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SCHOOL OF BUSINESS, ECONOMICS AND LAW

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Business Model Innovation in the Context of Sustainable Development

A case study of how a business model is modified when a corporation commits to bringing a sustainability innovation to market.

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BUSINESS MODEL INNOVATION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT
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Abstract

Sustainable development is a driving force of innovation and innovation has long been seen as a success factor for sustained competitive advantage. Further, the successful diffusion of innovations with environmental and social benefits holds the promise of transformational change which could lead to self-reinforcing feedback loops of sustainable development and innovation. Business models are subjects of innovation and are also regarded as necessary mediators between sustainability innovations and a business case for sustainability. Through a case study of an incumbent firm within the asphalt industry, I aim to understand the process of business model innovation and to outline sustainability driving forces that affect the process. Further, I aim to outline the challenges which face an organization that attempts to appropriate value from a sustainability innovation. The theoretical notions of sustainable development, sustainability innovation, business model and business model innovation are explored and the business model innovation process of a sustainability innovation within AkzoNobel Asphalt Applications is explained. The driving forces behind the development of the sustainability innovation as well as the challenges for it to gain market success are elaborated upon. The main findings of this thesis are:

- The business model innovation process at AkzoNobel Asphalt Applications has occurred through an evolutionary process triggered by external forces. The evolution occurred due to product development of a sustainability innovation.
- There are three main challenges facing market diffusion and value appropriation of the sustainability innovation explored in this thesis.

Keywords: Sustainable development, Business model, Business model innovation, Sustainability innovation, Driving forces of sustainable development, Appropriating value from sustainability innovation, innovation lifecycles

To all those relationships that I weakened or destroyed, I am sorry. It was not worth it, I can see that now.

To all those relationships that I created along this process, thank you!

Table of Contents

1. Introduction.....	8
1.1 Background.....	8
1.2 Line of Thought.....	8
1.3 Purpose.....	10
1.4 Research Questions	10
1.5 Delimitations	11
1.6 Logic of This Thesis	11
1.7 Disposition	12
2. Case Introduction	13
2.1 Background.....	13
2.2 Sustainable Development	13
2.3 Thesis Focal Point	14
2.3.1 Asphalt concrete.....	15
2.3.2 Asphalt Applications’ operational industry in Sweden: A short overview	18
2.4 Chapter Summary.....	19
3. Methodology	20
3.1 Philosophical Starting Point.....	20
3.1.1 Approaching theory.....	20
3.2 Systemic Combining and a Qualitative Strategy	21
3.3 Research Design	21
3.4 Research Methods and Data Collection	22
3.4.1 Interviews	22
3.4.2 Documents	23
3.4.3 Direct observations	24
3.4.4 Case selection.....	24
3.5 Data Analysis	25
3.6 Research Quality.....	25
3.6.1 Validity.....	25
3.6.2 Reliability	26
3.6.3 Research ethics.....	26
3.7 Chapter Summary.....	27
4. Theory.....	28
4.1 The Business Model.....	28

4.1.1	Different perspectives on the business model.....	29
4.1.2	The business model building blocks	31
4.1.3	The business model elements	35
4.1.4	Connecting the elements and building blocks into a canvas	37
4.2	Business Model Innovation	38
4.2.1	Business model innovation – process or result?	39
4.2.2	When does the business model innovation “occur”?	39
4.2.3	Perspectives on the process of business model innovation	42
4.2.4	Factors affecting a business model	44
4.2.5	Principles for business model innovation for sustainable development	49
4.3	Sustainable Development in a Business Context and Sustainability innovation.....	50
4.3.1	The relevance of sustainable development for business?	50
4.3.2	The need for public policy to support sustainable development	51
4.3.3	Sustainability innovation	52
4.3.4	Appropriating value from product innovation	54
4.4	Chapter Summary.....	60
5	Empirical Findings.....	61
Part I	61
5.1	The Business Models	61
5.1.1	The HMA adhesion promoter Wetfix	61
5.1.2	The WMA additive Rediset LQ.....	65
Part II	69
5.2	Business Model Innovation	69
5.2.1	Defining sustainable development.....	69
5.2.2	Driving forces for sustainable development	70
5.2.3	Defining business model innovation at AkzoNobel Asphalt Applications.....	72
5.2.4	Development of the Rediset-product family.....	72
5.2.5	Other factors affecting a business model	74
5.3	Appropriating Value from Sustainability Innovation.....	77
6	Analysis.....	82
Part I	82
6.1	A Static Comparison of Business Models	82
6.1.1	Overview and analysis of differences in the mapped business models.....	83
Part II	89

