Bocken et al., 2015, p. 4)



In this research the definition of an SBM by Schaltegger, Hansen, & Lüdeke-Freund (2016) was used. It was chosen since it provides a comprehensive definition of an SBM and clearly links sustainability to the abovementioned business model elements *value proposition, value creation & delivery* and *value capture*. They provide the following definition:

> *"A business model for sustainability helps describing, analyzing, managing, and communicating (i) a company's sustainable value proposition to its customers, and all other stakeholders, (ii) how it creates and delivers this value, (iii) and how it captures economic value while maintaining or regenerating natural, social, and economic capital beyond its organizational boundaries" (Schaltegger et al., 2016, p. 6)*

Purpose

When innovating business models for sustainability and adopting an SBM, companies need to change their approach to doing business, which can be reflected in a purpose. It requires incorporating a triple bottom line approach (i.e. people, planet, profit) and the use of sustainability as a business strategy itself, instead of an add-on to business strategy (Bocken et al., 2014; Stubbs & Cocklin, 2008). Stubbs & Cocklin (2008) illustrate that creating SBMs requires redefining the purpose of business. Their case studies of Interface and Bendigo Bank (considered as more sustainable businesses) reveal that these

companies do not solely have a financial business purpose in terms of profitability and shareholder returns, but embrace a wider set of terms to define their business purpose. Examples are the environmental terms 'cherishing nature and restoring the environment' and the social terms 'maximizing stakeholder satisfaction' and 'improving the prospects of customers and communities' (Stubbs & Cocklin, 2008). For these companies, profits are the outcome of environmentally and socially sustainable activities, and these profits also enable them to facilitate more of these activities. Instead of striving for short-term financial returns they opt for long-term value creation through sustainability initiatives (Stubbs & Cocklin, 2008). It is therefore important to establish what the purpose of oil & gas companies is, so that these can be redefined to facilitate an SBM.

In addition to purpose, goals and ambitions should be considered. These can be reflected in a company's vision. According to Kraaijenhagen, Van Oppen, & Bocken (2016), a clear vision is important for engaging your organisation with the intended change, as it will make it easier to engage colleagues and partners to collaborate. Although purpose, vision, goals and ambitions are much alike, the purpose of a business may be unknown or outdated when the business needs to innovate its BM. It may be a snapshot, whilst goals and ambitions reflect a new and more forward looking purpose, which can help redefine the current business purpose.

2.3. Sustainable business model archetypes

To aid business model innovation for sustainability Bocken et al. (2014) have developed SBM archetypes based on examples found in literature and practice Figure 3. The archetypes are grouped under the type of BM innovation, which can be technological, social or organizational. The examples provided below the eight archetypes, give an indication of how the archetypes unfold in practice, which were derived from a wide range of companies and industries. The definitions of each archetype can be found in appendix 2 (for full explanations see Bocken et al., 2014).

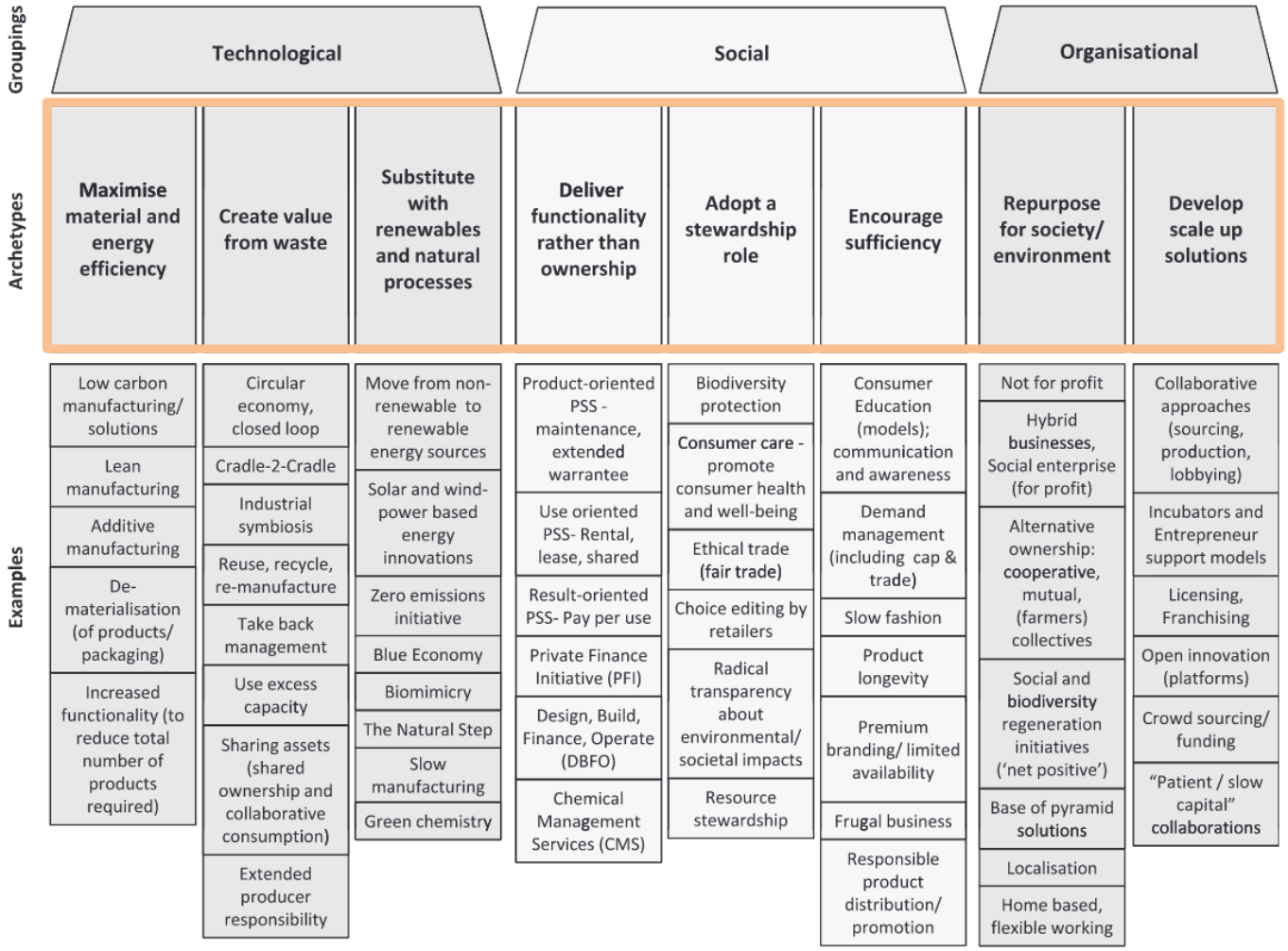


Figure 3: The sustainable business model archetypes and their examples (Bocken et al., 2014, p. 48)

According to Bocken et al. (2014) the archetypes have a fourfold aim:

1. They are a categorization and explanation of possible SBMs;
2. They provide mechanisms to assist embedding sustainability in business models (e.g. through case studies and workshops);
3. They define a clearer research agenda for SBMs;
4. And they provide examples for businesses to de-risk the innovation process towards SBMs

When using the archetypes, the authors stress that companies need to take a value network or systemic perspective. This implies moving the focus away from individual firms and technologies, towards new systems creation and value generation across the value network (Bocken et al., 2014).

How the archetypes apply to the content of the BM elements value proposition, value creation & delivery and value capture has also been elaborated on. An example can be seen in Figure 4, which illustrates the archetype 'create value from waste'.

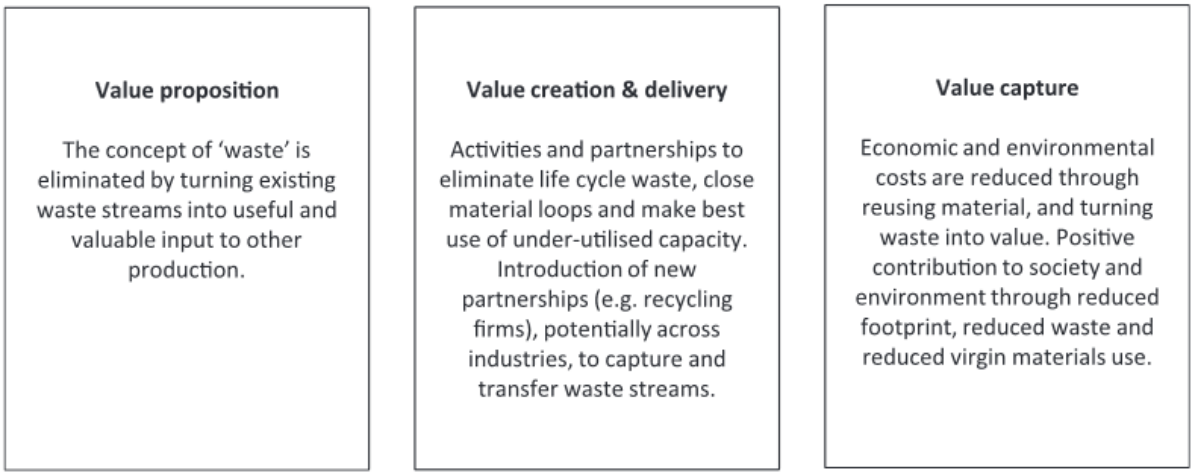


Figure 4: Sustainable business model archetype 'create value from waste' (Bocken et al., 2014, p. 49)

For business in the oil & gas industries, the archetypes and their examples can help identify the current BM's sustainability aspects, and give insights into which elements can be included in the new SBM.

2.4. Sustainable business model construction process

2.4.1. Stakeholder identification

According to Stubbs & Cocklin (2008) engagement and collaboration with stakeholders is a necessary condition of an SBM. Organizations can be considered sustainable organizations when they understand that their success relies on the success of their stakeholders. Rather than adopting the usual shareholder view that prioritizes shareholders' expectations, SBMs require the adoption of a stakeholder view that goes beyond shareholder needs and considers the needs of all stakeholders: from customers, to suppliers, partners, employees, local communities, and nature. Within this wide range of stakeholders, Bocken et al. (2014), stress that the environment and society should be considered as key stakeholders. Due to the current pressures in the oil & gas industry, it is important for oil & gas businesses to understand that their stakeholder view should shift from primarily customers towards other stakeholder groups like environment and society.

Adopting this stakeholder view will require these oil & gas businesses to identify their stakeholders and to gain understanding about their relationship with them. The well-known theory of stakeholder identification by Mitchell, Agle, & Wood (1997) provides insights into this matter. To consider who or what the stakeholders of the firm are, they have developed a normative theory of stakeholder identification. It provides an explanation for why certain classes of entities should be considered as stakeholders by managers. To explain to whom or what managers pay attention, the descriptive theory of stakeholder salience was developed. This explains why certain stakeholders stand out and under which conditions managers consider certain classes of entities as stakeholders (R. K. Mitchell et al., 1997). The authors identified three attributes that stakeholders could possess: *power, urgency* and *legitimacy*. With this theory R. K. Mitchell et al. (1997) stress that groups with legitimate claims should be the stakeholders that really count. By incorporating power and urgency of a claim however, it makes managers aware of entities in the firm's environment that have the intent to impose their will upon the firm. It also provides insight in how claims of power and urgency will affect managers' ability to serve the legal and moral interests of the legitimate stakeholders (R. K. Mitchell et al., 1997).

Driscoll & Starik (2004), have a different perspective on the abovementioned attributes for 'stakeholderness'. They view that the "definitions associated with these three constructs and their corresponding bases are inadequate for incorporating the near and the far, the short- and the long-term, and the actual and the potential." (p. 61). It is argued that the natural environment should be considered 'the primordial and primary stakeholder of all firms'. To incorporate the criterion of eco-sustainability, they have suggested *proximity* as an additional stakeholder attribute. Proximity is defined as "the state, quality, or fact of being near or next" in "space, time, or order" (Driscoll & Starik, 2004, p. 63). Physical proximity exists in the sense of spatial nearness (e.g. border sharing nation states and neighbours) but there is also organizational proximity, which means organizations share identical/similar ideas, approaches and actions. The natural environment possesses the attributes proximity, power, urgency and legitimacy, and should be included as a primary stakeholder that deserves managerial salience (Driscoll & Starik, 2004). This confirms the view of Bocken et al. (2014) that environment should be considered as key stakeholder. Since it can be assumed that society also possesses the attributes proximity, power, urgency and legitimacy, and the state of the environment influences society, Bocken et al.'s (2014) statement that society is a key stakeholder can also be confirmed.

2.4.2. Redefining the value proposition

Having mapped their stakeholders, companies can start the transformation process. Rethinking the value proposition lies at the heart of BM innovation, and in an SBM this requires a value proposition with a holistic view that includes the costs and benefits to all types of stakeholders (Bocken et al., 2013). According to Boons & Lüdeke-Freund (2013), a sustainable value proposition also calls for identifying trade-offs between optimal product/service performance and improved social and environmental effects. It is likely however, that such a balanced fulfilment of customer needs demands enhanced offerings (e.g. product-service systems) which have insecure profits during implementation (Boons & Lüdeke-Freund, 2013).

The value innovation opportunities for a firm and its stakeholders are visible in the conceptual portfolio provided by Bocken et al. (2013) in Figure 5, which distinguishes between three different forms of value. Using the current value proposition as a starting point, it illustrates the occurrence of *missed value* and *destroyed value* during the delivery of a products and services. In the sustainability context value destroyed mostly concerns the damaging environmental and social impacts of business activities (e.g. pollution or child labour). In literature this destroyed value is referred to as 'negative externalities', but Bocken et al. (2013) argue that this terminology could cause firms to artificially distance these impacts from themselves. Missed value occurs in situations where individual stakeholders fail to capitalize on existing capabilities, resources and assets, operate below the industry's best practice, or fail to receive benefits (i.e. they fail to capture value). Thirdly *new value* can arise when *value missed* is captured and *value destroyed* is reduced or eliminated. New value opportunities can help the business to step into new markets and introduce new products and services that are beneficial to all stakeholders (Bocken et al., 2013).

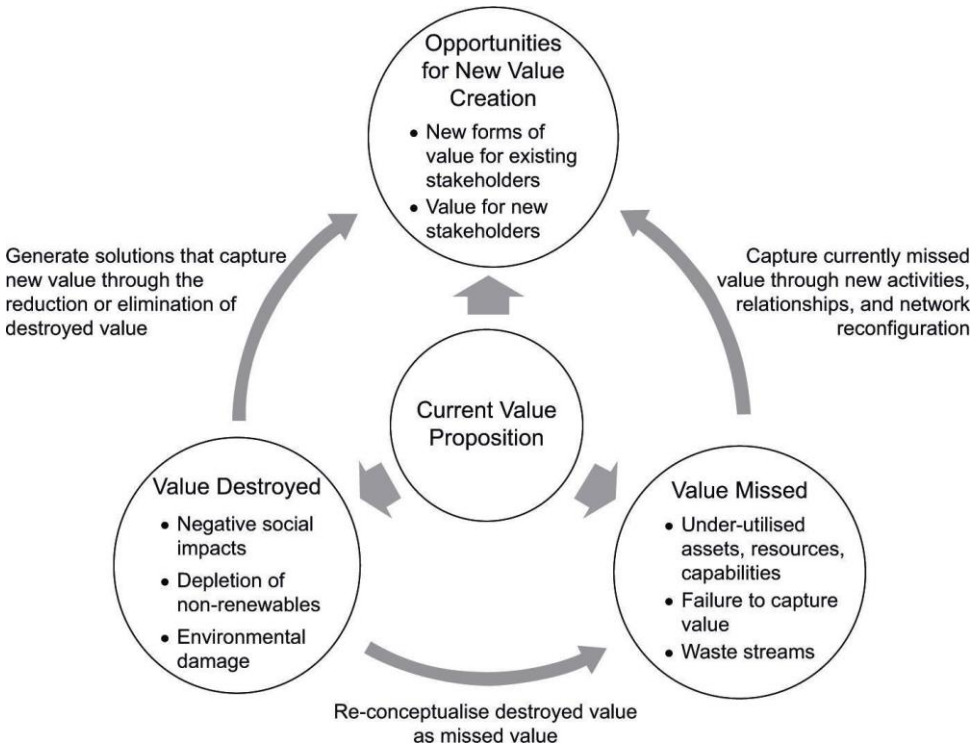


Figure 5: a conceptual portfolio for value innovation opportunities for a firm and its stakeholders (Bocken et al., 2013, p. 488)

2.4.3. Barriers to SBM innovation

Chesbrough (2010, p. 362) argued that "business model innovation is vitally important", however also noted that it is very difficult to achieve. Although BM experimentation could be seen as logical step when organizations face threats that could make their traditional business model redundant, many businesses do not probe for the potential of a new business model. The reason for this is that businesses face multiple barriers to BM innovation (Chesbrough, 2010; Schaltegger et al., 2011). These barriers should be taken into account and dealt with when constructing an SBM, because they can hamper the achievement of the construction process.

Especially when the innovation does not fit with the existing business model, explicit awareness is needed for the company's ability to identify and overcome internal and external barriers (Boons & Lüdeke-Freund, 2013). For oil & gas companies and sustainability innovations, this mismatch occurs, because sustainability could be seen as the opposite of the fossil fuel core business. According to Mont (2002), who investigated barriers for shifting towards service-oriented solutions, internal barriers relate to internal pressures within a company, and external barriers relate to external forces that hamper a company's development. In literature there are numerous barriers to sustainable business, and thus to SBMs. Since barriers to SBMs are not the main focus of this research, this section will stick to addressing some general internal and external barriers.

Internal barriers

A first internal barrier could be the conflict between the traditional BM and the experiments that can enable a new BM. Managers could for example resist experiments that could threaten their value to the company, whether or not the experiments are successful (Chesbrough, 2010).

Another example of a barrier is a firm's dominant logic' of how it creates and subsequently captures value (Chesbrough, 2010) . This logic helps firms to distill which information is important from information that conflicts the logic. Although following it helps businesses to operate in chaotic environments, when it concerns BM experimentation it could cause firms to miss valuable uses of a technology when these uses do not directly fit with the current BM (Chesbrough, 2010). Including sustainability-oriented innovations will most probably not fit with the dominant logic of an established, more traditional, business model (Schaltegger et al., 2011). This is also the case for oil & gas, since, since fossil fuels and sustainability could be considered opposites.

Furthermore, service-oriented solutions are part of the opportunities to innovate the business model for sustainability (e.g. the archetype 'deliver functionality rather than ownership in Figure 3'), and the barriers related are thus potential barriers to SBM innovation. For this, Mont (2002) found internal cost-related barriers, concept design barriers and organisational barriers.

External barriers

Some external barriers to innovating BMs for sustainability can be found in supply chain dependencies and locked-in infrastructures (Boons & Lüdeke-Freund, 2013). Mont (2002) found external barriers regarding relations with actors along the value chain, regulatory barriers, and context-related barriers.

2.4.4. Overcoming barriers

There are several things companies can do to overcome BM-related barriers. Chesbrough (2010) firstly mentions that companies should have a proactive approach towards business model experimentation. For SBMs, Schaltegger et al. (2011) add that accommodative and proactive sustainability strategies may help the creation and adoption of SBMs.

Secondly, Chesbrough (2010), mentions that the organisation should identify leaders, that can help lead the changes made for a new BM.

Thirdly, the company should manage the process of two parallel business models. This can be done by embracing the new model, while the effectiveness of the current BM is maintained (Chesbrough, 2010).

2.5. Research framework

Altogether, the former concepts can help investigate the construction of an SBM in the oil & gas industry. These concepts are combined in the research framework presented in Figure 6.
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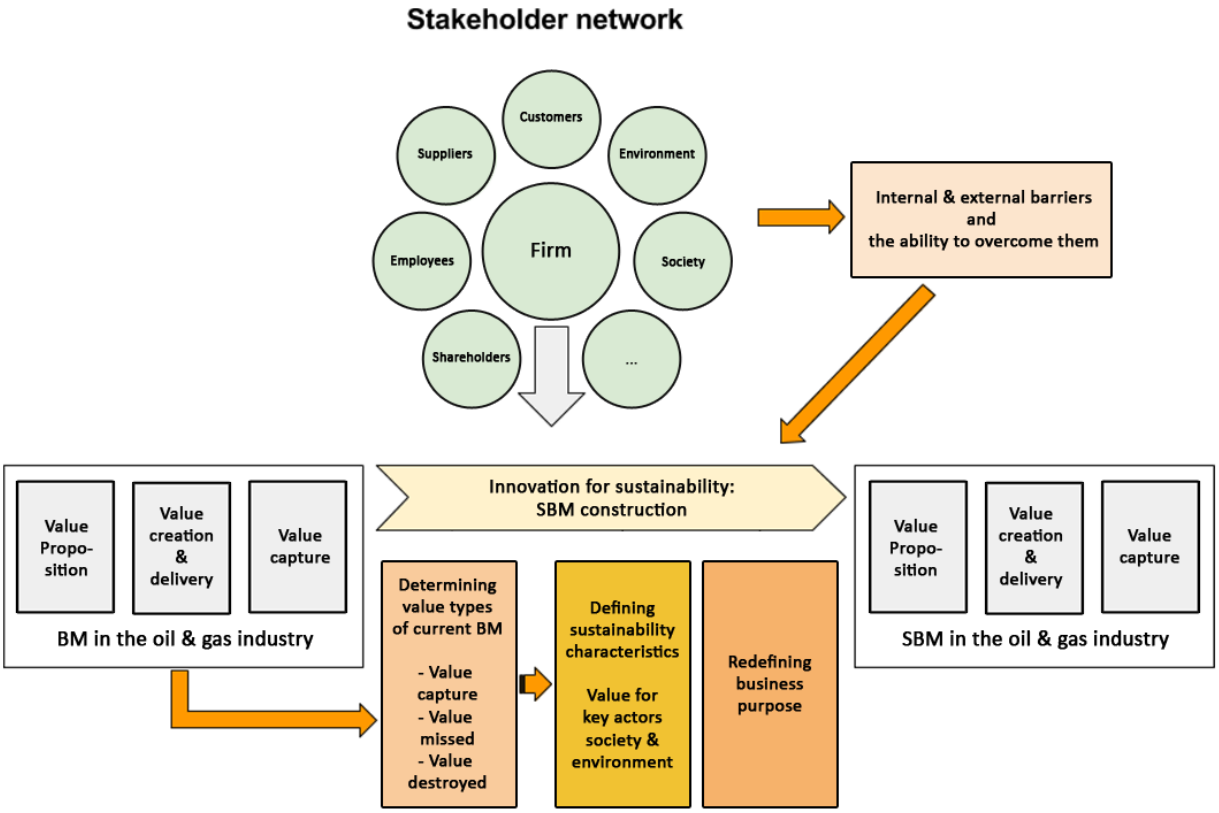

Figure 6: Research framework for sustainable business model construction in the oil & gas industry

This research framework shows how a firm's BM can be innovated for sustainability and become an SBM. The innovation or SBM construction process is influenced by the stakeholder network, consisting of the firm and its stakeholders. The innovation process itself consists of: determining the value types of the current BM, defining the potential sustainability characteristics, and redefining the business purpose. The value types are value captured, value missed, and value destroyed, and are derived from the current BM. In turn, these value types can help define the new SBMs sustainability characteristics, by enhancing value captured, re-conceptualising value missed and eliminating value destroyed. Finally, the internal and external barriers, that flow from the stakeholder network, and a company's ability to overcome them, can influence the SBM construction process.

3. Methods

This chapter discusses the methods used in this research. First the research design is discussed in section 3.1, followed by the methods for data collection in section 3.2 and the methods for data analysis in section 3.3. Data collection is subdivided into the data collection per sub-question and the general methods for data collection: stakeholder identification, interviews and the SBM workshop. The methods for data analysis are also subdivided into methods per sub-question.

3.1. Research design

This research concerns a qualitative exploratory study, which aims to provide an understanding of what SBM can be constructed in the oil & gas industry and how it can be achieved. As was explained in section 1.4, the research takes a case study approach. According to Yin (2015) a case study is: "an empirical inquiry that closely examines contemporary phenomenon (the *case*) within its real-world context" (p.194). A case study should use a concrete entity (e.g. a person or organization) as the main subject of the case, but a case study can consist of a single case or multiple cases (Yin, 2015). A single case was used here: Frames Group B.V. Since Frames is an organization that consists of 5 business units (BU's) however, data was collected from different BU's. Therefore, the research, to some extent covers multiple cases within the case of Frames.

The general research question will be answered through the answering of the sub-questions. The first sub-question *What business models are currently used in the oil & gas industry?* will be addressed by identifying Frames' current business model. Once this business model is understood, it is possible to look at how it can be innovated. The second sub-question *How can the business model be innovated for sustainability?* requires identifying possible sustainability characteristics in coordination with Frames' stakeholders. Next the third sub-question *What barriers influence SBMs in the oil & gas industry and how can they be overcome?* will be answered by identifying internal and external barriers, and exploring possible solutions to overcome the barriers. The specific approaches for answering each sub-question are elaborated on in sections 3.2 and 3.4.

3.2. Data collection per sub-question

This section elaborates on the data collection of this research, and is divided into data collection per sub-question and general data collection.

3.2.1. Sub-question 1: Identifying Frames' current business model

To tackle the first sub-question *'What business models are currently used in the oil & gas industry?*', the elements of Frames' current business model, *value proposition*, *value creation & delivery* and *value capture*, needed to be identified. Data for all elements were collected from Frames' company documents and interviews, and additional data for *value capture* was collected during the SBM workshop. The specific methods for the interview and workshop are elaborated on in section 3.3.

3.2.2. Sub-question 2: Business model innovation for sustainability

To identify SBM opportunities for the second sub-question *'How can the business model be innovated for sustainability?*' data was collected with interviews and the SBM workshop. The Value Mapping Tool

(VMT) by Bocken et al. (2013) in **Error! Reference source not found.** was used as the main method for BM innovation, and was the basis for the interview and workshop formats. The tool can stimulate discussion, raise awareness, engage with a broader range of stakeholders and begin the process of changing perspectives (Bocken et al., 2015). The tool is an extension of the conceptual portfolio in **Error! Reference source not found.**, and can specifically help identify failed value exchanges and develop new value opportunities. It also aims to provide understanding of the positive and negative aspects of the value network's value proposition, identify conflicting values, and realign interests to improve the outcome for all stakeholders (Bocken et al., 2015). The tool is divided into five circles covering the topics: *purpose*, *value* captured, value *missed*, *value destroyed*, *and value opportunities* The segments allow for including different stakeholders such as the ones depicted, but since (key) stakeholders will differ per firm these should be identified separately when using the tool.

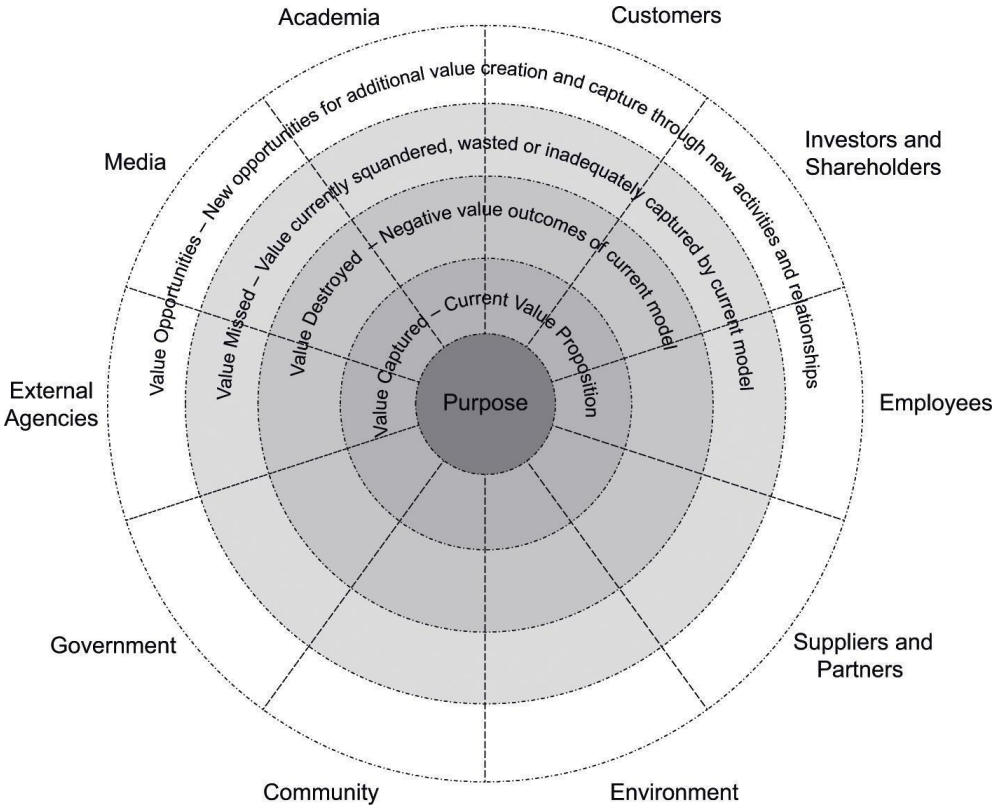

Figure 7: The Value Mapping Tool (Bocken et al., 2013, p. 490)

For this research data was collected for each circle of the tool. The first topic collected was the purpose of Frames, because constructing an SBM often requires redefining the purpose of the business, so the purpose should be known. The purposes of other companies in Frames' value chain were also collected, since similar purposes in the value chain can enhance collaboration for sustainability. In addition to purpose, goals, ambitions and vision were taken into account. This was taken after the example of Kraaijenhagen et al. (2016) and the approach of consultancy Copper8 (personal communication, 10th May 2016)

Other topics collected were the value captured, value missed, and value destroyed. The value missed & destroyed could help identify value opportunities. New value opportunities were also collected with the help of the SBM archetypes (Figure 4).

3.2.3. Sub-question 3: Identifying SBM barriers

Data for the second sub-question '*What barriers influence SBMs in the oil & gas industry and how can they be overcome?*' was collected with the interviews. These barriers were divided into internal barriers, which are inside the direct scope and influence of the company, and external barriers, that are outside the direct scope and influence of the company. Some barriers could also be identified from the topic value missed & destroyed and the discussions during the SBM workshop.

3.3. General data collection

This subsection elaborates on the general methods for data collection: stakeholder identification, interviews and the Sustainable Business Model Workshop.

3.3.1. Stakeholder identification

Since business model innovation for sustainability requires a stakeholder view, data needed to be collected from and with Frames' stakeholders. To identify these stakeholders the examples of stakeholder groups provided by Bocken et al. (2013) and Stubbs & Cocklin (2008) illustrated in the theory, were used as a starting point. For Frames these were employees, customers, suppliers, industry experts, academia, and the key stakeholders society and environment. Choosing specific persons and organizations to represent a stakeholder group was done in close coordination with Frames, and was based on their (place in the) organization, their relationship with Frames and sustainability. Although affiliation with sustainability could bring up a certain bias, it was necessary for retrieving noteworthy information about sustainability. Since leaders such as top executives can be considered a reliable source of knowledge (Lozano, 2013), leadership position was also a selection criterion.

3.3.2. Interviews

Interviews were used as an overarching method to collect data for answering the research question and sub-questions. This subsection elaborates on the interview process.

Semi-structured interviews

The interviews conducted were semi-structured, because semi-structured interviewing is a flexible commonly used qualitative method for small-scale research, especially for case studies (Drever, 1995; Longhurst, 2010). As suggested by Cohen & Crabtree (2006), Drever (1995) and Longhurst (2010) a general interview structure with a list of predetermined questions and topics was prepared, and the detailed structured was worked out during the interview. This approach was chosen since it causes the interview to unfold in a conversational manner, allowing the interviewees freedom to elaborate on issues important to them and control the length and content of their answers. Furthermore it allows the interviewer to stray from the interview guide if necessary (Cohen & Crabtree, 2006; Drever, 1995; Longhurst, 2010), which was helpful when issues came up that required elaboration.

Due to the variety of stakeholders, different interview formats were necessary. The general format for internal and external stakeholders can be consulted in Appendices

Appendix 1 – Interview format. Since the interviews were conducted in Dutch, the original interview format was also in Dutch. It has been translated to English for the appendix. Based on the stakeholder's properties (e.g. sustainability experience, relationship with Frames, BU) and the time available for the interview, these interview formats were adjusted or strayed from. For example, for questions 11-13, the interviewee was asked to focus on their specific BU, or the difference between their BU and that of the Frames as a whole. However, since this was a time consuming activity not all stakeholders were able to address all aspects. Furthermore, it had become apparent during the course of the interviews that some topics were difficult to comprehend for the interviewees and that some questions/topics overlapped. This also made it necessary to adjust the interview formats.

According to Cohen & Crabtree (2006) semi-structured interviews often come with open ended question and lead to discussion, therefore making it best to record them and transcribe them for analysis. In this research the interviews were all recorded using a smartphone, uploaded and consequently transcribed using Windows Media Player, which also allowed playing delayed versions of the recordings.

Interviewees

Fifteen semi-structured interviews were held with representatives all over the stakeholder network. The interviewees received an e-mail invitation that included a list of the general interview topics, and a request to look at the attached SBM archetypes for inspiration (appendix 2). Fourteen interviews were conducted in person and one interview was conducted via Skype. The duration ranged from 45 – 90 minutes. Eight stakeholders within the company (i.e. internal stakeholders) were interviewed and seven stakeholders within Frames' network (i.e. external stakeholders) were interviewed. The interviewees were chosen in close coordination with Frames and based on the stakeholder they could represent. The details of the interviewees are visible in **Error! Reference source not found.**: their interviewee number, function, organization, stakeholder group, and interview form. The choices that needed to be made for selecting persons to represent stakeholder groups are elaborated on below.

Table 1: Interviewee details

Interviewee #	Function	Organisation	Stakeholder group	Interview form
1	Sales Manager Europe	Frames Group	Employee	In person
2	Technology Manager	Frames Group	Employee	In person
3	Marketing & Sales Director	Frames Group	Employee	In person
4	R&D Engineer	Frames - FRES	Employee	In person
5	Project Manager	Frames - FRES	Employee	In person
6	Sales Manager	Frames - FRES	Employee	In person
7	R&D Engineer	Frames - FES	Employee	In person
8	Business Developer	Frames - OGP	Employee	In person
9	Managing Director	Revicon	Supplier	In person
10	Engineering/Project Delivery Manager	Tulip Oil	Customer	In person
11	Membrane Technology Developer	Shell | University of Twente	Customer	In person
12	Commercial Advisor Gas	Shell	Customer	In person
13	Director | Consultant	FMD Group | Frames Group	Industry expert	In person
14	Science & Technology Advisor	Institute for Sustainable Process Technology (ISPT)	Industry expert	Skype
15	Partner	MSG Sustainable Strategies	Environment + Society	In person

Firstly, within Frames (interviewees 1-8), it was important to distinguish which stakeholders in the business to focus on, due to the business unit (BU) structure. To provide an overarching view of the organization, top managers at the level of the Frames holding were interviewed. To retrieve specific information about sustainability at the BU level, persons within BU's that were affiliated with sustainability and had experience and knowledge on this topic were selected. Since FRES works with renewable energy and FES works on topics such as energy storage, interviewees from these BU's were selected. Furthermore, an interviewee from OGP was interviewed. This interviewee could provide alternative insights, because this BU could not be directly affiliated with sustainability supply chain: suppliers and customers

Secondly, stakeholders from the supply chain were interviewed. Frames has different types of customers, so interviewees from the large oil company Shell and a small company Tulip Oil were selected. Also, Frames has several suppliers, but it was chosen to include a supplier that makes custom products for Frames. Making custom products causes the supplier to be in Frames' direct sphere of influence, possibly enhancing the opportunity for collaborating for sustainability.

Thirdly, persons were interviewed that had many years of experience within the oil & gas industry and did not directly fall under the scope of a company. They could therefore give outsider views on the possibility of SBM topics for Frames and relate this to the broader oil & gas industry.

Lastly, the key stakeholders *society* and *environment* needed to be represented. During the interviews society and environment were represented by interviewee 15, and these stakeholder groups were thus not discussed by separate stakeholders. The reason for this was that, when looking at the B2B supply chain position of Frames, society and environment are a difficult stakeholder to diversify. Unlike Shell, who is an operator/end-user, they do not directly influence the surroundings and thereby have specific local communities or environmental NGO's to answer to. Therefore, a person with a sustainability background and experience with stakeholder dialogues in the oil & gas industry was selected to represent both environment and society. During the workshop a separate stakeholder from the academic world was invited to represent the stakeholder environment (Participant 9), and interviewee 15 was asked to mainly represent society.

3.3.3. Sustainable Business Model Workshop

Designing a sustainable business model should be done in close cooperation with a firm's stakeholders. By interviewing various stakeholders across the network this element was taken into account, but the dynamics of stakeholder interaction could not be covered with the interview method. Therefore, an additional method was created and used to include stakeholder interaction: The Sustainable Business Model Workshop. This workshop could help find a common ground in the multiple stakeholder views, and identify the most promising options for value transformation.

The workshop's goal was: *'to collect the ingredients for an SBM for Frames, so that Frames and its network can contribute to sustainable development'.* The workshop was based on the value mapping process as described by Bocken et al. (2013), and Kraaijenhagen et al. (2016). Nancy Bocken was contacted for the 'guide for facilitators', which also served as a basis for the workshop's format and for the brainstorm explanation document (Appendix 3 – Workshop: Brainstorm topics explanation). In this subsection the workshop's process, participants and group division are elaborated on.

Workshop process

The workshop was conducted on July 14th 2016, at Frames in Alphen aan den Rijn. Twelve stakeholders, of which 8 internal and 4 external, were invited to brainstorm about an SBM for Frames. The workshop duration was 2.5 hours, which was subdivided into a 30m introduction (during which the participants could enjoy lunch) and four 30m brainstorm sessions. A PowerPoint presentation (Appendix 5 – Workshop: PowerPoint presentation) and four A1 paper sheets with the simplified value mapping tool (Figure 8) were used to facilitate the session. Before the session a document explaining the workshop process was sent to the participants (Appendix 3 – Workshop: Brainstorm topics explanation), with the request to read the document so they could gain an understanding of the value concepts. This was especially important since this seemed to be a difficult topic during the interviews.

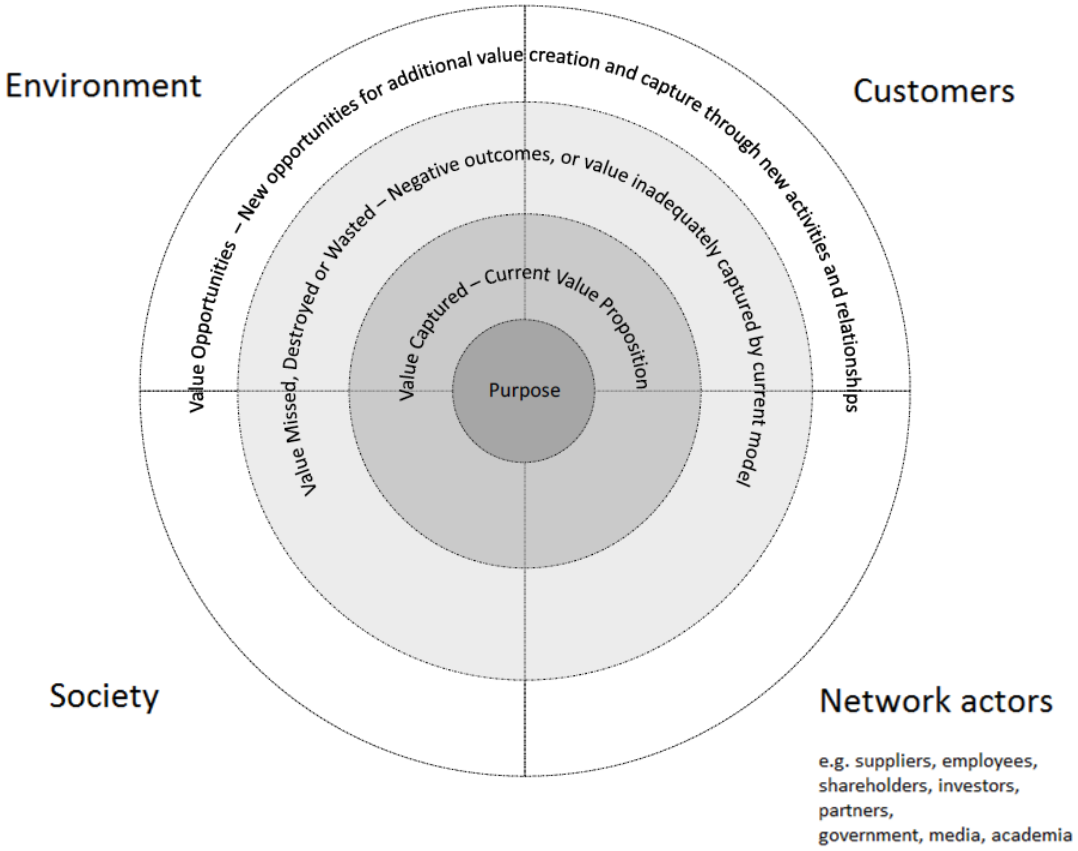

Figure 8: Simplified value mapping tool used in the workshop. Adjusted from Bocken et al. (2015)

The four brainstorm sessions tackled, in chronological order, the topics of the simplified VMT in Figure 8: *'purpose'*, '*value captured*', '*value missed and destroyed'*, and '*value opportunities'*. Each topic had its own coloured post-it notes on which the group could write their ideas: green (brainstorm 1), blue (brainstorm 2), orange (brainstorm 3), and pink (brainstorm 4). The participants were asked to place the post-it on the circle of the ongoing session and the stakeholder quadrant the idea applied to. These quadrants represented the stakeholder groups '*environment'*, '*customers'*, '*network actors'* and '*society*'. The '*network actors*' group is a compilation of stakeholders such as suppliers, employees, shareholders, investors, partners, government, media, and academia.