6.2 An Attempt to Explain the Differences.....	89
6.2.1 A brief analysis from an innovation lifecycles perspective	89
6.2.2 Exploring some of the challenges of appropriating value from Rediset LQ.....	91
6.2.3 Setting the scene for a process analysis.....	97
Part III	99
6.3 Business Model Innovation	99
6.3.1 Sustainable development drivers of WMA-technology R&D at Asphalt Applications	99
6.3.3 An evolutionary perspective on the identified differences in business model elements..	102
6.3.4 Further challenges of appropriating value from Rediset LQ	109
6.4 Connecting the Parts	110
7 Wrap Up	112
7.1 Conclusion	112
7.2 Discussion	115
7.2.1 Regarding method	115
7.2.2 Regarding theory	115
7.2.3 Regarding analysis	116
7.3 Future Research.....	116
References.....	118
List of figures	128
Appendixes	129

1. Introduction

This chapter presents a general background to the case study and the line of thought along with the aim and purpose of the research questions. Furthermore, the delimitation and an explanation of the thesis structure as well as the disposition are presented in this chapter.

1.1 Background

Extractive and material-intensive industries such as mining, chemicals and transport are increasingly regarded to be environmentally non-sustainable. A majority of the corporations within these industries were established and developed during a time of access to cheap energy and a belief that there was an abundance of raw materials (Hart and Milstein, 1995). However, with the passing of time an understanding of the scarcity of resources (Rockström and Wijkman, 2012) and an increase of the prices of fossil fuels such as oil can be expected (bp.com/statisticalreview, 2013). Thus, industries built on an old logic need to rethink the social and environmental impact of their activities in order to stay competitive (Hart and Milstein, 1995). Innovation has long been seen as a success factor for sustained competitive advantage (Dodgson et al., 2008). Shifting innovation activities towards a more sustainable direction is increasingly regarded as desirable by business and policy makers alike, in order to create business opportunities and mitigate the negative effects of economic growth (Barbier, 2011; Hekkert and Negro, 2008; SustAinability 2014).

A business model, although lacking an established definition (Amit et al., 2011; Schneider and Spieth, 2013; Teece, 2010), is regarded as an abstract concept which specifies the core logic of an organization (Gassmann et al., 2012) where the creation and capturing of value is central (Chesbrough, 2007). By shifting the elements of the core logic through innovation, an incumbent organization can become more sustainable (Hart and Milstein, 1999; Lovins et al, 1999; Sommer, 2012; Stubbs and Cocklin, 2008, SustAinability, 2014). There are some authors (Abernathy and Utterback, 1975; Gassman et al, 2012; Montignon et al., 2010; Sosna et al., 2010) who explain how the process of core logic change can occur however, few connect this process to sustainable development. In this thesis I aim to explore the connection between sustainable development and changes in a business model of an incumbent firm within the extractive and material-intensive industries.

1.2 Line of Thought

We live in volatile times where the ways we organize society and the economy today fall short on dealing with climate disruption, population growth and growing inequality between the rich and the poor (Rockström and Wijkman, 2012; Boons et al., 2013; OECD, 2008). These global trends together with large changes in the nature of technologies and policy continue to create fundamental shifts in how business is done (Sommer, 2011; SustAinability, 2014). In the light of these challenges sustainable development has gathered increasing interest. The motivation lies within the desire of trying to understand how technology and social practices enable societies to become more sustainable (Boons et al., 2013) since technology and social practices potentially lead to self-reinforcing feedback loops, so called virtuous cycles (Hekkert and Negro, 2008). In the report *Our common future* sustainable development is defined as “...development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (WCED,

1987:41). Thus, sustainable development is seen as a process of change where *“the exploitation of resources, the direction of investments, the orientation of technological development; and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations.”* (WCED, 1987:43).