The participants were instructed on the VMT using a populated VMT for the case of LED-lights (see Appendix 3 – Workshop: Brainstorm topics explanation). To provide a tangible example of an SBM the case of Tony's Chocolonely was introduced. Per brainstorm topic Tony's Chocolonely's connection to sustainability was shortly explained: i.e. that their purpose is 'A 100% slave-free chocolate industry', that their value captured for society is 'reduced slavery in the cocoa industry' and for the customer 'a guilt-free chocolate experience'. Small Tony's Chocolonely bars were then handed out for the participants to enjoy during the brainstorms and to boost the sustainability vibe.

An example of the brainstorm time division is visible in the schedule in Table 2. During the first minute the researcher introduced the topic by revealing a new slide and the brainstorm task. The participants were then given 10 minutes to brainstorm within their group and fill in the VMT circle. After each brainstorm 15 minutes were reserved for all four groups to present their ideas to the rest of the group and have a short question and discussion round about the ideas. Lastly, the workshop was wrapped up with questions on commitments concerning sustainability. The full time schedule of the workshop, which was also a handout in the workshop, can be consulted in Appendix 4 – Workshop Schedule

Table 2: Example of brainstorm time division

Time	Minutes	Activity
13.00 - 13.30	30m	Brainstorm 1: Purpose 1m Ratna introduces topic 10m brainstorm 15m each group sends a representative to present their ideas (3m each) + questions from other groups

Workshop participants

Twelve stakeholders attended the workshop, of which an overview can be found in Table 3. The table is subdivided into internal and external stakeholders, and shows details such as participant number, group number, participant's function, their organisation, and interviewee number. The latter, 'interviewee #', indicates whether the participant was interviewed prior to the workshop and refers back to the interview number they were given in **Error! Reference source not found.**. Participants 1, 2, 4, 6, 7, 8, 11 and 12 were interviewed before the workshop, and participants 3, 5, 9 & 10 were not.

Table 3: Workshop participant details

Participant #	Group #	Function	Organisation	Interviewee #
Internal stakeholders				
P1	1	Marketing & Sales Director	Frames Group	3
P2	1	R&D Engineer	Frames - FRES	7
P3	2	Marketing Manager	Frames Group	n.a.
P4	2	Sales Manager	Frames - FES	6
P5	3	General Manager	Frames - FES	n.a.
P6	3	Technology Manager	Frames Group	2
P7	4	Project Manager	Frames - FRES	5
P8	4	R&D Engineer	Frames - FES	7
External stakeholders				
P9	1	Assistant-professor Energy & Resources	Utrecht University	n.a.
P10	2	Process Supervisor	Engie	n.a.
P11	3	Managing Director	Revicon	9
P12	4	Partner	MSG Sustainable Strategies	15

Group division

The participants were divided into four groups of three, as can be seen in Table 4. Each group consisted of 1 external and 2 internal stakeholders. In this way the external stakeholders were evenly spread across the groups. Since the internal stakeholders belonged to different BU's, they were also evenly spread across the group, so that no participants of the same BU were in a group together. Moreover, every group was appointed an additional stakeholder focus based on the background of their external stakeholder. The groups were asked to use this focus as a specific attention point while brainstorming.

Table 4: Workshop group details

Group	Participants	Additional stakeholder focus
1	P1, P2, P9	Environment
2	P3, P4, P10	Customer
3	P5, P6, P11	Supplier/network actors
4	P7, P8, P12	Society

Sustainable Business Model Workshop

3.4. Data analysis

3.4.1. General data analysis

Qualitative data analysis was used for the data collected, which refers to making sense of the data gathered from sources such as interviews and documents and then presenting what these data reveal (Caudle, 2004). To achieve this, the data collected from interviews, the SBM workshop and company documents were grouped under the categories and subcategories presented in Table 5, which were primarily derived from the theory. Table 5 also illustrates the sub-questions the categories apply to. The categories were then presented in tables or figures, which allowed for making comparisons and recognizing patterns between the categories. An explanation of the data analysis per sub-question can be found below.

Table 5: Categories for data analysis

Category	Sub-categories
Sub-question 1	
Value proposition	- Product/service - Customer segments and relationships - Value for customer, society, and environment
Value creation & delivery	- Activities - Resources - Distribution Channels - Partners and suppliers - Technology and product features
Value capture	- Cost structure & revenue streams - Value capture for key actors incl. environment & society ○ Interviews and workshop - Growth strategy/ethos
Key sustainability aspects	The eight SBM archetypes (Figure 3**Error! Not a valid bookmark self-reference.**): - Maximise material & energy efficiency - Create value from waste - Substitute with renewables & natural processes - Deliver functionality rather than ownership - Adopt a stewardship role - Encourage sufficiency - Repurpose for society/environment - Develop scale up solutions
Sub-question 2	
Purpose	Interviews and workshop
Value missed & destroyed	Interviews and workshop
Value opportunities	Interviews and workshop
SBM archetype matches	The SBM archetypes (see above and Figure 3)
Sub-question 3	
Internal barriers	n.a.

External barriers	n.a.

For the workshop, the data on the four VMT posters and the notes taken during the discussions were analysed together, which resulted in four tables that could be used as further input for the answering the sub-questions. The data was grouped in the same way as the data was placed in the VMT. As mentioned before in section 3.3.3. these were the categories of each brainstorm session: *purpose, value missed and destroyed, value captured, and value opportunities*. The latter three were further subdivided into the sub-categories of the brainstorm sessions: the stakeholder quadrants. Overlapping ideas in each brainstorm session were taken together, but every idea was paired with the data source, i.e. the groups, from which it had come from.

3.4.2. Sub-question 1

To answer sub-question 1 '*'What business models are currently used in the oil & gas industry?*', the information gathered from the interviews, workshop and company documents were grouped under the categories of the BM elements 'value proposition', 'value creation & delivery', and 'value capture', the category 'sustainability characteristics', and their subcategories in Table 5. The interviews and company documents were used as input for all three BM element categories, and the workshop was used as in additional input for the category 'value capture'. To identify the current business model's key sustainability aspects, data from the interviews and workshop were placed under the SBM archetypes.

3.4.3. Sub-question 2

To analyse sub-question 2: *How can the business model be innovated for sustainability?*' data from company documents, interviews and the workshop was grouped under the categories 'business purpose', 'value missed & destroyed', 'value opportunities', 'SBM archetype matches', and the corresponding subcategories that are shown in Table 5. In order to compare the workshop and interview findings, 'purpose', 'value missed & destroyed' and 'value opportunities' were subdivided into workshop and interview findings. To identify value opportunities, it was taken into account that Frames' current sustainability characteristics could be further developed, and that re-conceptualising the category 'value missed & destroyed' could also generate value opportunities.

3.4.4. Sub-question 3

To analyse sub-question 3: '*What barriers influence SBMs in the oil & gas industry and how can they be overcome?*', data was categorized under 'internal barriers' and 'external barriers'. When the barrier was said to be linked directly to the activities of Frames, it was categorized as an internal barrier. Barriers that primarily related to activities outside the direct influence of Frames, e.g. relating to customers or the overarching oil & gas industry, were categorized as external barriers. Barriers were an explicit question in the interviews, but could also be identified from the conversations surrounding other interview topics. Furthermore, the presentation and discussion rounds from the workshop could also be used as inputs for the barriers.

4. Findings

This chapter discusses the findings of this research and answers the different sub-questions: sub-question 1 will be answered in section 4.1, and sub-question 2 will be answered in section 4.2. Section 4.3 combines sub-questions 1 & 2 by answering the first part of the research question: 'what sustainable business model can be constructed in the oil & gas industry'. Then, sub-question 3 will be answered in section 4.4. When applicable, the findings are subdivided into findings derived from the interviews, and findings derived from the workshop. These findings are then compared to one another.

4.1. Frames' current business model

This section will answer sub-question 1 'What business models are currently used in the oil & gas industry?' by providing the business model of the case study Frames. The three primary elements of a business model 'value proposition', 'value creation & delivery' and 'value capture' are discussed, and include the 11 SBM topics as pictured before in Figure 2. The current business model is then followed by the current business model's key sustainability aspects, and an answer to the sub-question.

4.1.1. Value proposition

The value proposition of an SBM revolves around the question *'what value is provided and to whom*?'. For Frames this question will be answered below by describing the value proposition elements 'product or service' and 'customer segments and relationships' and 'value for customer society and environment'.

Topic 1: Product/service

Frames offers a wide variety of products within its business units. Each business unit has a specific product and technology portfolio. In general, it can be said that Frames sells assembled engineered products, and their portfolio is technology driven (Interviewees 2, 3). Frames' full portfolio can be seen in the Frames Family Tree in Figure 9. The end product depends on the customer's needs, and ranges from modules to total plants. In addition, maintenance is offered to the client. (Interviewee 2)

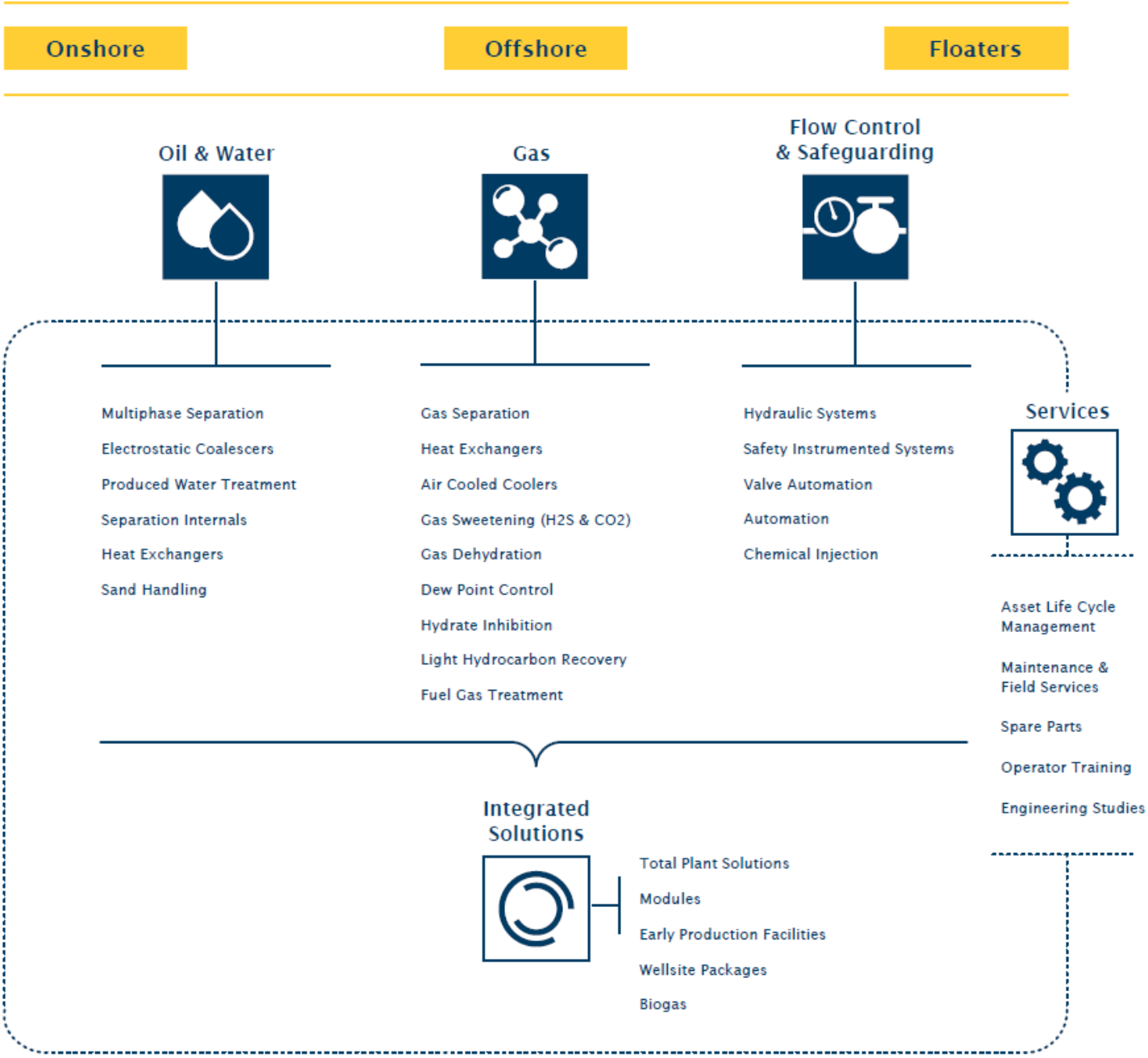

Figure 9: Frames portfolio (Frames, 2015b)

Topic 2: Customer segments and relationships

Frames focusses on the international upstream oil & gas industry and specifically addresses the market segments onshore offshore, and floaters (Frames, 2015b). Since frames works B2B their customers are other businesses. They have a broad customer base, but the end users of their products are primarily oil companies. These vary from small oil & gas companies with only 20 employees to corporations such as Shell and Exxon (Interviewees 1, 2). These end users are either served directly or through EPC contractors. These contractors take on the engineering, procurement and construction (EPC) of projects like oil & gas platforms, which have been issued to them by the end users (Interviewees 1, 3, 7). In approximately 70-80% of the cases the direct customer is the EPC contractor,

and in 20-30% of the cases business the end-user is the direct customer (Interviewee 1). At FRES, the customer segments are very different since they operate in the renewable energy sector instead of oil & gas (Interviewee 3). These customers are often large parties in the biogas market that harvest 10.000-100.000 tons of organic waste: waste treatment facilities, manure processors and horticulturists (Interviewee 6).

The customer relationships that Frames maintains depend on the type of company the customer comes from. Sometimes personal contacts are used and can help Frames to get asked for a project. More often however, customers need to be actively attracted and convinced (Interviewee 1). Attracting customers and maintaining existing relationships is therefore an ongoing process. Some companies like Shell are so large (approximately 90.000 employees), that new customers will have no idea of the successful project you have done at Shell before, so you will need to continue retelling your story (Interviewee 1). These customers often already have specific demands, and know almost exactly what they want Frames to deliver. At FRES however, customers only have a global idea of what they want: that they want to make biomass (Interviewees 4,6). Since the exact demand is not specified FRES has a large advisory role in the exact demand, and has a more proactive role:

"You could compare it to a car dealership. In the oil & gas sector the customer would come to the dealership with the knowledge of wanting a car with specific components. At FRES that happens sometimes, but our market is much more immature and therefore we more often need to approach potential customers and ask them whether they perhaps need a car." (interviewee 6)

Another factor that makes FRES' customer relationship different from other BU's at Frames, is that their customers often rely on subsidies. The customer will first have to issue for a subsidy, and only once they have received this, they will be able to continue the process and actually go through with purchasing the product from FRES (Interviewee 2,6)

Topic 3: Value for customer, society and environment

The proposed value for customer, society, and environment, has large similarities with value capture in section 4.1.3. An important value for the customer is that Frames can take care of the total package: from design to engineering and from small products to total plant solutions (Interviewees 2, 4). Furthermore, it offers multiple portions of the value chain, i.e. an integrated approach, in contrast to its competitors who handle a single portion of the chain. Frames is also said to have advanced technologies, strong engineering, and a way of that thinking that results in optimising the product for customer needs (Interviewees 2, 6, 7, 12). Furthermore, Frames is also seen as reliable company with qualitative products, which also helps FRES in the renewables market:

"Reliability and references are getting increasingly important. The benefit of being part of a large company like Frames, is that you can say that Frames is a reliable party. If something goes wrong you can assure the customer that it will be fixed, contrary to many other small companies in this market that lately that have left the customer with bad projects" (Interviewee 6)

The value for society lies in offering jobs within the company, and outside the company in the form of supply chain involvement. Knowledge exchange inside and outside the company is also an important offering, since working with Frames requires in depth knowledge of products within its portfolio (Interviewees 2, 3). This knowledge exchange is seen more as a more natural process of working together however, than something Frames specifically aims at:

"We don't specifically train people for the sake of it, or that the customer specifically trains us to enhance the wellbeing of people and the surroundings. That's not something that we do." (Interviewee

3)

When it comes to proposing other value for society, such as creating jobs abroad, this is also not something that Frames offers directly. When local content is used and a foreign company is hired to perform activities for Frames, this is predominantly because the customers specifically demands this. (Interviewees 3, 7). Although it is felt that not many customers feel the need for local content (Interviewee 3):

In some cases we initiative local content ourselves, but that is more from an economic point of view than that we aim at creating employment (Interviewee 7)

For the environment Frames takes into account that its products cause as little harm as possible. Different process techniques are used for optimizing energy efficiency, such as heat integration, process water treatment, and minimizing waste (Interviewees 1, 2, 3). However, the interviewees acknowledged that environmental aspect either have an economic driver, are a result of laws & regulations or specific customer demand (Interviewees 1, 3, 4, 7, 8). In their design safety for humans and of the installation are a priority, which result in benefits for environment and society. But explicitly including environmental and social value (except for safety) is rather reactive than proactive (Interviewee 1).

Having better environmental performing products reduces operational expenditures for the customer however, or prevent the need for end-of-pipe technologies. Sometimes the customer also has emission requirements, so if Frames knows such customer demands it will offer these since it'll be easier for them to get the job (Interviewees 3, 8)

Subsection conclusion – value proposition

To sum up and answer the value proposition question 'what value is provided by Frames and to whom?' is that Frames provides technology based customized solutions for the upstream oil & gas industry, representing multiple portions of the value chain. The value is provided to the market segments onshore offshore and floaters, and specifically to the end-users and EPC contractors.

At FRES the value proposition is slightly different, as it provides technology based customized solutions for the biogas sector, and delivers this to large agricultural related parties. In addition, it has a different customer relationship, since the renewables market is immature and customers have far less specific demands than in the oil & gas industry.

For the whole of Frames, it can be said that the provision of value is directly targeted at customers, and that providing value to society and environment has economic drivers, is not viewed as value. Therefore, providing it as part of the value proposition is rather incidental.

4.1.2. Value creation & delivery

Value creation & delivery in an SBM tackles the question *'how is value provided?'*. For Frames this question will be answered below by describing the value proposition elements '*activities*', '*resources'*, '*distribution channels'*, '*partners and suppliers'*, and '*technology and product features'*.

Topic 4: Activities

Frames' main activity is the assembly and engineering of different oil & gas technologies and products, which are predominantly obtained from other companies, into an end product. These end products range from single products to total plants (Interviewees 2, 8).

Topic 5: Resources

Frames considers its employees to be their primary resource, because the knowledge of its people are essential to the development of the company (Interviewees 3, 6). This is also visible in the 'why' of their business: 'people make the difference' (Frames, 2015b).

Since Frames is a fabricator of engineered products Frames acquires its physical resources through or together with its suppliers. These resources consist of intermediate goods such as pipes and instruments like valves and thermometers (Interviewees 2, 8).

The financial resources are secured by maintaining a positive cash flow. Projects are not initiated when the resources have not been secured. Therefore, customers are asked to pay per project phase (interviewees 2, 3).

In addition, their technological partners are considered to be an important resource, because Frames does not primarily develop technologies itself. These right partners are therefore important for the added value that Frames can deliver to its customer (Interviewee 3).

Topic 6: Distribution channels

One on one contact is a largely used channel to target clients. With their network of 9 international offices in the most important oil & gas regions, Frames tries to be closer to its customer. Other used channels are tradeshows, seminars, making tenders, and using their network. Less personal marketing instruments such as the website are also used, as a very broad way to promote their portfolio, image and added value (Interviewees 2, 3). As mentioned before, the market for FRES is less mature, so it has to more actively approach its customers. Falling under the umbrella of Frames has benefits when approaching customers, since Frames' good reliable image in the oil & gas market is seen as an added value for customers (Interviewee, 6)

The distribution of their end products may vary due to customer demand. Many customers want their product to be delivered on site (for example in a harbour in Brazil), so depending on demand Frames or the customers arranges the products transport. Transport is always outsourced however, since Frames does not have its own distribution network (Interviewees 2, 3)

Topic 7: Partners and suppliers

Frames mostly works with partners in the form of joint ventures. These partnerships can be in the form of local content, where Frames works together with local parties to fulfil the customer's needs. In South America and Nigeria partnerships in the form of local content are prevalent (Interviewees 2, 3). Partnerships are also set up to add new technologies to their portfolio (Interviewee 3).

When it comes to their suppliers it is sometimes dictated by the client which supplier they need to work with. Their relationships with partners and suppliers are set up for the long term. In this way they can maintain optimum standards and save time and money (Interviewee 2).

Topic 8: Technology and product features

Frames' main technologies are directed towards oil & water, gas, flow control and safeguarding and biogas treatment and upgrading (Interviewee 2). The main technology and product features are visible in the previously shownFigure 9. According to interviewee 3 these technologies and products are designed for added value for the customer, optimisation, and minimizing waste.

The technologies used for the renewables market, e.g. biogas for FRES and energy storage at FES, are close to their core business. For biogas the process technology is similar to gas, but uses different components (biogas instead of natural gas). The fact that Frames has good knowledge on oil

& gas process technologies has allowed them to make the move to the renewables sector (Interviewees 1, 3).

Subsection conclusion – value creation & delivery

To sum up, an answer can be given to the value creation & delivery question *'how is value provided?'.* Frames provides its value through the assembly of different technologies into end products ranging from single products to total plants solution. It's most important resources are its people and their knowledge, Customers are primarily targeted through one on one contact. At FRES a more proactive approach is needed to target customers, due to the immaturity of the renewables market.

Their main technologies are process technologies, and are directed towards oil & water, gas, flow control and safeguarding and biogas treatment and upgrading. Partners are important for providing them with these technologies. Partner and supplier relationships are usually set up for the long term, and can also occur as a result of a customer's local content demand.

4.1.3. Value capture

This subsection will elaborate on the value capture question '*How does the company make money and capture other forms of value?* by addressing the topics '*cost structure & revenue streams'*, '*value capture for key actors'* and the '*growth strategy/ethos'*. Since value capture was treated in the interviews and extensively treated in the workshop, these are both treated and compared under topic 10: 'value capture for key actors'.

Topic 9: Cost structure & revenue streams

Frames primarily has a cost-driven cost structure, which consists of variable costs. This cost-driven property is said to have been more prevalent the last two years, due to pressure experienced as a result of the turbulent market with low oil prices (Interviewees 1, 2). Frames' prices are based on materials procured, hourly wages and profit shares. The costs are therefore variable, since the costs depends on the amount of projects running, and the nature of these projects (Interviewees 2, 5).

Since Frames works on a project-basis, the revenue streams are predominantly project-related. Therefore, it has little continuity in their BM in the sense of a fixed revenue stream (Interviewee 2). When a project or product is delivered the income stops. The duration of a project is around 12 – 18 months. Within this period there are several moments of payment wherein Frames first tries to neutralize its cash flow. Towards the end of the project the profit component comes their way (interviewee 3).

For the cost structure this can be considered a safe model, but for the continuation of our income we have a riskier model. This is visible in the current oil market where projects are diminishing, which we directly suffer from. In our new vision we're looking at opportunities to gain a revenue stream from what we delivered in the past, like maintenance and services (Interviewee 3)

At FRES subsidies are also said to sometimes be part of the income structure (Interviewee 5). Depending on the amount of projects, profit margins change, because the costs and incomes fluctuate as a result of the amount of projects (Interviewee 3).

Topic 10: Value capture for key actors

Here the value captured for key actors, as defined in the interviews and workshop are discussed. The value capture findings from the workshop have similarities with value proposition in section 4.1.1, so some overlap will occur.

Interviews

The value for the customer is a custom made, high quality, reliable product. An important factor is also that Frames takes care of multiple facets of a project, from design to engineering, so it relieves the customer in many aspects (Interviewees 2, 4). For the customer and suppliers, knowledge is also said to be a value captured, because of the exchange of products and technologies. Furthermore, jobs and income are a value captured by suppliers and Frames' employees (Interviewee 2).

Value capture for the environment and society is not something Frames defines itself, but their products contribute to worldwide energy access (interviewees 1, 2, 3). In addition, there are high safety standards, and a business ethic in the form of a code of conduct that takes a stance on corrupt issues like bribery, extortion, fraud, and money laundering. (Interviewees, 2, 3, 8; Frames, 2015a). According to interviewees 1 & 3 these standards are part of the western way of doing business, and therefore perhaps not noteworthy to promote as part of a sustainable value.

Due to its more environmentally friendly technologies focused on efficiency and process optimization, the value captured for the environment could be decreased environmental degradation, and therefore also better social impacts (Interviewees 1, 2, 3). A specific example of environmental value captured is provided by Interviewee 6 for the case of FRES:

"Our technology makes biogas suitable for use in the gas infrastructure, and ensures that it is used in a superior way. In this way the heat and energy from the biogas are better utilized then when one would directly put it in a gas engine, where all heat is destroyed." (Interviewee 6)

Workshop

In the workshop, the topic of value captured was tackled much more extensively than during the interviews. V*alue captured* was covered in the second brainstorm. The participants' task was: *'Determine the value captured for different types of stakeholders.'* The outcomes of this brainstorm for the stakeholders *environment*, *customer*, *network actors*, and *society* are visible in

Table 6. For each idea it can also be seen how many times it was mentioned, and by which groups.

VALUE CAPTURED							
Environment		**Customer**		**Network actors**		**Society**	
Footprint reduction through energy and material efficiency		Optimized Opex & Capex (operating expenditures & capital expenditures)		For partners and suppliers Frames is a reliable party.		Employment	
1 x	Group 3	**1 x**	Group 1	**1 x**	Group 3	**1 x**	Group 1
CO_2 reduction as a result of technologies for CO_2 reduction and sequestration		Frames has a broad portfolio, and can deliver a total package: advice and customized high quality solutions that integrate multiple parts of the chain.		Frames connects different actors in the supply chain, and therefore bridges the gaps in the chain		The oil & gas industry has largely contributed to (Dutch) welfare	
2 x	Group 1, 4	**3 x**	Groups 1, 2, 3, 4	**1 x**	Group 4	**1 x**	Group 1

Qualitative products ensure a long product lifetime		Lowest total cost of ownership (TCoO) is provided		Knowledge development in the areas of oil & gas and renewable energy technologies		High ethical standards are ensured through the use of a code of conduct	
2 x	Group 1, 2	**1 x**	Group 4	**1 x**	Group 4	**1 x**	Group 3
At FRES better lifecycle management concerning chemicals, energy, water and transport		Warranty		Academic knowledge is applied in practice		Environmental footprint reduction also benefits society	
1	Group 2	**1**	Group 2	**1**	Group 4	**1**	Group 4

Table 6: Value captured per stakeholder type, as defined by the workshop groups

As can be seen in
Table 6, the primary value captured for the stakeholder *environment* are environmental footprint reduction through energy and material efficiency, the use of technologies for CO_2 reduction and sequestration, and long product lifetime. For the stakeholder *customer*, all groups considered an important value captured to be Frames' broad portfolio of solutions that enables integration of multiple parts of the chain. For the stakeholder groups *network actors* and *society* all groups, except group 2, came up with different values captured.

Comparison interviews and workshop

When comparing the interviews and workshop, it could be seen that there are many similarities. The majority of the ideas from the brainstorm were identified in the interviews, and were also pointed out during the topic value provided, mentioned before in 4.1.1. This could have been because 8 out of 12 participants were interviewed before, but since the workshop topics were generated in groups, it is interesting to see that the combined visions matched those in the interviews.

The main identified value captured for the environment in interviews and workshop was environmental footprint reduction through energy and material efficiency, CO_2 reduction, and long product lifetime.

The main value captured for the stakeholder customer was Frames' broad portfolio and integrated solutions.

For networks actors the value captured described in the workshop was more diverse than during the interviews, because apart from suppliers, stakeholders such as academia were taken into account. However, a main topic here was still knowledge transfer.

Similarities in value captured for society were providing employment and high ethical standards. An interesting match was seen in a value captured with broader scope than Frames. Group 1 mentioned that the oil & gas industry has largely contributed to Dutch economic welfare, which was also mentioned by interviewee 10.

Topic 11: Growth strategy/ethos

When it comes to Frames' stance on growth, it was acknowledged that growth is crucial part of the business:

"In the end we are an entrepreneurial company that pursues growth, the wellbeing of our people, and profitability. Those are our core principles" (Interviewee 3).

The growth at Frames is said to be organic. This means that they first look for projects, and after that they look at the financial side. They for example first want to make sure that there are sufficient projects, before appointing more personnel to a BU (Interviewees 2, 4).

Concerning the growth of renewables, a goal was established that in 5 years 10-15% of the revenue should come from renewables. However, how this growth in renewables should be achieved is not yet clear throughout the whole organisation (Interviewee 6). A top executive however, indicated that they intend to grow by continuing to broaden their already broad portfolio (Interviewee 3). This shows that some plans have been given thought at top management level, but that this hasn't been spread out over the organisation. Interviewee 6 provided its own stance on how to achieve this growth, which is in line with the approach mentioned before:

"You cannot achieve growth without innovation within your organisation. If you grow you will also have to make better and more diverse products, and direct another part of the market. Growing with one product will not be so easy as growing with a broad range of products" (Interviewee 6)

Subsection conclusion – value capture

Based on the above, the value capture question *How does the company make money and capture other forms of value?* was answered. In short, it can be said that Frames works on a project basis, and that its cost & revenue streams and profit margins are vary according to their projects.

The main value captured of its activities are for the customer, but during it operations it also manages to capture value for society and the environment, and network actors such as suppliers and academia. For the environment it is important to note that despite its fossil fuel core business, Frames attempts to decrease its environmental impacts by using technologies that for example increase efficiency and minimize waste and emissions.

Growth is essential to the firm, and approximately 10 - 15% of its growth should be derived from renewable in the next 5 years. Specific strategies to achieve company growth were not found however.

4.1.4. Key sustainability aspects

The previous sections have discussed the business model elements of Frames. This sections sums up the key sustainability aspects of the BM by grouping them under the SBM archetypes. The interviews and workshop revealed that some SBM archetypes are already present in Frames' BM. In Figure 10 the archetypes that were encountered are coloured in: dark orange indicates that the archetype was frequently mentioned, and light orange indicates that the archetype was mentioned only incidentally.

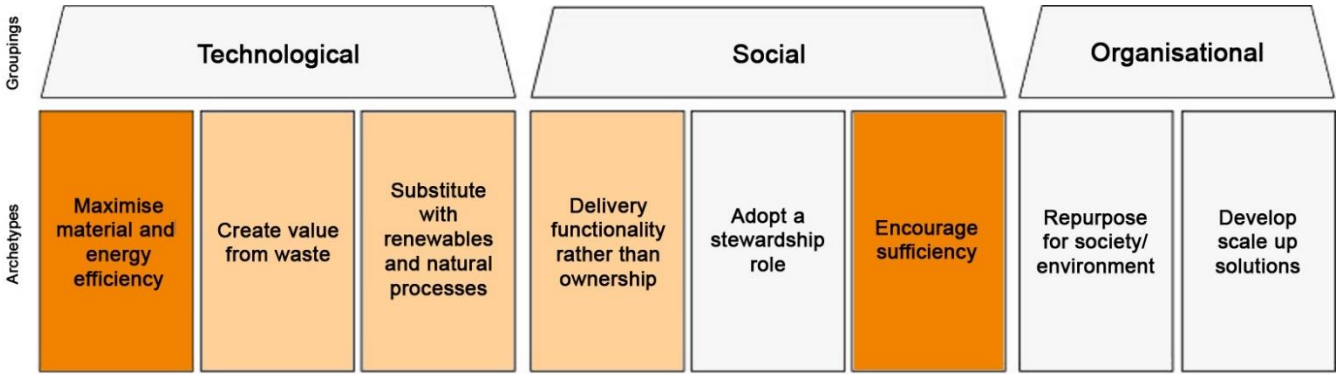

Figure 10: SBM archetypes in Frames' current BM. Dark orange was frequently mentioned, and light orange was mentioned

As can be seen in Figure 10, the archetype *'maximise material & energy efficiency*' occurs in the Frames BM and was mentioned by all interviewees and during the workshop. Efficiency is considered very important, since reduced energy and material use also reduces costs and thereby increases cost competitiveness. Improving efficiency is a regular topic in the oil & gas industry. '*Create value from waste*' is a specific business case at FRES, since one of their main activities is to treat biogas that occurred from waste (Interviewee 6). For Frames in general recovering heat from processes and using it as input for other processes is also a way value is created from waste (Interviewee 2). The role of '*substitute with renewables and natural processes*' is especially present at FRES, since their goal is to develop renewable energy technologies. At FES technologies are also being developed to support renewable energy, such as power to gas. In addition, natural processes such as solar are used here to help further develop oil & gas (Interviewee 7).

Two social archetypes were encountered at Frames. The archetype 'd*eliver functionality rather than ownership*' is a rather new concept that is currently being developed in the form of the BOOM concept (build, own, operate and maintain). 'Encourage sufficiency' as an archetype is present in the fact that in the oil & gas industry equipment is designed to last for 20-30 years. Frames' clients are interested in buying products with high quality and high product longevity, that can for example withstand harsh environmental influences at sea. In contrast to business-to-consumer markets such as 'furniture' and 'apparel' (see Bocken & Short, 2015) it can be said that sufficiency is a trait inherent to the oil & gas industry.

Organisational archetypes could not be identified to currently have a place in the Frames business model.

4.1.5. Sub question 1 - concluding remarks

By addressing the aspects above, an answer has been given to the first sub-question: '*What business models are currently used in the oil & gas industry?'.* Since a single-case study approach is used, it was not possible to cover more business models, as addressed in the question. Therefore, an extensive description of the BM of Frames was given.

First of all, it was found that the concept of business models is new within the company, and that a ready business model, e.g. in the form of a document, was not present. The concept of value, which is the underlying concept of business models according to Richardson (2008), Teece (2010) and Bocken et al. (2014), was also new to Frames.

Secondly, it was found that the current BM of Frames is a more traditional business model centred around economic value creation, where a focus on the stakeholder customer and economic value is predominant. Frames' BM does not attribute a large role to sustainability aspects, and when it does this primarily has an economic driver. Furthermore, its stakeholder scope is limited to its customer and employees. Therefore, a SBM that encompasses multidimensional (economic, social, environmental) value for all stakeholders, as described by Bocken et al. (2015) and Schaltegger et al. (2016) is not yet present.

Furthermore, some differences were visible in the business model of FRES, Frames' renewable energy business unit, compared to the BM of Frames in general. Considering the fact that FRES focusses on renewable energy, it has different products, that provide more sustainable value. It therefore has a more sustainable BM than Frames. Also, it serves the renewables market instead of the oil & gas market, which requires a more proactive approach to targeting customers. This matches with the notion of Schaltegger et al. (2011) that SBMs requires more proactive sustainability strategies.

Finally, the identification of Frames' current BM could provide some new insights to the SBM archetypes. Although Frames has a reactive sustainability approach, it does entail some archetypes. All technological SBM archetypes were found, some social archetypes, but no organisational archetypes. The archetypes 'maximise material & energy efficiency' is a constant focus at Frames and other oil & gas companies, since it contributes to cost reduction. In addition, the archetype 'encourage sufficiency' was found to be an inherent trait of the oil & gas industry, because customers demand installations that are designed for a lifetime of. 20-30 years. This could also indicate that this archetype could apply more to the B2C market (e.g. Bocken & Short, 2015) than the B2B oil & gas market.

4.2. Sustainable business model opportunities

This section will answer sub-question 2: '*How can the business model be innovated for sustainability?*'. Subsection 4.2.1 discusses the purpose of the business. Subsection 4.2.2 the value missed & destroyed of the current business model, because these provide input for the value opportunities. Subsection 4.2.3 discusses the value opportunities for Frames and its network. For these three subsection the outcomes of the interviews and the workshop are discussed and compared. In section 4.2.4 the opportunities seen in the SBM archetypes are presented. Finally, subsection 4.2.5 provides an answer to sub-question 2.

4.2.1. Purpose + goals

Creating an SBM requires redefining the purpose of business (Stubbs & Cocklin, 2008). Therefore, this subsection discusses Frames' current purpose in order to redefine it for a potential SBM. In order to compare Frames to the rest of the oil & gas industry, the purposes of other oil & gas companies are also illustrated. Since the purpose and goal of a company are both necessary for redefining the SBM, these are both discussed in this section.

Interview findings

During the interviews, the question was posed to internal stakeholders and those affiliated with Frames what the purpose and goal of Frames and their respectable business unit was. Multiple viewpoints on Frames' goal and purpose were found. Although some could identify a specific goal and purpose for either Frames or their business unit, identifying a general goal for Frames as a group turned out to be a difficult task.

At top management level for the Frames Group the goal and purpose was generally seen as providing technologies, which are primarily directed towards the upstream oil & gas industry, to meet a portion of worldwide energy demand. Water treatment and renewables are said to be gaining momentum and are therefore an important direction for the future (Interviewees 1, 2, 3). Other interviewees had more difficulty in defining a purpose for Frames. Although a mission and vision are available, these are described as vague, diffuse and too generic. Thereby making it unclear for employees to know what is expected from them (Interviewees 5, 7, 13).

"In my opinion the goals are not very clear. When I ask people about the strategy of the firm, then I do not get a uniform answer and sometimes no answer at all ... there are thoughts and ideas, but no clear action plan (Interviewee 13)"

Table 7: The vision and mission of Frames (Frames, 2015a)

Frames - Vision
"The development in global prosperity guarantees a growing demand for energy and an increasing demand for oil and gas. This goes along with a social need for environmentally friendly and safer technologies.
Frames - Mission
"We want to be the first choice for our clients, suppliers and employees in the worldwide oil and gas industry."

It was also stated that it was unknown what Frames' long term goal for in 50 years is, for when fossil fuels are no longer necessary. Feelings exist that the company will continue current practices as long

as possible, and that when fossil fuels are redundant Frames will also cease to exist (Interviewee 8). Furthermore, it was mentioned that Frames' goal and strategy are currently focused on financial success (Interviewees 4, 5, 7), and that growth and business continuity are an important component for the long term goals (Interviewees 3, 7).

The goals of the separate business units were easier to define for the interviewees. The long term goal of FRES is to become a player in the renewable energy market. They expect that renewables will take in a large place in the energy market, and that they need to be part of this when the costs of green and grey energy will start becoming equal. According to interviewee 6 this goal of FRES fits within the ambition Frames has set to have 15% of its revenue from renewables in 5-6 years, although this was considered to be a pretty heavy ambition (Interviewee 6). For OGP it was expected that gas is an important fuel for the energy transition, and that their goal could be to meet this gas demand (Interviewee 8). Another interviewee acknowledged however, that the goals from the BU's are also not clearly defined, since it is the task of the Frames holding to set up the template for these (Interviewee 7).