According to Hart and Milstein (2003) a firm needs to simultaneously deliver economic, environmental and social benefits in order to be sustainable. Therefore, a sustainable organization *“creates profit for its shareholders while protecting the environment and improving the lives of those with whom it interacts.”* (Savitz and Weber, 2013:xvii). However, the dominant model of the corporation draws on shareholder value maximization logic where the primary obligation of the corporation is to maximize shareholder profits (Fligstein, 2001). Consequently, goals such as protecting the environment and improving the lives of those whom the corporation interacts with are subordinated to economic profits (Stubbs and Cocklin, 2008). Opposing the view of Stubbs and Cocklin (2008) Desrochers (2010:161) argues that *“business as usual”* and increased focus on reducing costs and increasing profits has historically led to *“more efficient use of materials and the continual creation of higher quality resources”*. However, Barbier (2011) highlights that the costs associated with environmental problems are not usually reflected in markets nor have regulations or institutions been adequately developed to handle these costs. Consequently, relying on the idea of *“business as usual”* is not an option. Sustainable development needs to be economically sustainable (Schaltegger et al., 2011; Bocken, 2013), however it does not force companies to trade-off profitability. Sustainability is a key driver for innovation as it forces organizations to change how they think about products, processes and business models. These changes do not only lower cost and risk but also generate revenue and/or enables companies to create new business (Nidumolu et al., 2009).

Innovations where sustainability considerations are fully integrated, so called sustainability innovations (Boons et al., 2013), are assumed to create and extend opportunities for business and are believed to have a pivotal role in industry transformation towards sustainable development. The assumed ability of sustainability innovation to contribute to transformative effects has to do with their creation of more sustainable patterns of consumption and production, as well as their contribution to new knowledge development. New knowledge together with new patterns of production and consumption can in turn trigger a virtuous cycle of technological diffusion, reinforcing sustainable development (Charter and Clark, 2007; Hekkert and Negro, 2008). Further, the transformative effects potentially mitigate market imperfections (Lüdeke-Freund 2013) which in turn are a reason of why pure profit incentives and market forces alone cannot facilitate sustainable development (Barbier, 2011). It thus appears that the relationship between sustainability and innovation is mutually reinforcing where sustainable development is a driver for innovation and innovation in turn is a potential driver of sustainable development. Although a significant uncertainty remains regarding how innovation will lead to a more sustainable society (Lüdeke-Freund, 2013), Hart and Milstein (2003) argue that sustainability needs to be incorporated within the company strategy.



Figure 1.1: Connection innovation and sustainable development

The business model serves as a tool to communicate and analyze strategic choices; as such, it can be used to understand the economic logic of production and consumption systems (Chesbrough, 2007; Wells, 2008). Thus, a business model defines how a firm creates and captures value and can therefore be regarded as a manifestation of the company strategy (Chesbrough, 2007; Davidson and Lambert, 2013) while not being equal to the strategy (Amit et al., 2011; Casadesus-Masanell and Ricart, 2009). Further, business models have a significant impact on the captured economic value available in technological innovation (Chesbrough, 2010; Wells, 2008) and ultimately on how technological artifacts are used. Affecting usage also influences stakeholders¹ perceptions of the technological artifacts and further influences how these artifacts are marketed (Boons et al., 2013). Consequently, business models act as mediators between sustainability innovations, a business case for sustainability and further sustainable development (Boons et al., 2013; Lüdeke-Freund, 2013). The business model can also be seen as a subject of innovation (Gassmann et al., 2012) and such innovation often requires conflicting systems, processes and value chains compared to existing offerings (Markides, 2006; found in Bessant and Tidd, 2013). Stubbs and Cocklin (2008) additionally assert that an alteration of the dominant economic logic involves new business models.

In summary, sustainable development is a driving force of innovation (Nidumolu et al., 2009) thus affecting how an organization creates and captures value (Chesbrough, 2010) which in turn influences knowledge development and how technological artifacts are used and produced. Thus, potentially reinforcing the process of sustainable development through a virtuous cycle (Boons et al., 2013; Charter and Clark, 2007; Hekkert and Negro, 2008; Lüdeke-Freund 2013). The business model, being a manifestation of how an organization creates and captures value, is a subject of innovation (Gassmann et al., 2012) as well as a mediator between sustainability innovations and a business case for sustainability (Lüdeke-Freund, 2013). The business model is therefore an interesting perspective to explore further in the context of sustainable development and sustainability innovations within an incumbent firm.

1.3 Purpose

This master thesis is a part of the innovation and industrial management program, which is why its central point is innovation and the main purpose is to understand the process of business model innovation. However, considering the line of thought presented in 1.2 where sustainable development is presented as a driving force of innovation (Nidumolu et al., 2009) and innovation in turn being a key towards sustainable development (Charter and Clark, 2007; Hekken and Negro, 2008; Lüdeke-Freund, 2013). Any sustainability driving forces affecting the business model process need to be understood. Furthermore, the barriers preventing AkzoNobel Asphalt Applications from appropriating value from a sustainability innovation need to be outlined as they act as possible barriers for a potential industry transformation towards sustainable development.

1.4 Research Questions

In order to establish if there has been a business model innovation and further understand the process the following question is asked:

RQ1: How is business model innovation conducted within AkzoNobel Asphalt Applications?

¹ Such as customers, competitors and regulators (Boons et al., 2013)

Following the line of thought (1.2) an understanding of potential sustainability driving forces are needed, thus the second research question is:

RQ2: Are there driving forces related to the notion of sustainable development which have potentially affected the business model innovation process at AkzoNobel Asphalt Applications?

Finally, in order to connect the research to a tangible aspect of the barriers preventing a sustainability innovation from contributing to an industrial transformation, the following question is asked:

RQ3: Why is a specific sustainability innovation not taking off in the Swedish marketplace?

1.5 Delimitations

In order to answer the research questions this thesis is limited to AkzoNobel and more specifically to how business model innovation within Asphalt Applications in Stenungsund is conducted. In an attempt to understand if any change in the business model has taken place two comparable product business models will be analyzed, one of which represents a sustainability innovation. If there is an identified difference, the process of change will be outlined. The empirical scope is limited to employees at Asphalt Applications in Stenungsund, their customers, key partners as well as government agencies in Sweden. These limitations are due to the data available through the use of snowball sampling² as well as dimensions found significant through continuous theoretical and empirical analysis.

Generally, asphalt negatively affects the environment throughout its lifecycle, from the extraction of bitumen and stone materials until exhaustion (NVF, 2000). However, the products which are in the focal point of this thesis are mainly affecting the production and paving parts of the asphalt lifecycle which is why emphasis is put on those steps. The lifecycles of the focal products themselves are not researched in this thesis due to the main focus on business model innovation, sustainable development drivers and bringing sustainability innovation to market. There is an additional limitation in terms of geographical scope connected to RQ3 where the main focal point is the Swedish marketplace. A deeper explanation to this limitation can be found in chapter 2.6.

Finally, it is important to note that this thesis has a normative bias in favor of the concept of sustainable development. In other words, it is assumed that moving towards sustainable development is necessary (Rockström and Wijkman, 2012; Boons et al., 2013) for all actors within society in order to deal with the issues of as climate disruption, population growth and growing inequality.

1.6 Logic of This Thesis

The logic of this thesis follows specific steps that were taken during the unraveling of the research questions. The first steps were to understand the external driving forces affecting AkzoNobel Asphalt Applications in general and to map the business models of the two products representing different technologies. Once the mapping was done, the differences in the business models were viewed

² Further described in chapter 3.4.4

through the lens of innovation lifecycles. In order to understand how the identified difference had occurred, thus attempting to answer RQ1, the development of the product with potential environmental and social benefits was mapped and analyzed. Using the identified external driving forces which related to sustainable development and combining them with the mapping of the product development process several sustainability drivers were identified and analyzed thus answering RQ2. Finally, several challenges of appropriating value from the focal sustainability innovation have been identified throughout the empirical data gathering. These were analyzed and connected to the line of thought in 1.2 which answers RQ3. Figure 1.2 visually shows the logic of this thesis and what the reader can expect in the final analysis.