Purposes of other companies in the oil & gas industry

Since having common goals make it easier for parties to collaborate, external stakeholders were also asked about the goal or purpose of their company. Customer Shell is said to be an integrated company that uses technology as a differentiator. It believes in an energy mix for the future and has the following twofold long term goal: to remain a large player in the worldwide oil & gas market, and to play a significant part in the transition towards new energy concepts (Interviewees 11, 12). An interviewee mentioned that at other large oil & gas companies, the tipping point has arrived that forces them to make a decision in which direction they would like to continue in the future: oil & gas or other markets (Interviewee 12). For customer Tulip Oil, the goal is to continue to develop in the gas sector, so their role in the energy transition would be as a gas provider (Interviewee 10). For supplier Revicon, the goal is broadening the market outside the oil & gas industry, towards the food sector (Interviewee 9).

Workshop findings

In the workshop the first circle of the VMT was used to define the purpose. The participants' task was: *'Determine the purpose of Frames'*. All four groups came up with different variations on a purpose, visible in Table 8.

Table 8: Purpose of Frames as defined by the workshop groups

Purpose
Applying technologies for oil, gas, and bio-energy to facilitate energy production
Group 1
Meeting the energy demands of the industry
Group 3
Making knowledge on renewable energy available
Group 2
To contribute to the sustainable development of the energy demand, by providing installations that enable the supply of renewable energy

Group 2
The purpose used to be 'independent earnings', perhaps now it is 'integrating the oil & gas value chain'
Group 4

The general purpose of Frames that could be distilled from these was:

'To enable energy supply and availability'

Although Frames' tagline is *'a family of oil & gas solutions'*, the purpose defined above focuses around energy, instead of oil & gas. By acknowledging that the purpose of Frames should exceed the oil & gas industry, the participants had already taken this brainstorm to the next level by putting it in a wider context and determining what the actual purpose could be. It was even brought up that the purpose of Frames could move beyond energy, since Frames has the know-how to build many things. An example is distillation systems for the downstream oil & gas industry, which for instance serve the petrochemical market.

Comparison interviews + workshop

From the interviews it has become clear that an overarching long term goal for Frames is missing. During the workshop different purposes were also defined, but none of the participants mentioned this absence of a clear goal. Instead of presenting a uniform goal that could have been communicated as the Frames purpose/goal, the participants presented their own take on what Frames' purpose is or should be. This differs from the interviews, where no brainstorming atmosphere was present for the interviewees to come up with suggestions for the purpose. What did match with the interviews however, was the purpose mentioned by group 4: having 'independent earnings', because related phrases such as 'making money' were mentioned by interviewees 1, 2, 4, 7 and 8.

What both the interview and workshop findings have revealed, is that Frames is in need of a purpose that exceeds the oil & gas industry. This would match more to Frames' activities, that are also compatible with the overarching energy industry and markets concerning water treatment.

Like Frames, other companies in the oil & gas now need to make, or have made the decision whether or not to redefine their goals, diversify their portfolios, and define their position in the energy transition. In contrast to Frames, the interviewees from Shell, Tulip Oil and Revicon were able to define long term goals. Since having similar goals could improve collaboration, Frames should consider how their goal would fit within the goals of the network and what the impact of changing the goal would be. If there is a match (for sustainability), Frames could opt for increased collaboration. If they don't, Frames could look into new partners and clients that could help improve their contribution to sustainable development.

4.2.2. Value missed & destroyed

This subsection discusses the value missed and destroyed of Frames and its network. The interview and workshop outcomes are presented separately, and are then compared.

Interview outcomes

During the interviews the concepts of value missed and destroyed were considered to be difficult topics. Especially for customers, it was said that they did not miss much in Frames' value proposition. A reason for this could be that Frames offers solutions that are customized to the customer's needs. This was illustrated by Interviewee 12:

"*I don't know if there is anything in Frames' value proposition that we miss. Although more is always possible, I think that what they offer with their current BM is fine. Especially, because of their ability to integrate with the customer." (Interviewee 12)*

Although not as extensive as during the workshop, it was possible for some interviewees to identify some values missed or destroyed. These are summed up in Table 9, and accompanied by the number of the interviewee who mentioned the topic.

Table 9: Value missed or destroyed identified during the interviews

Value missed or destroyed	Interviewee #
High industry standards	3, 9
Lack of employee satisfaction	15
Lack of awareness	3
Lack of after sales services	11
Overdesign	9
Local content and upcoming markets	13
Lack of communication of current sustainability aspects	13, 15
Reuse	3

The table shows different values missed or destroyed. To continue on the value missed/destroyed for the customer, it was identified by Interviewee 11 that there is sometimes a lack of after sales services. When for example part of an installation delivered by Frames is experiencing malfunctions, the customer is often referred to the producer of the specific component for repair. The reason for this is that Frames assembles products, but does not manufacture these themselves, and therefore does not have the ability to fix it. Since Frames is known for its integrated solutions, it would be an added value for the customer if Frames would extend this integration by tackling such issues itself. By providing such after sales services, Frames would relieve the customer of addressing other parties for help.

In addition, it is said that overdesign often occurs, making the product no longer fit to the customer's original needs (Interviewee 9). This makes products costlier for Frames and its supplier, thereby destroying economic value. It also leads to unnecessary material use, destroying environmental value.

Frames also misses value by not communicating its current sustainability aspects. If Frames were to actively communicate its sustainable activities, e.g. on their website or in the form of reporting, this could help attract customers and give and enhance its image (Interviewees 13, 15)

Another value missed/destroyed can be found in the network context of the oil & gas industry. The industry has very high standards, that are set up to minimize the risks its activities could bring for humans and the environment (Interviewee 3). This high standard attitude is visible in customer demand, who do not opt for reusing products, thereby missing environmental and economic value:

"I think that in many cases, customers could reuse products. If the customer has the opportunity to buy a used product for 50% of the price of a new product, then I think that the customer will opt for the new option. Simply because the customer could run the risk of buying something that is not completely safe" (Interviewee 3)

Although Frames designs a product for 25 years of safety, after 2 years outside in the open air the installation could look like its 10 years old and therefore less safe. This could cause customers to refrain from reuse.

The high industry standards also make it more difficult for oil & gas companies to operate in other markets, because their way of working makes them too expensive (Interviewee 4, 9), and to welcome sustainability innovations (Interviewees 3). This causes the Frames network to miss or destroy environmental, social, and economic value.

Workshop outcomes

In the workshop the topic of value missed and destroyed was covered in the third brainstorm session. The participants' task was: *'Determine the value missed and destroyed for Frames and its network'*. Table 10 presents the value missed and destroyed for the stakeholder groups *environment*, *customer*, *network actors*, and *society*. Every value is followed by the frequency mentioned, and which group mentioned it.

Table 10: Value missed & destroyed for Frames and its network, per stakeholder type, as defined by the workshop groups

VALUE MISSED & DESTROYED							
Environment		**Customer**		**Network actors**		**Society**	
Sustainability aspects (social + environmental impact) such as recycling, energy use, CO_2 emissions, and resource use of technologies, in the supply chain and product lifecycle, are not a specific attention point and are not integrated in design		Products are optimized for the warranty, but not their true lifecycle (e.g. a component that needs replacement after 3 years will last for the warranty period, not the product lifetime)		Employee satisfaction of working in oil & gas is declining, due the industry's negative image		No communication with society, and actors such as government	
4 x	Groups 1, 2, 3, 4	**1 x**	Group 2	**1 x**	Group 4	**2 x**	Groups 3, 4
The supply chain is not involved to ensure product recycling		Products are delivered that no longer fit the requested		The value chain is very complex and there are diverging interests, which		The potential of globalization is missed. Frames does not sufficiently	

		purpose: overdesign, building nice-to-haves		leads to discrepancies and over specification. Products are delivered that no longer fit the purpose.		make use of resources outside their comfort zone of Europe, that globalization offers.	
1 x	Group 1	**1 x**	Group 3	**1 x**	Group 3	**1 x**	Group 1
Fossil enabler. By operating in the oil & gas industry, Frames and its network enable the use of fossil fuels, negatively impacting the environment		No customer satisfaction surveys or after sales care to evaluate product performance					
1 x	Group 4	**1 x**	Group 2				
The new and improved generation of products/technologies is not implemented, that are more environmentally friendly.		Total cost of ownership (TCoO) is for the end user, but Frames works with contractors for whom TCoO is not of the greatest significance					
1 x	Group 3	**1 x**	Group 1				
Over specification: products with 'a golden edge', causing unnecessary environmental impacts.		Markets that are close to Frames' core business are not covered (geothermal, chemical industry, refinery)					
1 x	Group 3	**1 x**	Group 1				
		No focus on standardization					
		1 x	Group 1				
		Design inefficiencies as a result of specifications and regulations					
		1 x	Group 3				
		Frames has faulty DNA: Extremely high (oil & gas) standards will make it difficult to adjust and switch to other industry standards					
		1 x	Group 3				

As can be seen in Table 10, for the stakeholder *environment* all groups found that a value missed/destroyed is that sustainability aspects received little attention within the business network, supply chain and product lifecycle. Aspects such as recycling, energy use, CO_2 emissions and resource use, are not included as specific attention points and are not or too little integrated in the design.

For the stakeholder *customer* all groups named different values, although some values had similarities with the values mentioned for *environment*. Group 3 noted that products are delivered with a 'golden edge', which causes the product to no longer fit the purpose requested by the customer, and

cause additional environmental impacts. Group 2 noticed that a missed value for the customer is that products are optimized for the warranty instead of their lifecycle, which is compatible with what all groups mentioned about lack of attention for the products environmental lifecycle impact. A point that sparked discussion was group 3's finding about Frames having faulty DNA. The high standards of the oil & gas industry make it difficult to operate in other industries, potentially missing opportunities to capture value for and from new customers.

For the stakeholder *network actors* group 4 mentioned that the industry's negative image could cause a decline in employee satisfaction. Group 3 added the complex value chain with diverging interests as value missed/destroyed, which leads to discrepancies and the previously mentioned over specification for the stakeholders *environment* and *customer*.

Finally, for *society* a lack of communication with society and government were considered a missed value by groups 3 and 4. Enabling this dialogue could help boost the industry's image and create dialogue about the role of oil & gas in the energy transition and future energy.

Comparison and conclusion of value missed & destroyed

When comparing the value missed & destroyed from the interviews and workshops, it can be said that the workshop provided a much better understanding of the topic. It also allowed for identifying value missed & destroyed for the distinct stakeholder groups *environment*, *society*, *customer* and *networks actors*, giving a better insight into value missed & destroyed in the network.

Some matching insights could be found, e.g. missing the potential of globalization (Group 1) and not sufficiently addressing international upcoming markets (Interviewee 13); lack of after sales services (Group 2 & Interviewee 11); and that Frames does not specifically address sustainability in its BM, which was discussed before in section 4.1.

It also yielded some contrasting views. Interviewee 3 for example, said that Frames designs for a product lifecycle instead of only for the warranty period. The customer in group 2 however, brought up that some components in the product need to be replaced shortly after the warranty period has passed. This allows Frames to see its BM from the customer's point of view, and to recapture such missed customer value.

4.2.3. Value opportunities

This subsection discusses the value opportunities for Frames and its network. The interview and workshop outcomes are presented separately, and are then compared.

Interview outcomes

The interviewees were asked to give suggestions for how Frames and its network could contribute to sustainable development. Most participants had read through the SBM archetypes beforehand and gave suggestions based on these archetypes. The results of the value opportunities are visible in Table 11, and are grouped under the type of innovation (technological, social, or organizational), and accompanied by the interviewee who posed the opportunity.

Table 11: Value opportunities for the Frames network as identified by interviewees

Value opportunities	Interviewee #
Technological innovations	
Standardization	2, 3, 12
Water treatment	2, 3, 13
Increased use of renewables	1, 2, 4, 5, 6, 8, 9, 13
Waste management	1, 7
Plastics from waste or renewables	1
Increased efficiency	3
Energy storage (in the form of electricity or molecules)	1, 7, 12
Social innovations	
Services	2, 3, 10
Local content	13
Organisational innovations	
Dialogue with society & government	5, 15
Encourage sustainability in internal operations (building)	3
Collaboration for technology development	1, 12

As visualized in Table 11, many different value opportunities were identified during the interviews. Most of the opportunities were seen in the form of technological innovations. Here, further developing Frames current practices related to renewable energy, energy storage, and water treatment (but for other purposes than oil & gas) were said to be opportunities. For renewable energy and energy storage, interviewees 7 and 12 noted that it is important to distinguish between electricity and renewables, since these require different approaches, knowledge, and people.

Furthermore, an opportunity was seen in using more standardized components in its custom-made solutions. According to interviewee 12, the opportunity to custom build is not the same as in oil &

gas, and that it depends on the type of renewable energy. Unlike oil & gas fields, that are different each time, wind turbines or solar panels are largely standard products. A suggestion where Frames could combine its custom built expertise with standard components is geothermal (Interviewee 12).

Workshop outcomes

The value opportunities of the workshop were a result of the fourth brainstorm session. The participants' task was: '*Determine new value opportunities*'. The participants determined the value opportunities for the VMT stakeholder quadrants environment, customer, network actors and society. The outcomes of this brainstorm are visible in Table 12, which also shows how many and which groups came up with the opportunity.

Table 12: Value opportunities identified by the workshop groups

VALUE OPPORTUNITIES							
Environment		**Customer**		**Network actors**		**Society**	
New markets and applications: Geothermal, heat pumps, biomass fermentation		Improve contact with current customers by measuring performance and customer satisfaction. This can help improve, update and standardize products		Acquiring knowledge and market feedback for development, through technology platforms, partnerships with complementing companies, universities etc. FRES' portfolio could provide Frames opportunities for renewable energy partnerships		Taking a proactive approach towards sustainable development and appointing the right spokesperson to communicate this approach	
2 x	Groups 1, 2	**2 x**	Groups 1, 2	**2 x**	Groups 2, 3	**1 x**	Group 4
Offer the customer the possibility to integrate environmental aspects: recycling, energy efficient materials, better maintenance		After sales contact can lead to serving current customers through the offering of services, maintenance, optimization, retrofit		Attracting network actors such as shareholders and government to actively participate in the Frames business model		Market for society by participating in (energy) dialogues, and communicating Frames' position in the energy transition	
1 x	Groups 1	**1 x**	Groups 1	**2 x**	Groups 3, 4	**1 x**	Group 4
Design scalable and mobile equipment, and equipment that can be modified and redeployed		Setting up guidelines to facilitate standardization and sustainability within product range		Making better use of suppliers' skills and challenging them to deliver new solutions, and trusting their potential to do so		Making integrated designs in such a way that they are designed for prosperity	
1 x	Group 3	**3 x**	Group 1, 2, 3	**1 x**	Group 3	**1 x**	Group 4

More energy efficient materials and processes		Screening other business models and developing new business models such as leasing (e.g. through the BOOM concept)		Altering the Frames-DNA through cross-pollination: -Setting up joint traineeships with other industries -Hiring new people with different backgrounds than Frames people currently have, to boost sustainability in the organization	
1 x	Group 1	**2 x**	Group 3, 4	**1 x**	Group 4
Optimizing waste management		Broaden customer range by entering new markets, such as geothermal and distillation. Search for low hanging fruits and develop from there		Use small things like waste separation to create sustainability awareness within the organization	
1 x	Group 4	**2 x**	Group 1, 2	**2 persons**	P1 + P6
Recycling, refurbishment		Proactive approach for and participation in new market development: - Organize customer events/ seminars, attend market related conferences -Use FRES to position Frames as a thought leader for renewable energy -R&D investments to increase know-how			
1 x	Group 4	**2 x**	Group 2, 3		

As can be seen in Table 12: Value opportunities identified by the workshop groupsTable 12, for the stakeholder *environment* groups 1 & 2 stated that opportunities lie in new markets and applications. Other groups specified these many different opportunities, mainly concerned with incorporating technological traits to improve environmental impact, such as efficiency and waste management.

For the stakeholder customer, the most frequently mentioned value opportunity was to set up guidelines to facilitate standardization and sustainability within Frames' product range. Also it was considered important to actively develop new markets and business models (groups 1, 2, 3 4). Other opportunities were said to lie in improved service for current customers (groups 1 & 2).

The opportunities for *network actors* revolved around attracting new parties for partnerships and to help redevelop the business. During the final discussion it was also mentioned by two participants that steps could be taken to create sustainability awareness within the organisation.

For stakeholder group *society* Group 4 came up with all the opportunities. These concerned taking a proactive approach towards sustainability, by appointing a spokesperson, communication about sustainability, participating in dialogues and integrating prosperity in designs.

Comparison and conclusion of value opportunities

During the interviews and workshop many value opportunities were identified of which some were unique, and some overlapped. Within these opportunities it could be important for Frames to make a

distinction between its current oil & gas market, and new markets. In the oil & gas markets, more sustainable products could be promoted to customers, but the core would be fossil fuels. Frames could also target new markets, which require different knowledge, products and ways of doing business.

A common ground that was identified however, was that working with these value opportunities requires an active sustainability approach, and will require Frames to work together more with its network and acquire new partners. In turn, these value opportunities can help alter the 'the Frames DNA', and deliver more sustainable value.

4.2.4. SBM archetype potential

The previous sections have discussed multiple sustainable business model opportunities. In Figure 11 these are now combined and matched to the SBM archetypes by Bocken et al. (2014). The different shades of orange show how much potential each archetype has for being incorporated into the SBM of Frames. The darker the shade of orange, the more potential was seen in the archetypes by the interviewees and workshop participants. This is elaborated on below.

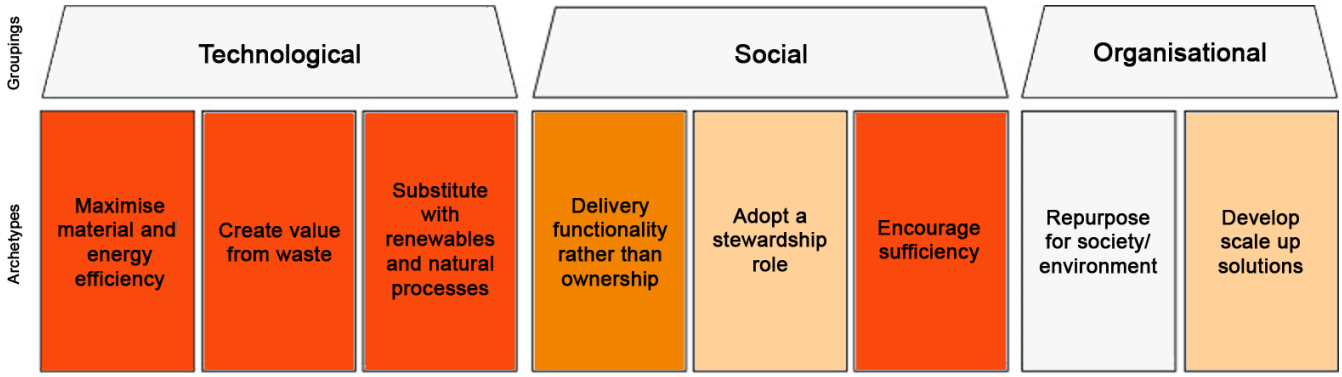

Figure 11: Potential SBM archetypes

Technological archetypes

Technological archetypes were most frequently mentioned during the interviews and workshop, and were considered to have the most potential. The archetype '*maximize material and energy efficiency*' is already present in the Frames BM, and in other oil & gas companies, because it can significantly reduce costs. In order to increase environmental, economic, and value for the customer, this archetype can be continued further

The archetype '*create value from waste'* was also already identified in Frames current BM, but predominantly for the case of FRES and its biogas solutions. New opportunities that could further develop this archetype were found in e.g. biomass fermentation, recycling, refurbishment, and optimizing waste management within processes.

For '*substitute with renewables and natural processes*' large potential is seen. FRES' main activity is currently biogas, but it could look into many more forms of renewable energy. Many interviews acknowledged that the shift in energy towards renewables is becoming increasingly evident, and that it is therefore important to maneuver in this direction.

Social archetypes

For the social archetypes, different potentials were seen. '*Delivering functionality rather than ownership'* is a topic that is currently being developed at Frames under the BOOM concept. During the workshop and interviews it was mentioned that customers could benefit from more services. However, the potential of only delivering the service instead of owning the products was not acknowledged by everyone. Frames often delivers products that become a part of a whole installation, which then disappear beyond their reach (Interviewee 1), making it difficult to keep providing functionality.