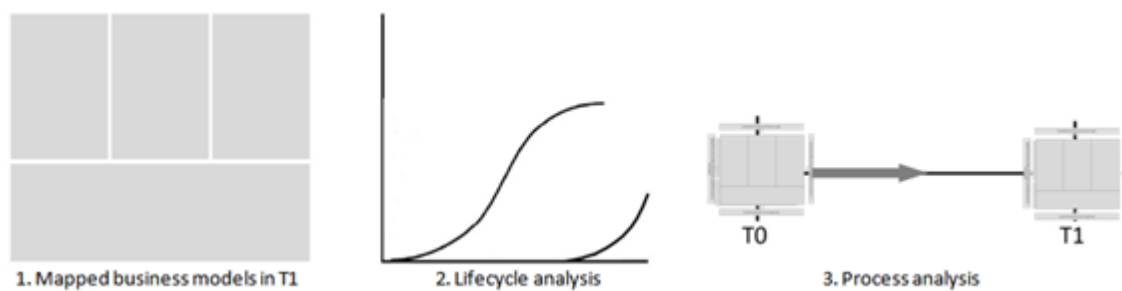


Figure 1.2: Overview of the different parts of the analysis

1.7 Disposition

The general disposition of this thesis revolves around three main themes, namely: *sustainable development*, *business model* and *business model innovation*. These themes are then developed and merged successively in the different chapters.

In order to gain an understanding of the general context of this thesis a short definition of sustainable development as well as an exploration of the case company, the chosen technology for the analysis and the industry in which it resides, is found in chapter 2 – *Case Introduction*.

Readers who are interested in understanding how this thesis was written and how data was collected will find the details in chapter 3 – *Methodology*.

In chapter 4 – *Theory*, the different theoretical frameworks used to understand the main themes are presented.

The empirical findings concerning each of the main themes are further available in chapter 5 – *Empirical Findings*.

In the subsequent analysis, found in chapter 6 – *Analysis*, the theory and the empirical findings are connected and explained. The main themes are then linked at the end of the chapter.

A final wrap up including conclusion, thoughts and self-remarks regarding this thesis and areas for future research can be found in chapter 7 – *Wrap up*

2. Case Introduction

This chapter gives a general introduction to the case company, an overview of the industry and narrows down the focal point of the products that are used in the analysis. Furthermore, a description of sustainable development is presented.

2.1 Background

The companies who constitute the chemical industry cluster in Stenungsund have developed a joint vision “Sustainable Chemistry 2030” explaining that their ambition is to work towards a fossil-independent West Sweden 2030 (Kullendorff (Ed.) 2012). AkzoNobel, one of the corporations within the cluster, has had activities focusing on sustainable development within its organization since 1993. Starting with one employee doing life cycle assessments, focusing on carbon footprints, there is now a sustainable development group (SDG) based in Gothenburg. The SDG acts as an internal expert center which provides strategic support internally and are thus an important part in the corporations work with sustainable development (AkzoNobel.com, 2014c; Interview 140522³). Further, AkzoNobel claims it has fully implemented the notion of sustainable development⁴ in their corporate strategy and aim at becoming a sustainability leader by focusing on three key areas. The areas of focus cover:

- **The environmental dimension** - *aiming at an acceleration of resource efficiency across the value chain.*
- **The social dimension** - *engaging and interacting with stakeholders in different ways.*
- **The economic dimension** - *driving innovation through the concept of eco-premium solutions.*

(AkzoNobel, 2014; AkzoNobel.com, 2014c)

Additionally the company recognizes that the journey towards becoming more sustainable will have an impact on products, processes and business models (AkzoNobel, 2014; AkzoNobel.com, 2014c). Consequently, there is a plethora of reasons as to why the thesis is concerned with AkzoNobel as a focal company.

2.2 Sustainable Development

The concept of sustainable development flavors every aspect of this thesis and it is thus of important to define the concept before moving on.

A widely used definition of sustainable development (Dresner, 2008; Jackson, 2010; Hart and Milsteen, 2003, Sommer, 2012) can be found in the report *Our common future* (WCED, 1987). Dresner (2008) argues that the definition of sustainably found in *Our common future* is rather broad and thus hard to operationalize. The authors of the report break down the concept of sustainable development into three fundamental components:

- **Environment** – *Through gradual change of the ways in which technology is used and developed the common resource base should be conserved and enhanced.*

³ An overview of the interviews can be found in table 3.1

⁴ As stated in *Our common future* (WCED, 1987). *Our common future* is also known as the Bruntland report.

- **Social equity** – *On a national level all must be allowed to meet their basic needs in terms of employment, food, energy, water and sanitation. Achieving this needs a sustainable level of population.*
- **Economic growth** – *Developing nations should be allowed a growth of equal quality to the developed nations however economic growth should be revived.*

(Sustainable-environment.org, 2014; WCED, 1987)

Thus, the critical elements of sustainable development include meeting basic needs of people, intergenerational and intragenerational equity and a recognition of environmental limits (Dresner, 2008). Although effort has been made to identify environmental limits (Rockström et al., 2009) and although people in general understand the concept equity on an emotional basis, Dresner (2008) argues that the concepts are still too fuzzy. The concept of “need” is used as an example where a Dresner (2008) states that it cannot be objectively defined or measured since it is a subjective concept. From an economist’s perspective there is no difference between needs and wants. Even if that perspective is challenged, there are still difficulties regarding when to separate the two (Dresner, 2008). Several authors (Daly, 2007; Jackson, 2009; Wijkman and Rockström, 2012) succeeded to develop the concepts of sustainable development. However, they did so by arguing that continuous economic growth on a planet with limited resources is not possible. Thus, the economic growth dimension can be regarded as being in conflict with the environmental dimension of sustainable development if one recognizes a strong sustainability paradigm and environmental boundaries. A deeper discussion regarding the concept of sustainable development and issues regarding economic growth and environmental limits are however outside the scope of this thesis.

2.3 Thesis Focal Point

AkzoNobel is a large corporation with about 50000 employees worldwide specializing in paints, coatings and specialty chemicals (AkzoNobel, 2014). Figure 2.1 gives a rough overview of how the corporation is organized in terms of business areas etc. Specialty Chemicals stand for 34% of the corporation revenues globally and the end-users are segmented into four segments: buildings and infrastructure, transportation, customer good and industrial, all of which have different sub segments. Within the business area Specialty Chemicals the functional chemicals and surface chemistry business units are located in Stenungsund (AkzoNobel.com, 2014f; Interview 140522; Interview 140505). Within surface chemistry, Asphalt Applications is a unit which specializes in doing chemical applications for the road construction and maintenance industry globally (AkzoNobel.com, 2014k).

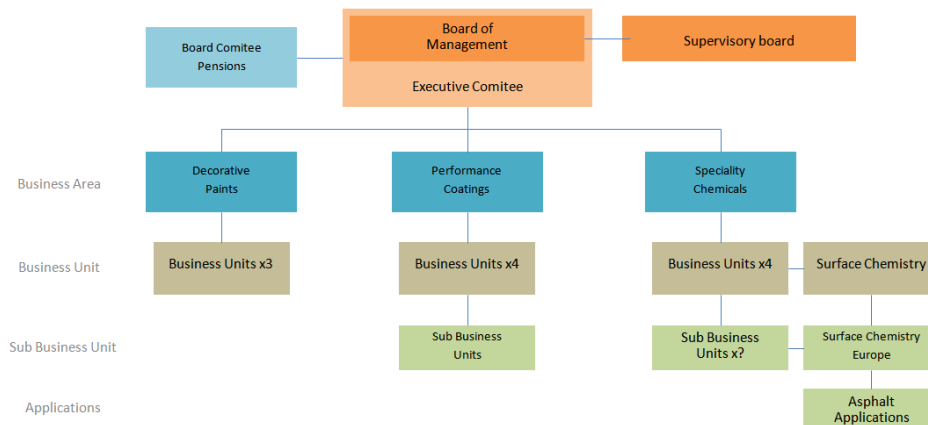


Figure 2.1: Delimited organization chart for AkzoNobel focusing on Asphalt Applications
Sources: Interview 140505; interview 140522; AkzoNobel.com, 2014f

Furthermore, the different business areas are divided into four end-user segments: *building and infrastructure, transportation, consumer goods* and *industrial*. The building and infrastructure segment include products for building interior and exteriors as well as products for infrastructure such as roads and airports (AkzoNobel, 2014). Asphalt Applications is part of the building and infrastructure segment (Interview 140527).