For adopting a stewardship role, very little potential was seen. Being an oil & gas company, it was considered to be difficult to become a credible sustainability steward. Interviewees 13 & 15 mentioned however, that being transparent about the sustainable value Frames does provide, is a first step and therefore has potential for including in an SBM.

The archetype *'encourage sufficiency'* was already present in Frames' current BM, but can be developed further. Although product longevity was seen as a trait that belongs to the oil & gas industry, it was found in the interviews and workshop that overdesign of products occurs frequently. Addressing this more could result into more sufficiency.

Organisational archetypes

Least potential was seen in the organisational archetypes. The archetype '*repurpose for society/environment*' was not seen as an option, and especially the example '*not-for-profit*' was considered to be unnecessary.

In the archetype '*develop scale up solutions*' little potential was seen. Although some interviewees saw the benefits of e.g. open innovation, others acknowledged that this could also threaten their competitiveness and their ability to receive a return on their investments. Sharing knowledge in another form, such as technology partnerships with research institutes, was considered to be valuable. However, knowledge sharing in such a form does not really fit with this archetype.

4.2.5. Sub question 2 - concluding remarks

With the description of the above, an answer was given to sub question 2: '*How can the business model be innovated for sustainability?*'. It was found that it is important for Frames to redefine its purpose, as it is currently directly at the oil & gas industry. Expanding it to the energy industry was suggested as being significant for making way for more sustainable opportunities

Furthermore, combination of the topics value missed and destroyed, value opportunities and the SBM archetypes were able to give a comprehensive overview of the value opportunities. Not only for Frames, but for its whole stakeholder network, including the key stakeholders *environment* and *society*.

It was striking that technological innovation opportunities were predominant in these opportunities, which could be as a result of the very technical nature of the oil & gas industry. Also, it was notable that none of the interviewees saw an opportunity in the archetype '*repurposing for society and environment'*, and especially not in being '*not-for-profit'*.

4.3. Frames' potential sustainable business model

This chapter combines the findings of the sub-questions in the previous sections and provides a suggestion for a potential SBM for Frames. It therefore answers part of the research question, '*what sustainable business model can be constructed in the oil & gas industry*'. It will give suggestions for the value proposition, value creation & delivery and value capture, in line with the definition of an SBM by Schaltegger et al. (2016. P.16) as mentioned before in chapter 2:

> *"A business model for sustainability helps describing, analyzing, managing, and communicating (i) a company's sustainable value proposition to its customers, and all other stakeholders, (ii) how it creates and delivers this value, (iii) and how it captures economic value while maintaining or regenerating natural, social, and economic capital beyond its organizational boundaries"*

When looking at Frames' current business model, a stakeholder approach is not present. According to the definition above and Bocken et al. (2014), an SBM should align the interests of all stakeholder groups, and explicitly include the environment and society as key stakeholders. Therefore, this value for stakeholders is a golden thread that should run throughout the SBM.

Value proposition

For its value proposition, Frames could continue to provide technology based, customized, integrated solutions. It could incorporate more standardised components however, and further integrate its offers by providing after-sales services.

In addition, it should increasingly opt for offering its solutions to more customers outside the oil & gas industry, to customers in the wider energy market or the renewables market. Hereby, Frames should take into account that it will have to main different customer relationships than in the oil & gas market, that require a more proactive approach.

In its value proposition it should also target other stakeholders. For the environment it could include solutions that minimize environmental impacts, by increasing material and energy efficiency, using renewable energy, and creating value from waste. For its suppliers, this could be relying more on their expertise, for its employees providing a better working environment, and for society solutions such as local content that induce economic development.

Value creation & delivery

To provide the proposed value, Frames firstly could develop their core skill of process technologies to serve more sustainable solutions. It could also consider acquiring or developing more sustainable technologies, through partnerships with research institutes and other businesses, government on the energy transition.

The more sustainable product portfolio will also have to be actively promoted through their distribution channels. It could become part of their offer to a customer, and featured on their website, and other media. Their activities at FRES can be featured in its marketing to attract customers for these more sustainable solutions.

Value capture

Frames' cost & revenue streams are currently variable and project-based. Shifting away from project-based work and offering more service contracts could induce a more continuous form of income. By incorporating more sustainable value, Frames could also capture new markets, improve business continuity, enhance its image, and increase employee satisfaction of working in a more sustainable company. For the customer and suppliers, it could be enhanced satisfaction of working with Frames, and more environmentally-friendly solutions will decrease environmental degradation, also benefiting society.

4.4. Barriers for sustainable business models in the oil & gas industry

This section will answer sub-question 4: '*What barriers influence SBMs in the oil & gas industry and how can they be overcome?*'. The barriers are split up into internal barriers and external barriers. For both sections an overview of the barriers found during the interviews are presented. Then, overcoming the internal and external barriers will be discussed.

4.4.1. Internal barriers

This subsection discusses the internal barriers for oil & gas companies such as Frames for contributing to sustainable development and developing an SBM. An overview of the internal barriers, and which interviewees mentioned them, can be found in Table 13.

Table 13: Internal barriers for BM innovation for sustainability

Internal barrier	Interviewee #
Lack of vision/goal/strategy	2, 7, 8, 13, 15
Lack of sustainability awareness	2, 3, 13, 15
Culture	3, 8, 15
Internal discrepancy on what to do	2
Short term mindsets	1, 2, 7, 10, 12, 15
Money	1, 7, 8
Difficulty in collaboration/lack of information exchange between departments	1, 8, 9, 15
Lack of (skilled) personnel	4, 6, 13
Lack of trust	8, 9

As Table 13 shows, many different internal barriers were found. The most frequently mentioned barriers are discussed below.

Lack of vision

Within Frames, a frequent was the lack of a clear vision, goal or strategy. Although employees recognize that it is a challenging task for the board of directors to choose a direction, they find it difficult to pursue future activities since there is no strategy under which they can place these:

> *Not having a goal is difficult. As a researcher my role is to see where technology can help Frames take the next steps, but if there is no clear goal for what we want to be in 10-15 years, it is really hard for me to say 'you should do this, because that will take you a step in the wanted direction' (Interviewee 7).*

A possible explanation given for this lack of strategy was that Frames' history and business model has always been to go with the abundance of jobs present in the oil & gas market. Due to volatile oil prices this luxury the oil & gas market provided is no longer present. A specific strategy for the future is missing, but is:

When growth no longer comes naturally you'll really have to come with a plan of how you want to place yourself in the market, what differentiates you, what your added value is towards customers, and how you can you still deliver value in a really difficult market (Interviewee 13).

The absence of strategy also causes a lack of consensus within the company of what should be done and deserves priority. At the beginning of 2016 some strategic elements concerning sustainability were presented, but unfortunately further development and implementation of the ideas have not yet been pursued (Interviewees 2, 8).

Difficulty in collaboration between departments

An organisational barrier for Frames is managing the different business units, and the collaboration between them. Although Frames is one company, it can be considered that there is a lack of unity within the business. Sometimes two business units approach the same customer, without knowing, which can be confusing for the customer (Interviewees 1, 8). Also, the business units are responsible for their own profit and loss, which makes it difficult for a business unit that is struggling to pursue its activities. It would be preferable if the units would work together, and help each other more, to strengthen the company as a whole (Interviewee 8).

4.4.2. External barriers

This subsection discusses the external barriers for oil & gas companies such as Frames for contributing to sustainable development and developing an SBM. Table 14 gives an overview of the external barriers found during the interviews, and indicates which interviewees mentioned the barriers.

Table 14: External barriers for BM innovation for sustainability

External barrier	Interviewees
Oil price	1, 2, 7, 10, 11, 14, 15
Oil & gas image and public opinion	3, 8, 10, 11, 15
Conservative industry with high standards	2, 3, 4, 7, 9
Climate change sceptics	15
Lack of information exchange	8, 15
Customers who don't walk the talk	3, 13
Position in the value chain	2, 3, 9
Lobby oil industry	2, 3
Shareholders	7, 11
CO_2 price	11
Government and politics	3, 5, 11
Competition	4

Oil price

A barrier that was specifically asked for was the influence of oil price volatility. It was acknowledged by most participants that the crisis in oil & gas is affecting oil & gas companies' profits and financial wellbeing. This also results into lack of funds for investing in sustainability and short term mindsets.:

"If you are bound to things like oil price, costs and benefit will no longer be in balance, so then there will be some pressure on the money you'll be able to bring towards the sustainable development aspect. (Interviewee 10)"

This closely relates to the internal barrier of short-term mindsets. At Frames the time frames for setting goals are relatively short (5 years), and have decreased due to the oil & gas crisis. This is much shorter than what is desirable for sustainability thinking:

"Usually those were 5 year plans, but with the current oil & gas crisis it has become shorter. Now we are more in a survival mode: what will we do next year and the year after? The time horizon has come closer, because there really is a certain crisis in the oil & gas as a result of low oil price" (Interviewee 1)

Some interviewees did not think that oil price alone was an SBM barrier for the broader oil & gas industry. It was said that there are many powerful players, that play with oil prices, because they don't want to give in to renewable energy. Therefore, lobby of the oil industry was said to be an important barrier (Interviewees 2, 3).

Oil & gas image and public opinion

The negative image of oil & gas, is considered to be difficult when dealing with sustainability. Despite the necessity of the oil & gas industry for issues such as energy security, public opinion can easily hamper initiatives that could enhance sustainability:

"You need to create public support when it comes to new energy options. If you don't take that into account from the beginning, and negative rumors starts, then you'll run the risk of your great technology being framed wrongly which you can eventually flush down the drain" (Interviewee 15)

For end-users, that operate oil & gas fields, this is said to be a significant issue. Especially, the media attention of the Shell shareholders meeting in May 2016, where a sustainability motion was rejected, adds to this barrier. Frames has a position further up the value chain, and therefore comes into less contact with such issues, but still gets negative associations.

Conservative industry with high standards

This barrier was mentioned before as a value missed & destroyed, during the interviews and workshop. The oil & gas industry is said to be very conservative, making it difficult to enable innovations to come through. Especially innovations for renewable energy experience problems, because they provide to the fossil fuel core business (Interviewee 3).

Also high standards make it difficult to move away from the oil & gas industry to other sectors, because oil & gas companies' prices are too high (Interviewee 9). This reduces companies' ability to diversify and develop more sustainable BMs.

4.4.3. Overcoming the barriers

This subsection elaborates on the possibilities for overcoming the barriers for constructing SBMs in the oil & gas industry. The general points for overcoming the internal and external barriers will be discussed.

Overcoming internal barriers

A frequently found internal barrier was the lack of a clear vision. To overcome this barrier, it is important for the leaders within the organisation, the board of directors, to set a clear vision for the company, wherein the role of sustainability emerges clearly. The important of a clear vision and purpose were considered to be important for stakeholder engagement for the BM change by Kraaijenhagen et al. (2016) and important for overcoming SBM barriers according to Schaltegger et al. (2011).

The next step, is to make this vision known throughout the organization. During an interview with a top executive, it was repeatedly said that Frames has a strong vision on certain topics. However, other interviewees said that the goals of Frames were unclear and were thus not aware of the presence of this strong vision. Therefore, efforts need to be made to set a clear vision, goals and ambitions, and communicate this.

Once this vision is clear, and the role of sustainability has been established, Frames can start tackling the barrier of sustainability unawareness in its organization by engaging its employees. According to Interviewee 3, sustainability might be seen as a threat since Frames operates in polluting industry, but that this is not something that Frames wants to convey:

"One could say that we would rather see more gas-guzzling cars, because that's better for our business. But no, that is not something we want to express to the outside world! I think that we should all express that we believe in the current energy transition and that we want to seize the opportunities that sustainability brings." (Interviewee 3)

By communicating the sustainability opportunities, Frames could tackle the unawareness and start changing the company mindset. This was considered to primarily be a task for the board of directors, but since it is difficult for a few people to motivate a large group of around 250 people it was brought up to select a group of for example 15 people to help spread and guard the message (interviewee 5). This is in line with Chesbrough (2010) who advises identifying leaders to lead the BM change. According to interviewee 5 "Those people would become the cores of little oil spills, that get larger and larger".

Nevertheless, when a vision on sustainability is presented much scepticism about its potential may arise as a result of the unawareness and conservative culture. Interviewee 13 suggested continuously providing best practices concerning sustainability to engage employees and create enthusiasm:

"You could give examples that say: Look this company developed this, and nobody gave them a chance, but in the end it yielded something that was x amounts cheaper, that made the customer overjoyed, and is now something that everybody wants." (Interviewee 13)

The potential of visualizing sustainability in the internal business practices is also seen as a part of the total package of creating sustainability awareness. For example, through promoting electric vehicles and facilitating waste separation (Interviewees 2, 3)

Overcoming external barriers

External barriers to SBMs could be seen as difficult to overcome, because they occur outside the scope of the company. Especially for a small company like Frames, that has little power in the oil & gas value chain (Interviewee 3). However, a first strategy to overcome such barriers is taking a proactive approach towards BM experimentation, as mentioned by Chesbrough (2010). Although experimentation could be seen as a risk, sticking to the current BM that is experiencing many pressures is also risky:

It is a large risk if they only stick to their current customers, e.g. a Shell or the NAM. If those customers collapse Frames will also go down, which is a huge risk. It would be wise to actively pursue sustainable activities since it'll allow them to spread their risks. (Interviewee 15)

It is not expected that the old BM is to be discarded, but that is maintained while a new BM is being developed. The company should therefore also learn to embrace the model (Chesbrough, 2010)

Accommodative and proactive sustainability strategies could also help the adoption of SBMs (Schaltegger et al., 2011). Adopting such an approach, will allow Frames to target other markets and customers, and perhaps be less vulnerable to oil price volatility. It is thereby suggested that sustainability is marketed in such a way, that it will capture the customer's interest, even if it does not walk the sustainability talk:

"There are parties that are really good at highlighting values of reduced footprints or emissions reduction. They market their product and target their customer in in such a way, that rejecting the product would be at odds with the customer's sustainability philosophy. And such a contradiction, is something that nobody can afford." (Interviewee 13)

For tackling barriers of oil & gas image, public opinion and conservative industry, engaging in stakeholder dialogues with actors such as government were considered to be important:

"Oil & gas' image is of course not good when it comes to sustainability. That is something that could be communicated better by the government, because we mustn't forget that 40% of all oil & gas in the Netherlands is government property. On top of that if you look at tax income, it means that 65-70% of all oil & gas benefit eventually lands with civilians like you & I" (Interviewee 10)

Taking part in the public debate was also considered to be an important step by the workshop participants. Engaging in dialogue with government, and informing them on possibilities and barriers, could also inspire changes in laws and regulations, that could enhance the ability of oil & gas companies to contribute to sustainable development. (Interviewee 5).

4.4.4. Sub question 3 - concluding remarks

The sections above have provided an answer to sub-question 3: '*What barriers influence SBMs in the oil & gas industry and how can they be overcome?*' Multiple internal and external barriers were found. For Frames, frequently found internal barriers were a lack of vision and cultural traits such as lack of sustainability awareness. The barrier of oil price and the barrier of collaborations between departments match with cost-related barriers, and organisational barriers as mentioned by Mont (2002). Also, barriers of the dominant logic as illustrated by Chesbrough (2010) were found, such as internal discrepancy on what to do.

For external barriers, supply chain difficulties were found, which is in line with Boons & Lüdeke-Freund (2013) and Mont (2002). In addition, some context-related barriers (Mont, 2002) were found for the oil & gas industry, in the form of conservative industry with high standards.

For overcoming internal as well as external barriers, it was found that a proactive sustainability approach and a stakeholder approach could be helpful strategies.

5. Discussion

This section discusses the limitation of the research, its theoretical implications, suggestions for further research, and some practical implications.

5.1. Reflection on research approach

This subsection reflects on the research approach by addressing the limitations concerning the case study, interviews and workshop, stakeholder representation and language barriers.

5.1.1. Case study

This thesis concerned a case study research, and therefore needs to address generalizability. Yin (2015) argues that the ability to generalize from a single-case study (or from a small set of case studies) is considered to be a major shortcoming of case study research. Since only one firm was used as a case study this is also a limitation of this research. Despite having incorporated part of the industry as stakeholders, this proves difficult for generalizing the case study to the entire oil & gas industry. The oil & gas industry consists of different types of companies, and specific business models apply to one company. General traits of the oil & gas industry could be distilled however, and can thereby help other oil & gas companies construct an SBM.

Furthermore, within Frames representatives from different business units were included, but some BU's were excluded. Therefore, it is difficult to generalize the business units to specific BU's. By interviewing top executives from the Frames holding however, and taking a helicopter view on the organisation, the research will apply to the general way of doing business at Frames and can thus be used as input for all BU's.

5.1.2. Interviews

Choosing interviews as a method to collect data, came with factors that can affect the reliability of the research. First of all the choice was made to interview top executives, as they are a reliable source of knowledge (Lozano, 2013). On the other hand, this has limitations in the form of geographic perspectives, hierarchical bias, and self-justification (Lozano, 2013). Interviewing representatives of the business units however, who take in a lower level in the organization, allowed for comparing the results and identifying such discrepancies.

Furthermore, interviewees could have misinterpreted the questions or topics, because the topics were difficult or because they had failed to read archetype appendix beforehand. During the interview these potential factors were diminished by starting off with general questions and explanations to specify the to be treated topics. Interviewees could also have felt a certain bias towards the topics, or could have felt the need to give socially desirable answer. To avoid this the interviewees were assured that the answers would be treated with care and caution, and would be used for research purposes.

In addition, bias and error on the side of the researcher could also have occurred, by asking questions of a suggestive nature or misinterpreting the answers. This could also apply to the SBM workshop. To minimize this potential, the researcher stuck as closely as possible to the interview format, and carefully analysed the answers by matching them to the predetermined categories.

5.1.3. Workshop

During the workshop, a limitation could have been unprepared participants. Prior to the workshop an e-mail was sent with a document explaining the topics, but not all participants may have read this. Since the concepts of value mapping may have been difficult, this could have limited their understanding of the matters. Through the provision of a thorough explanation of the subjects in the introduction, a hard copy of the document at the workshop, and pairing participants with at least one interviewee with prior experience on the topics, it was attempted to minimize this limitation.

Furthermore, 30 minutes for each brainstorm session (including brainstorming, presenting and discussion) may not have been sufficient. For the participants and their time schedules however, 2.5 hours was already a large part of their day. Therefore, taken from the perspective of both the researcher and participants the 2.5 hours can be considered to have been a good balance.

Another limiting factor could have been the group division and the group dynamics. During the workshop it became apparent that some participants were more dominant then others, causing some group members to have less opportunity to provide their inputs in the available time.

The selection of participants should also be noted as a possible limitation, since eight participants were interviewed before, and four were not. On the part of interviewed participants this could have caused an increased understanding of the workshop topics, but could also have caused a certain bias towards issues that had already been regarded as important during the interviews. For the non-interviewed participants, the lack of prior experience with the SBM subject could have caused less understanding of the topics on one the hand, but could on the other hand have generated fresh ideas.

5.1.4. Stakeholder representation

During an SBM construction process the stakeholder network should be engaged. For this research the choice was made to include 10 internal and 9 external stakeholders, but including more and different stakeholders could have provided additional perspectives. With this selection however, the internal stakeholders were able to give the researcher a thorough idea of the business and its BM, which was essential considering the researcher's outside perspective. The selection of external stakeholders were then able to give input that would challenge the ideas of internal stakeholders.

5.1.5. Comparison of interviews and workshop

Since two methods were used, these results needed to be compared in order to place them under their categories. The interviews gave more in depth perspectives, while the workshop accounted for the stakeholder interaction. Matching these may have resulted in comparing could bring up the question whether these results are incompatible in the first place, since they were derived in different settings. However, since the collected data fell under the same categories, their identities were compatible for comparison in that respect.

5.1.6. Language barriers

Even though this research is presented in English, the data was primarily collected in Dutch. Therefore, a language barrier could have occurred. For the interviewees and workshop participants, some English terms could have been difficult to understand, or had lost their value when they were translated for the

interviews (e.g. the value concepts: value capture, value missed/destroyed, value opportunities). During the workshop, the conversation language was Dutch, but all media and terms were in English to ensure a proper and uniform understanding of the topics.