2.3.1 Asphalt concrete

Asphalt concrete (asphalt) is a composite material used to pave surfaces such as roads, airports and parking lots. It generally consists of 94% stone and 6 % bitumen⁵ (Asfaltskolan.se, 2014). In order to get rid of water and moist the stone material, also called aggregate (eapa.org, 2014a), together with bitumen are generally mixed at high temperatures (160-180°C) at an asphalt production plant. After production the asphalt is loaded on to trucks to be taken to the place in need of paving (interview 140604). Since the asphalt needs to be paved above a certain temperature the operational radius of plants are limited and thus some of them are mobile (interview 140521). Additionally asphalt production in Sweden is seasonal dependent and is mainly done between May-October (Ålands miljoprövningsnämnd, 2003). Further when paving asphalt; potentially hazardous fumes are released thus negatively affecting the working environment of the asphalt pavers (Naturvårdsverket, 1999; eapa.org, 2014b). Once the pavement is exhausted most of it is recycled. This traditional way of producing asphalt concrete is called hot mix asphalt technology (HMA) (NVF, 2000; interview 140521).

Asphalt properties can be enhanced in different ways and even the characteristics of bitumen can be modified (Interview 140604). The following sections include an overview of the modifications and technologies which are relevant for this thesis.

2.3.1.1 Adhesion promoters

Water is detrimental for asphalt, which is susceptible to water damage (Interview 140604). The reason is that the presence of water weakens the adhesion between the bitumen and the aggregate on a molecular level. A loss in adhesion is called stripping and leads to rutting, loss of chippings from surface dressings, washing out of and raveling of the surface layers and ultimately potholes in the asphalt surface. The asphalt deterioration is accelerated as the pavement undergoes freeze-thaw

⁵ A petroleum product

cycles (AkzoNobel.com, 2014a). The durability of asphalt concrete can be increased through the use of adhesion promoters. There are different types of adhesion promoters such as concrete, hydrated limestone and chemical compounds. Certain types of stone material attract bitumen while others do not thus chemical adhesion promoters increase asphalt durability by strengthening the chemical bonds between the bitumen and the stone material (Interview 140604). It is important to note that an adhesion promoter is required in all road surface asphalt products in Sweden due to regulation (Interview 140505; Interview 140602; Interview 140604) therefore adhesion promoters are frequently used in HMA production. AkzoNobel Asphalt Applications have several adhesion promoter products, which counteract stripping. The brand Wetfix belong to the family of adhesion promoter products which have been sold in their current form for a long period of time (AkzoNobel.com, 2014a).

2.3.1.2 WMA technologies

The emerging warm mix asphalt (WMA) technologies allow asphalt to be produced at lower temperatures (100-160°C) thus saving energy, reducing fumes developed when paving, increasing the operational radius of the asphalt production plants and increase the production season compared to hot mix. There are thus environmental, economic and social benefits connected to these new technologies (interview 140521). Some general types of WMA technologies include foaming, additives and KGO. Foaming technologies allow a lower production temperature through the injection of water into the asphalt mix. Additives, on the other hand, are used to modify the bitumen properties and KGO allows a lower production temperature by blending the asphalt components in a different order (Interview, 140614; US Federal Highway Administration, 2008). A summary of the different WMA-technologies is presented in table 2.1.

Technology	How it allows lower production temperatures
Foaming	Water is injected into the bitumen in different ways thus starting a foaming process when heated which lowers the temperature
Additives	Inserts a chemical or organic compound into the bitumen which allows the bitumen to gain similar properties as with HMA at lower temperatures. Includes adhesion promoter
KGO	By blending the asphalt components in a different order production temperature is lowered and the asphalt mass gets similar properties as with HMA

Table 2.1: *Different Warm mix asphalt (WMA) technologies.*
Sources: Interview 140604; US Federal Highway Administration, 2008

One way of classifying the WMA technologies and compare them to other technologies is through the use of temperature. The differences in production temperature as well as some of the implications are shown in figure 2.2. WMA is generally produced and mixed at temperatures around 100°C – 150°C whereas HMA is produced around 120°C - 190°C. The y-axis of figure 2.2 shows the approximated fuels consumption related to the increase of temperature, which is directly linked to

fuel costs. Further, the graph concludes the current technology development trend in Europe⁶ (eapa.org, 2014; Interview 140604).