On the side of the researcher, language barriers could also have occurred. It was attempted to translate matters as accurately as possible, but some information could have gotten lost in translation, taking away some nuances. However, collecting the majority of the data in Dutch, the native tongue of the people involved, gave the participants the ability to freely speak about the subjects, without being hampered by a potential language barrier.

5.2. Theoretical implications

This section will elaborate on the research's theoretical implications, by addressing the contribution to science and giving suggestions for further research.

5.2.1. Contribution to science

This research has extended the current literature on SBMs by providing a very detailed perspective on constructing an SBM through the case of Frames. It has attempted to fill a gap in literature, by addressing the unexplored area of the oil & gas industry. Several contributions to science were be identified.

First of all, this research has confirmed that business model innovation (for sustainability) should be a continuous process. As indicated by Osterwalder, Pigneur, & Tucci (2005, p. 10) "business models are subject to external pressure and thus constantly subject to change", and according to Chesbrough (2010) and Bocken et al. (2013) business model innovation requires continuous improvement and experimentation. This research confirms this, as the constructed SBM for an oil & gas company industry is only the beginning of a more sustainable BM. For an oil & gas company's BM to become more sustainable, it will have to continuously implement more sustainable value, and perhaps move away from fossil fuels as its core business.

The second contribution is that it was found that oil & gas companies have certain characteristic sustainability traits in their BMs. Through the use of the SBM archetypes insights were given into what sustainable elements the case study already possesses. It was found that the archetype '*maximize material and energy efficiency*' and '*encourage sufficiency*' were inherent to Frames' BM and that of other oil & gas companies.

The third contribution of this research is the identification of oil & gas industry specific barriers to constructing SBMs. It was found that oil & gas is a conservative industry, which has high standards in order to avoid risks. Apart from minimizing the risk of minimizing environmental and safety hazards, this also makes it difficult to respond to the current atmosphere, switch to other industries and adopt sustainable innovations. Also, a difficult barrier found in oil & gas was the B2B supply chain position of Frames and the supplier. On the one hand Frames' client dictate what they want, and on the other hand Frames also dictates to is supplier what it wants. This is in line with the barrier of supply chain dependencies mentioned by Boons & Lüdeke-Freund (2013)

Fourthly, this research has confirmed the necessity of interacting with the stakeholder network for constructing SBMs. The network perspective brought alternative insights that would not have been found if only the firm's perspective was taken, and highlighted contrasting views between internal and external stakeholders. In addition, a stakeholder perspective was found to be of potential importance for overcoming barriers to SBM construction. E.g. dialogue with society and government could help

overcome the barrier of negative public opinion about the oil & gas industry, which could cause the oil & gas industry to engage more in sustainability issues.

Finally, extensively working with the methods of the value mapping tool has revealed some improvements to the tool and theory. When looking at the VMT of Bocken et al. (2013) in Figure 7, and its conceptual portfolio in Figure 5, value innovation opportunities are addressed by reasoning from the value proposition. This research found that indeed the value needs to be innovated, but that this does not primarily lie in the business model element value proposition. Therefore, the researcher would like to propose an improvement: that the VMT should be used for helping to redefine the business model as a whole, instead of only for the value proposition.

5.2.2. Suggestions for further research

Several suggestions can be made for further research. Firstly, to provide a more comprehensive understanding of SBMs in the oil & gas industry, similar research can be done that has other companies as its main focus. This research focused on a single case: Frames, a privately owned SME in the upstream oil & gas industry. Although this research has included other companies as a part of its network perspective, it cannot provide detailed statements about an SBM for other companies, since an SBM is tailored to a specific business. Companies could be included that operate in the mid-stream or downstream oil & gas industry, are part of the oil & gas value chain, are bigger companies, multinationals, or publicly owned companies. Furthermore, Frames also conducts business in the renewable energy sector, so it could be valuable to research how the construction of an SBM would differ for oil & gas companies that do and do not work with renewables. Focusing on different companies will also reveal different stakeholders, which can provide different insights.

Secondly, this research focused on the construction of an SBM in the oil & gas industry, but one could extend it by addressing the implementation of the proposed SBM. Osterwalder, Pigneur, & Tucci (2005) argue that business model implementation or execution is a widely neglected issue, and that it is important to distinguish between the model and its implementation. Since this research has focused on the construction process of the case study's SBM, it is not yet clear what the next steps for implementation would be if the proposed SBM is accepted. Therefore, one could extend this study and research how an SBM in the industry can be implemented.

Thirdly, this research gave an overview of barriers for SBMs in the oil & gas industry, but this was not the main research focus. Barriers for an SBM and strategies to overcome them are an important aspect of constructing and implementing SBMs, but have not yet been extensively studied. Therefore, a full research that is solely committed to the topic of SBM barriers could be performed.

5.3. Practical implications

5.3.1. General

This research has two main general practical implications. From a sustainability and business continuity point the SBM concept can be considered a useful approach that oil & gas companies can use an example to construct their own SBM. These companies are all stakeholders in the oil & gas industry, and considering the importance of stakeholder engagement illustrated in this research, it is clear that more companies are needed to transform the industry and contribute to sustainable development. Constructing SBMs has a stakeholder perspective, in which stakeholders from other industries will also be reached that can help increase the scope of the contribution of SBMs to SD. The methods used can also be used for other companies in other industries.

This relates to this research's second main practical implication: the SBM workshop. This research has further specified the practical use of Bocken et al.'s (2013) Value Mapping Tool and guide for facilitators into the SBM workshop. This could be used as an interactive tool by other companies for BM innovation with the help of their stakeholder network/embed sustainability in business.

5.3.2. Advice to business

The other practical implications of this research are directed at the case study of this research Frames. An SBM for Frames was proposed in section 4.3, and this section will elaborate on the steps Frames can take further, to innovate its business model for sustainability.

The first recommendation for the SBM construction process would be to consider redefining the purpose of Frames. Literature shows that innovating BMs requires redefining the purpose of business (Stubbs & Cocklin, 2008), and that a clear purpose and vision can engage the organization with the intended change, and can enhance stakeholder collaboration (Kraaijenhagen et al., 2016). During this research it has become clear that Frames' purpose of seizing the numerous opportunities in the oil & gas industry, that were there for decades, no longer fits current times. This lack of clear purpose, and related to this a proper vision, goals and ambitions, make it difficult for employees to exploit future activities, contribute to ensuring business continuity, and for placing sustainability within the business. A lack of coherence between the BU's and the Frames holding was also seen, which could be improved by establishing a common purpose.

Furthermore, the current purpose and vision are directed towards the oil & gas industry, which is visible in the tagline of 'a family of oil & gas solutions'. This does not fit with (potential) activities directed towards sustainability, such as energy storage, water treatment, and the renewable energy activities of FRES. During the SBM workshop, participants already determined that a new purpose could be 'the supply of technologies to enable energy supply and availability'. This redefinition of purpose should consider the role of sustainability and can be initiated by the board of directors, together with different stakeholders throughout Frames and the BU's.

The second recommendation would be to take a proactive approach to sustainability. It was found that the importance of sustainability was acknowledged by the participants in this research, that many ideas for sustainability roam around in the Frames network, and that an SBM could be a way of dealing with current pressures experienced in and around the organization. By spreading the purpose, vision, goals and ambitions throughout the stakeholder network, the network will become aware of the

fact that sustainability is something that the business wants to pursue. This can battle the barrier of sustainability unawareness, and help further develop the proposed SBM in section 4.3.

This proactive approach also involves making resources, such as personnel, time and funds available, and selecting ambassadors to help lead the change. It also involves facilitating bottom up ideas, and internal and external stakeholder interaction. The SBM workshop had this approach and was received with much enthusiasm and generated many ideas.

The third recommendation continues on this, and is to communicate and market the approach to external stakeholders. This can help induce collaboration for sustainability in the form of partnerships with stakeholders such as academia, and engaging in dialogues on the energy transition with e.g. government and industry partners. It could also be used to attract customers. Here it is important to distinguish between the new and existing markets. For example, renewable energy can either come in the form of electricity or molecules, but each will require different technologies, products and market approaches.

The fourth recommendation concerns tackling the SBM barriers, such as unawareness, conservative industry, supply chain dependencies, culture, and short term mindsets. By taking a proactive approach, and engaging the stakeholder network, Frames can start managing the change and attempt to overcome these barriers. This could involve educating employees, suppliers and customers about sustainability, and providing them with best-practice examples. For the customer this could also include making them offers that carefully match their purpose and sustainability ambitions. In this way the customers could become more inclined to pursue these ambitions, and start walking the talk, which will in turn also allow Frames' to exploit more sustainable activities.

Finally, it is recommended for Frames not to be reluctant, but to embrace the concept of SBMs, its underlying concept of value, and to welcome experimentation. Working with SBMs is a continuous process, and experimentation implies taking risks. However, sticking to the current BM also implies risks. Redefining the BM by including sustainability may be the way to ensure business continuity, renew profits and growth, contribute to sustainable development, and as illustrated by Chesbrough (2010, p.362), escape the 'trap' of the current business model.

6. Conclusion

This research has attempted to extend the research field of SBMs, by addressing the gap in literature of the construction of SBMs in the oil & gas industry. The current pressures of oil price volatility and sustainability, oil & gas companies should opt for new ways of doing business. This can be done in the form of innovating their business models for sustainability, where economic, social, and environmental value is created for the business and its stakeholder network. In this research this was studied through the following research question:

What sustainable business model can be constructed in the oil & gas industry and how can it be achieved?'

Three sub-questions were formulated to help answer this research question, which were addressed through the case study of Frames, the concepts of value mapping, SBM archetypes, interviews and the SBM workshop. The answers to each sub-question are discussed below, followed by a general answer to the research question.

Sub-question 1

The first sub-question '*What business models are currently used in the oil & gas industry?*' was answered by looking at the business model of Frames, and its elements value proposition, value creation & delivery, and value capture. Firstly, it was found that Frames value proposition consists of the provision of technology-based, customized, high quality solutions that integrate multiple parts of the chain. These are primarily provided to the upstream oil & gas industry, and are partly directed towards the renewable energy market.

Secondly it was found that Frames provides the proposed value, the value creation & delivery, through the assembly of technologies into different products. These technologies are mainly directed towards oil & gas, water flow control and safeguarding and renewable energy. One-on-one client contact and long term partner and supplier relationships are an important factor in creating and delivering the value.

Thirdly, Frames' value capture is primarily directed towards capturing economic value for the company and those directly affiliated with it. Its revenue streams are project-related, and Frames considers economic growth to be vital to the company.

Within the current business model, a focus on the stakeholder customer and economic value is predominant. The sustainability topics that are present focus on the environmental aspects material and energy efficiency and product longevity, and the social aspects safety, and misconduct in the supply chain. To sum up, for sub-question 1, it was found that the oil & gas company Frames has a more traditional business model centred around economic value creation, which does not attribute a large role to sustainability aspects.

Sub-question 2

The second sub-question '*How can the business model be innovated for sustainability?*' took a look at the SBM opportunities for Frames. Through the analysis of Frames' purpose, value missed and destroyed, value opportunities and potential SBM archetypes, several sustainability opportunities for Frames' BM were found. From this flowed an SBM, which explicitly includes value for multiple stakeholder groups: customer, environment, society, and network actors.

Here, Frames' value proposition still includes offering technology-based high quality solutions that integrate multiple parts of the chain. In addition, it includes solutions that maximize material and energy efficiency, create value from waste, and are directed more at renewables, customer service and delivering functionality. The solutions can be directed to the existing customer base in the oil & gas market, or at new customers in new markets.

To provide this value, Frames' value creation & delivery will need to focus more on marketing its sustainable solutions, and setting up new activities and partnerships that can enable these solutions. These partnerships should be directed towards knowledge exchange with new and existing parties, but with a broader range of stakeholders. Parties in the supply chain, such as suppliers, will play an important part in providing the more sustainable solutions. Also, for better business continuity, it should move away from project based work as its main activity.

By doing so, Frames can capture value for its stakeholders in the form of positive environmental impact (reduced CO_2 emissions, energy use, materials and waste), positive societal impact (knowledge exchange, welfare, increased livelihoods), and enhanced customer satisfaction. For itself Frames could achieve cost reduction, access to new markets and knowledge, the opportunity for business continuity, and renewed profits and growth.

Sub-question 3

The third sub-question was '*What barriers influence SBMs in the oil & gas industry and how can they be overcome?*'. A lack of vision, oil price volatility, conservative industry, and sustainability unawareness were frequently found barriers. For overcoming barriers to SBM construction, it was found that a proactive sustainability approach, stakeholder engagement, and setting clear visions and goals, could be helpful approaches.

Research question

Through the answering of the sub-questions above, an answer has been given to the main research question: '*What sustainable business model can be constructed in the oil & gas industry, and how can it be achieved*?' For the case study Frames, a sustainable business model could be constructed that takes into account economic, environmental, and social value for the firm and its stakeholders.

All in all, this research has shown how an SBM could be constructed in the oil & gas industry. Involving the stakeholder network, using the SBM archetypes, the concept of value mapping and investigating SBM barriers, were essential to this process.

For other companies in the oil & gas industry, it is recommended to use this approach to construct an SBM. These oil & gas companies should realise however, that using the concept of SBMs is an ongoing process, which requires continuous reconstruction, adjustment and experimentation, in order to move to a more sustainable business. In turn this can help reformulating the way of doing business, contributing to the sustainable development of the business and society.

Furthermore, it was found that there are many barriers to SBM construction in the oil & gas industry, such as conservative industry and sustainability unawareness. Taking a proactive approach to sustainability and engaging stakeholders, could help overcome such barriers that hamper the achievement of the construction process.

For further research the author suggests to study other companies in the oil & gas value chain, address the implementation of SBMs in the oil & gas industry, and devote a study to barriers for SBMs in the oil & gas industry. In this way the author expects that SBMs could become one of the tools that can reverse the current negative sustainability role of companies in the oil & gas industry, into a much needed positive one.

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8. Appendices

Appendix 1 – Interview format

Depending on the stakeholder, their position in the organization and their knowledge on Frames, different questions were asked. The general outline for both internal and external interviewees is found below, with an indication of questions for internal and/or external stakeholders. This outline was translated from Dutch.

General

Internal + external

1. How would you/your company define sustainable development?
2. What is your role within COMPANY and how long have you been active in this role and in the company?
3. What are the activities of COMPANY? And what is your relation to Frames?

Purpose

Internal + external

4. Why does COMPANY exist?
5. What is the long term goal of COMPANY and what are the ambitions?
6. How do you see the oil & gas industry in the future?

Sustainability

Internal + external

7. What are the drivers of COMPANY to contribute to sustainable development?
8. How is sustainability experienced at COMPANY?
9. In what ways are sustainability implemented at COMPANY? Are there sustainability criteria?
10. When looking at the SBM archetypes, what are the opportunities for the Frames network to contribute to sustainable development?

Business model Frames

Internal

11. **Value proposition**: What value is provided and to whom?
    - What value is provided to customers (e.g. products/services)?
    - To other stakeholders: investors, shareholders, partners, society, environment etc.
    - On which customers do you focus?
    - What kind of relationships do you have with your customer?

12. **Value creation & delivery**: How is value provided?
    - What are the most important activities for delivering value?
    - Resources (e.g. human, financial, physical, intellectual)
    - Distribution channels: through what channels are the customers targeted

- Partners & suppliers: do you make certain choices to execute your core business well?
- Technology & product features

13. **Value capture**: How do make money and capture other forms of value?
    - Cost structure (e.g. cost-driven, value driven, fixed/variable costs, economies of scale/scope)
    - Income structure (e.g. pay per product/use/service)
    - What value is provided for key actors
    - Growth strategy ethos: e.g. focus on growth, growth less important than innovation, no focus on growth.

External

14. What value does Frames create for you, how do they do this, and in what ways do you benefit from this?
15. How does Frames differentiate itself compared to other similar parties you collaborate with?

Internal + external

16. In what way does Frames distinguish itself from the competition?
17. To what extent is there a difference between the renewables and oil & gas market? Which attention points are there when manoeuvring from oil & gas towards renewables?

Collaboration and shared value creation

Internal + external

18. What economic, social, and environmental opportunities for value creation are currently missed in the Frames network? E.g. capacities are underutilized, valuable materials are lost, pollution.
19. In what way could the Frames network convert these values into opportunities for new value creation? With which current or new parties?
20. What benefits are there for collaborating with the network? What are the potential costs and risks?
21. Wat could Frames learn from other parties (competitors, suppliers, customers, industries etc.) to enhance sustainability and create more value for the stakeholder network?

Barriers

Internal + external

22. What internal and external barriers are there now or in the future for Frames, its network and the oil & gas industry to contribute to sustainable development?
23. e.g. turbulent times in oil & gas can cause short term thinking, halting long term thinking necessary for sustainability
24. What efforts are made to overcomes the aforementioned barriers, in order to move in a more sustainable direction?

Appendix 2 – Interview invitation attachment

Sustainable business model archetypes

Figure 1 presents the sustainable business model archetypes as described by Bocken et al. (2014). These 8 archetypes are typical examples of sustainable business models found at different types of companies. They are categorised under their innovation type: *technological*, *social*, or *organisational*. Under the archetypes examples of the archetype found in practice are presented. To increase the sustainability of the business model a combination of the archetypes is highly desirable.

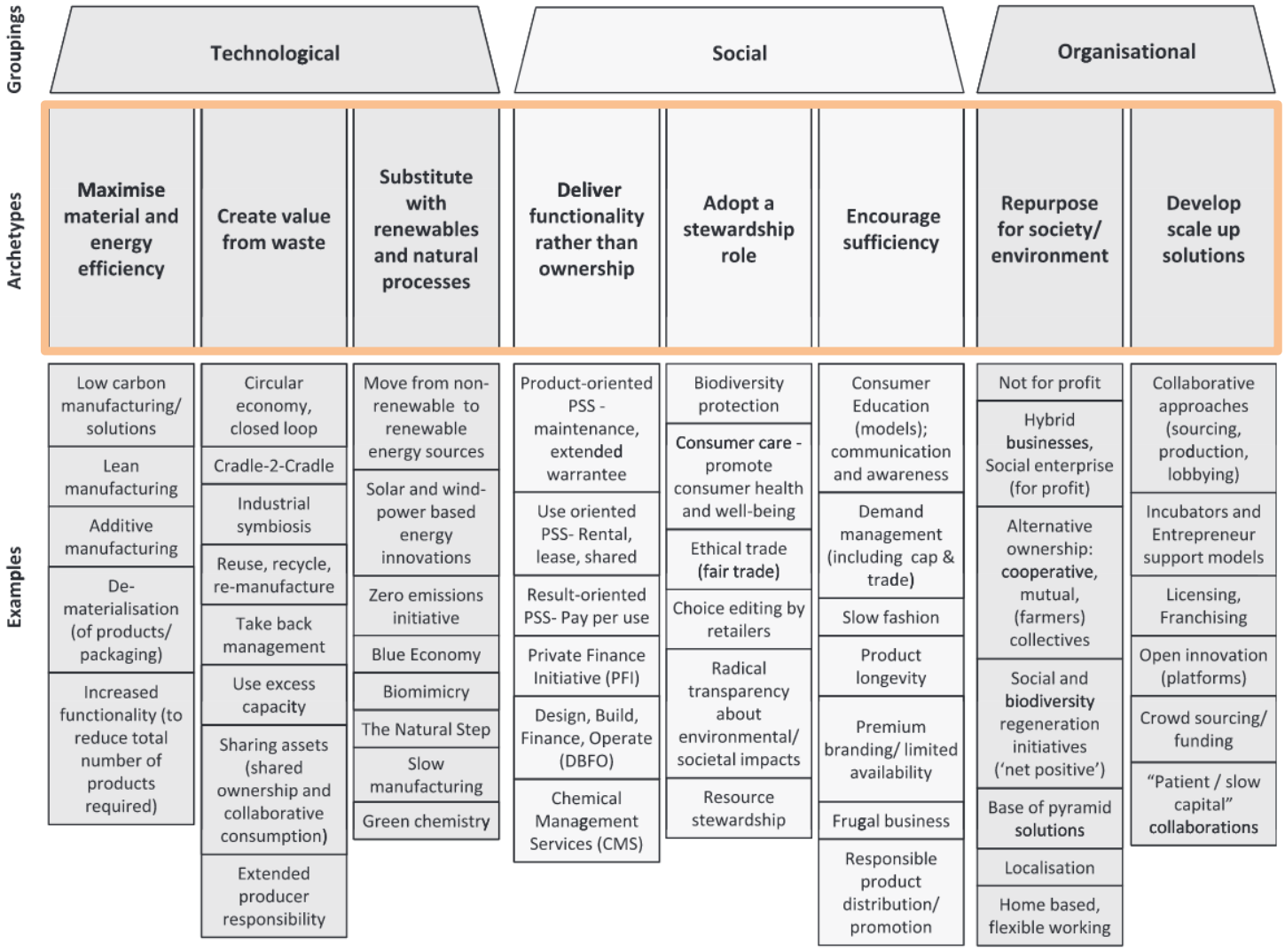


Figure 1: Sustainable business model archetypes (Bocken et al., 2014, p. 48)

Below you will find definitions of each archetype:

Technological

1. **Maximise material and energy efficiency**

Do more with fewer resources, generating less waste, emissions and pollution.

2. **Create value from waste**

The concept of 'waste' is eliminated by turning waste streams into useful and valuable input to other production and making better use of underutilized capacity

3. Substitute with renewables and natural processes
Reduce environmental impacts and increase business resilience by addressing resource constraints 'limits to growth ' associated with non-renewable resources and current production systems.

Social

4. Deliver functionality rather than ownership
Provide services that satisfy users' needs without having to own physical products.
5. Adopt a stewardship role
Proactively engaging with all stakeholders to ensure their long-term health and well-being.
6. Encourage sufficiency
Solutions that actively seek to reduce consumption and production.

Organisational

7. Repurpose for society/environment
Prioritizing delivery of social and environmental benefits rather than economic profit (i.e. shareholder value) maximisation, through close integration between the firm and local communities and other stakeholder groups. The traditional business model where the customer is the primary beneficiary may shift.
8. Develop scale up solutions
Delivering sustainable solutions at a large scale to maximise benefits for society and the environment.

Source:

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

Appendix 3 – Workshop: Brainstorm topics explanation

Value Mapping Brainstorm Topics

This document provides an explanation of the 4 concepts of the Value Mapping Tool. During the SBM workshop the simplified version of the tool will be used. Figure 1 provides an example of the tool which has been filled in for the case of LED lights.

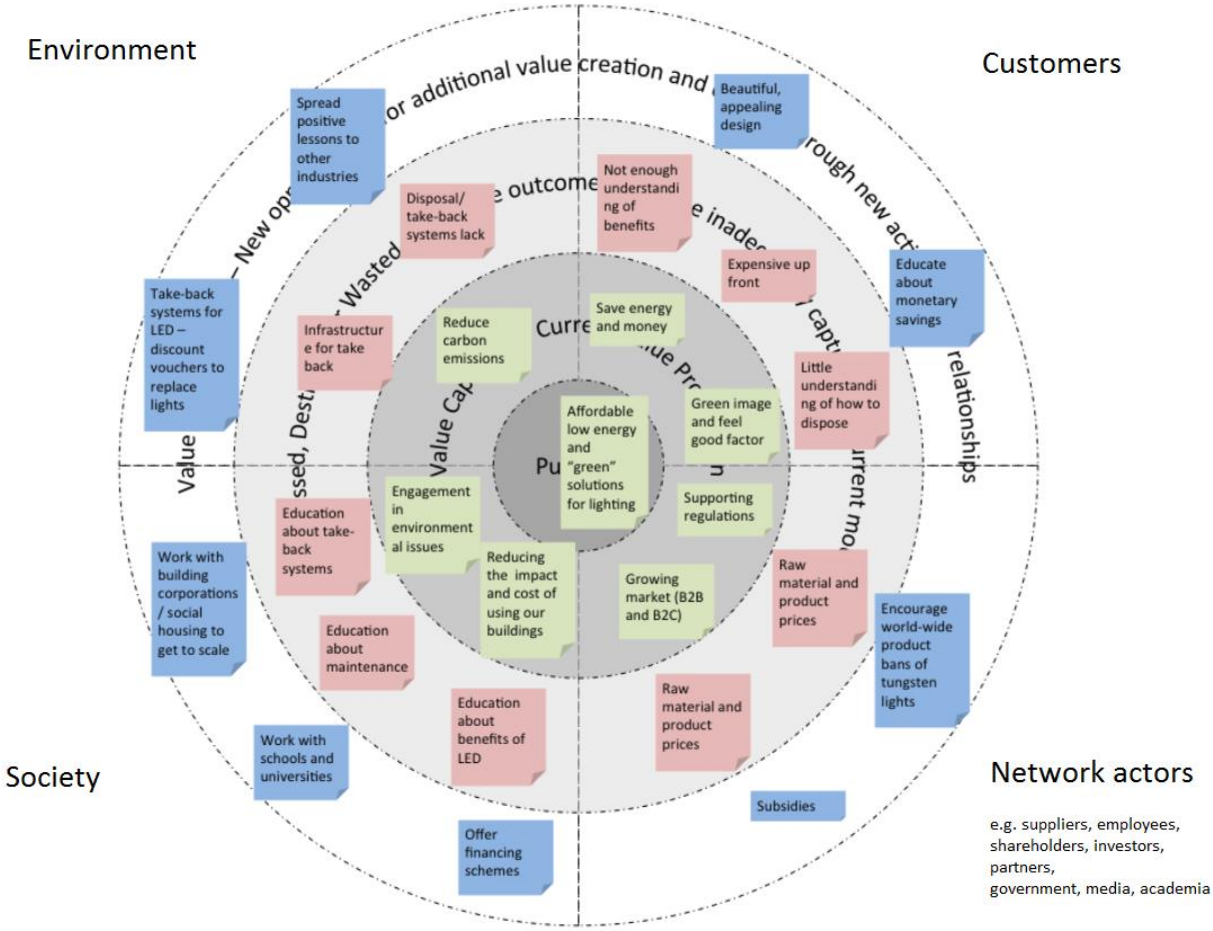


Figure 1: Populated example of the Value Mapping Tool for the case of LED lights (Bocken et al., 2013)

Brainstorm 1: Purpose

Here the purpose of the business is discussed. The purpose is about more than just profits and making money, so the purpose should contain different aspects.

The following questions can help determine the purpose:

- Why is the business here in the first place?
- What is the primary reason(s) for the existence of the business and its network of stakeholders including the value chain?

- What is the product or service offered?
- Why should any of your stakeholders, particularly a customer, care about the existence or continuation of the business network?

Brainstorm 2: Value captured

Here the value captured for each stakeholder should be determined. Value captured describes cases where an effective value exchange takes place from which stakeholders benefit.

The following questions can help determine the value captured for each stakeholder:

- What positive value is created?
    - For example, why does your customer buy the products and services offered (e.g. enjoyment in use, belonging to a group that buys a brand)
    - What do you offer society, the environment, suppliers, employees etc.
- Does the business network mitigate or offset some negative outcomes in full or in part (such as carbon emissions)?
- Also consider forms of joint and contradicting value. For instance, product durability is desirable for the customer, but might not be affordable. Leasing could make durable products more readily available.

Brainstorm 3: Value missed + destroyed

Here the value missed and destroyed (negative outcomes) is determined for each stakeholder.
Try to identify cases where there is a 'joint' or similar value missed or destroyed to create win-win situations (e.g. pollution has negative environmental and social effects)
Trade-offs can also be identified between positive and negative value *(*e.g. technology improvement versus cost increase; or environmental impact reduction version negative societal impact)

Value missed

The following questions can help determine the value missed for each stakeholder:

- Is the business missing an opportunity to capture value in its existing operations?
- Or is it losing or wasting value in its existing operations?

Examples:

- customers are not receiving what they really want
- assets, resources, capacity and skills are underutilized
- employees, suppliers and partners operating below best practice
- potentially useful materials such as by-products are discarded as waste
- value is created that is not desired or noticed by stakeholders
- stakeholders fail to receive benefits from the network

Value destroyed

The following questions can help determine the value destroyed for each stakeholder:

- What are the negative outcomes of the business for any of your stakeholders?
    - *Consider for example, environmental impacts such as pollution, or loss of local employment caused by offshoring or global outsourcing.*
- Is there a potential or perceived risk of value being destroyed by continuing 'business as usual' practices – think of risk of reputational damage, loss of customers, profitability and market share, risk of regulatory change.
    - *E.g. in agriculture there is a potential risk, as yet still under debate, that use of pesticides may damage the bee population required for crop pollination*
- What are the impacts generated by each of your key suppliers/partners/distributors/customers on the environment and society and others?
    - *E.g. inadequate working conditions and water pollution in the supply chain*
- Are there contradicting impacts at the local versus national and global level?
    - *E.g. something may be considered good for the environment or society at a global level (e.g. climate change mitigation), but devastating at a social development level.*

Brainstorm 4: New value opportunities

Here the new value opportunities for the network can be determined. Consider those options that create the greatest value for the whole network of stakeholders (i.e. how can everyone benefit). The new opportunities can on the one hand be derived from the values identified in the previous steps, and on the other hand through the introduction of completely new activities.

The following questions can help determine the new value opportunities for each stakeholder:

Review the output of the previous steps (value created, destroyed and missed) and consider:

- How could existing value created be enhanced further;
- how could destroyed value be eliminated;
- how could missed opportunities be converted into new value to be captured?

What new positive value might the network create for its stakeholders through introduction of new capabilities, activities and relationships? For example:

- How might emerging technologies offer potential solutions?
- How might new partnerships and collaboration offer potential solutions?
- How might new customers or markets be targeted?
- How might relocation of activities assist (outsourcing, offshoring, on-shoring, localised production)?

Learning from others

- What can you learn from competitors, suppliers, customers or even other industries to enhance stakeholder alignment and sustainability outcomes?
- How are they doing things differently to create new positive value, and reduce or eliminate negative value?
- How might innovations from other industry sectors be applied?
- What additional value proposition might create differentiation from the competition?

Appendix 4 – Workshop Schedule

Schedule - Sustainable Business Model Workshop

Frames, Alphen a/d Rijn, Thursday July 14th 2016

Time	Minutes	Activity
12.30 - 12.45	15m	Participants grab lunch Introduction by Ratna Participant introduction round
12.45 - 13. 00	15m	Instructions on the value mapping tool
13.00 - 13.30	30m	**Brainstorm 1: Purpose** 1m Ratna introduces topic 10m brainstorm 15m each group sends a representative to present their ideas (3m each) + questions from other groups
13.30 - 14.00	30m	**Brainstorm 2: Value created** 1m Ratna introduces topic 10m brainstorm 15m each group sends a representative to present their ideas (3m each) + questions from other groups
14.00 - 14.30	30m	**Brainstorm 3: Value missed + destroyed** 1m Ratna introduces topic 10m brainstorm 15m each group sends a representative to present their ideas (3m each) + questions from other groups
14.30 - 15.00	30m	**Brainstorm 4: New value opportunities** 1m Ratna introduces topic 10m brainstorm 15m each group sends a representative to present their ideas (3m each) + questions from other groups
15.00 - 15.15	15m	**Commitments + End** What did you learn and what will you do next to promote sustainable development within your business environment? Thank you and goodbyes!

Sustainable Business Model Workshop

As a part of the master thesis research:
Towards the construction of a sustainable business model in the oil & gas industry

Thursday July 14th 2016

Ratna Timmermans
MSc candidate Sustainable Business & Innovation

Universiteit Utrecht

FRAMES
a family of oil & gas solutions

Welcome!

Schedule

12.30 - 12.45 *Introduction*
12.45 - 13.00 *Instructions*
13.00 - 13.30 *Brainstorm 1: purpose*
13.30 - 14.00 *Brainstorm 2: value created*
14.00 - 14.30 *Brainstorm 3: value missed + destroyed*
14.30 - 15.00 *Brainstorm 4: new value opportunities*
15.00 - 15.15 *Commitments + end*

About my research

- Ratna, 25, Universiteit Utrecht, MSc candidate Sustainable Business & Innovation
- Master Thesis: *Towards the construction of a sustainable business model in the oil & gas industry*
- Case study Frames
- Data collection: interviews with Frames stakeholders

Why the workshop?

- Workshop as a follow up for the interviews, additional value is in its interaction
- I will take pictures of the results, and send these and a summary of the findings to all participants
- In October you will receive a copy of my thesis

Goal of this workshop

To collect the ingredients for a SBM for Frames, so that Frames and its network can contribute to sustainable development.

Everybody is primarily here for research purposes and as an individual, so please don't feel restricted during the workshop so we can make this a fruitful process!

Confidentiality - Chatham House Rule
When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed

Introduction round

In a few sentences state:

who you are
what you do
why you decided to attend this workshop
your interests in sustainability and sustainable business

A Sustainable Business Model

Value proposition	Value creation & delivery	Value capture
1. Product/ service, 2. Customer segments and relationships, 3. Value for customer, society, and environment *What value is provided and to whom?*	4. Activities, 5. Resources, 6. Distribution channels, 7. Partners and suppliers, 8. Technology and product features *How is value provided?*	9. Cost structure & revenue streams, 10. Value capture for key actors incl. environment & society 11. Growth strategy/ ethos *How does the company make money and capture other forms of value?*

Sustainability: people, planet, prosperity, time

- Economic, social & environmental value
- Value network perspective: stakeholder approach
- Improvement sustainability performance, competitive advantage

Frames' Business Model

Frames is a B2B company in the international upstream oil & gas industry, 5 business units, 350 employees

FRAMES
a family of oil & gas solutions

Value proposition

- Technology based customized solutions for the upstream oil & gas industry, specifically provided to the market segments onshore, offshore and floaters.
- Added value in offering multiple portions of the value chain

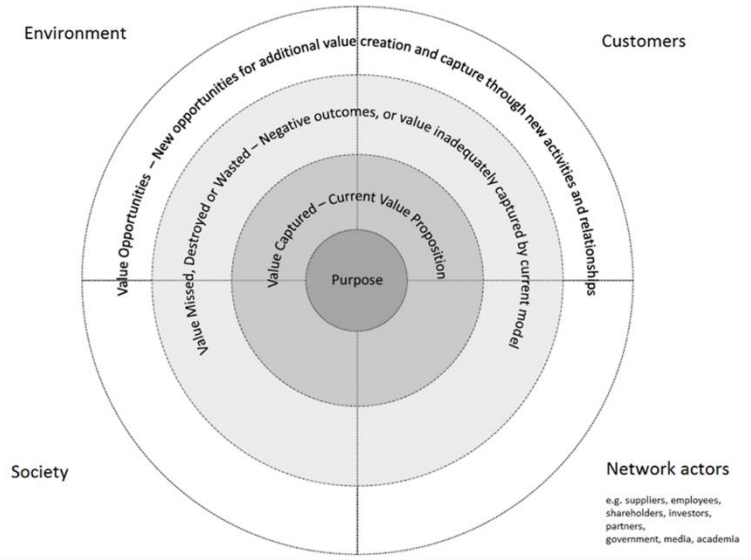
Value creation & delivery

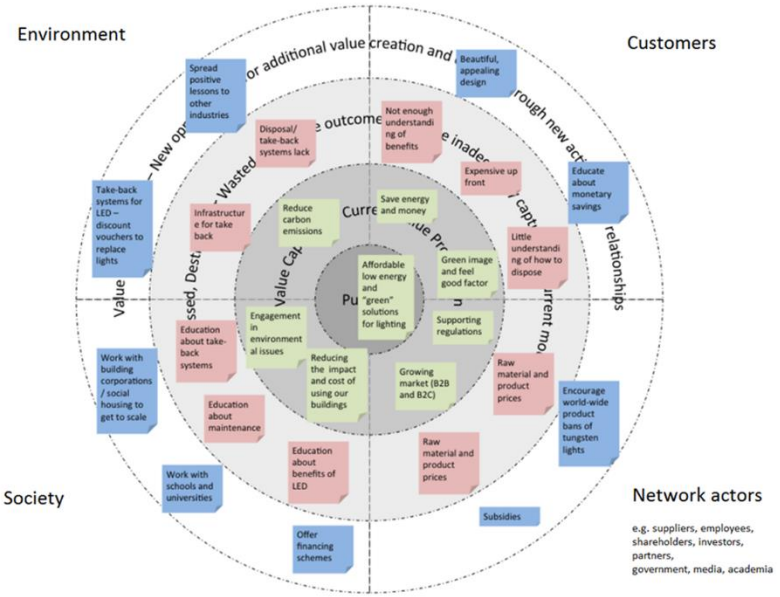
- Assembly of technologies into an end product ranging from single products to total plants
- One on one client contact and long term partner/supplier relationships
- Main technologies are directed at oil & gas, water, flow control and safeguarding and renewable energy (primarily biogas treatment and upgrading)

Value capture

- Project-based revenue streams
- Knowledge transfer, jobs and income, energy access, efficiency and process optimization

BM innovation for sustainability





How to use the VM tool

- Each circle on the poster represents a brainstorm session
- For every concept (circle) you will have 10m to brainstorm with your group
  - Note: consensus is not required, so different ideas may emerge. The groups are in place to discuss ideas, and to inspire and support one another
- Write your ideas on the post-its
  - Green = Purpose, Blue = Value captured, Orange = Value missed and destroyed, Pink = New value opportunities
- Stick them on the circle of the active brainstorm session and the stakeholder quadrant the value applies to.
- Try to cover all stakeholder quadrants, if you don't know write a **?** on the post-it.

After each brainstorm

- 15m is reserved for presenting ideas and questions
- Each group will present its ideas in 3m - select a representative to present
- Questions can be asked by other groups for clarification

Group division

- Each group contains 1 external stakeholder and is appointed 1 additional stakeholder focus, based on the external stakeholder's background.
- This stakeholder focus should be a specific attention point for each group during the brainstorms, next to the participants' own perspectives.

Group 1 (4p)	Additional stakeholder focus
P1, P2, P9	Environment
Group 2 (3p)	
P3, P4, P10	Customer
Group 3 (3p)	
P5, P6, P11	Supplier/network actors
Group 4 (3p)	
P7, P8, P12	Society

Brainstorm 1: Purpose

10m brainstorm | 15m presentation and questions

Task: Determine the purpose of Frames

Note: The purpose is about more than making money, so it should contain different aspects.
Also consider how the purpose of the BU's connects to the Frames purpose.

Possible supportive questions:

- Why is the business here in the first place?
- What is the primary reason(s) for the existence of the business and its network of stakeholders including the value chain?
- What is the product or service offered?
- Why should any of your stakeholders, particularly a customer, care about the existence or continuation of the business network?

Brainstorm 2: Value captured

10m brainstorm | 15m presentation and questions

Task: Determine the value captured for different types of stakeholders

Possible supportive questions:

- What positive value is created?
- Does the business network mitigate or offset some negative outcomes in full or in part (such as carbon emissions)?
- Also consider forms of joint and contradicting value. For instance, product durability is desirable for the customer, but might not be affordable.

Brainstorm 3: Value missed and destroyed

10m brainstorm | 15m presentation and questions

Task: Determine the value missed and destroyed for Frames and its network

Possible supportive questions:

Value missed

- Is the business missing an opportunity to capture value in its existing operations?
- Or is it losing or wasting value?

Value destroyed

- What are the negative outcomes of the business for any of your stakeholders?
- Is there a potential or perceived risk of value being destroyed by continuing 'business as usual' practices
- What are the impacts generated by each of your key suppliers/partners/distributors/customers on the environment and society and others?

Brainstorm 4: New value opportunities

10m brainstorm | 15m presentation and questions

Task: Determine new value opportunities

Possible supportive questions:

- How could existing value created be enhanced further;
- How could destroyed value be eliminated;
- How could missed opportunities be converted into new value to be captured?
- What additional value proposition might create differentiation from the competition?
- What new positive value might the network create for its stakeholders through introduction of new capabilities, activities and relationships?
- What can you learn from competitors, suppliers, customers or even other industries?
- What would need to be done to completely eliminate negative externalities?

Commitments

What would you be willing to commit to in order to contribute to sustainable development in your business environment?

- tell your colleagues about this workshop
- set an example within the company: facilitate waste separation, compensate your flight's emissions, serve more vegetarian/plant based meals

Core business related:

- consider less short term profits to facilitate sustainability and long term profits
- position yourself from an oil & gas company towards a (renewable) energy company

Suggestions (based on the workshop)?