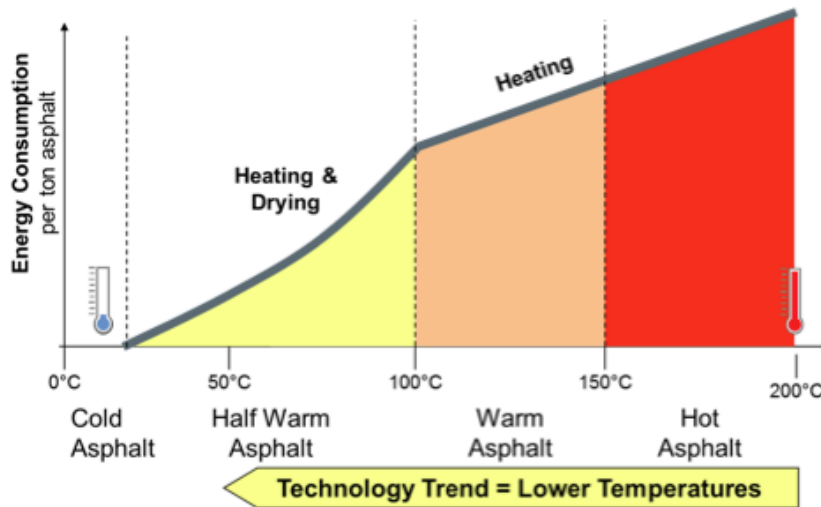


Figure 2.2: Defining WMA and HMA.
Source: Interview 140604; eapa.org, 2014c

In Sweden there are different road types with different standard requirements. As an example a runway has very strict requirements on asphalt durability since stone chips could potentially cause airplane engines to fail thus endangering human lives. In contrast, gravel roads are scarcely trafficked and the requirements for durability or need for asphalt in general is limited (interview 140521). Figure 2.3 gives a brief overview of where WMA has potential use. There are barriers however regarding proven durability of the WMA products. Since the technology is relatively novel, roads paved with WMA are relatively scarce and few have been tested for durability for longer periods of time (Interview 140521; interview 140605). AkzoNobel Asphalt Applications have developed a WMA technology additive called Rediset which is the product scrutinized further in the analysis of this thesis.

Area of possible use of a WMA-product

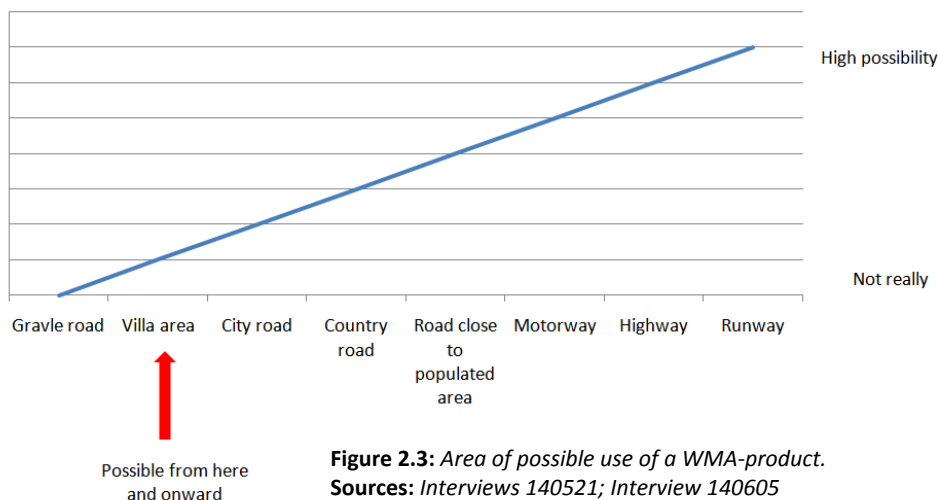


Figure 2.3: Area of possible use of a WMA-product.
Sources: Interviews 140521; Interview 140605

⁶ Consequently also Sweden

2.3.2 Asphalt Applications' operational industry in Sweden: A short overview

AkzoNobel is a global corporation that sells its asphalt products worldwide (AkzoNobel, 2014). AkzoNobel Asphalt Applications has seven laboratories available in the US, South America, Asia and Europe. However, Asphalt Applications only have two R&D Centers, which are specialized in developing new products and technology. One is located in Stenungsund (Sweden) and the other is located in New York (USA) (AkzoNobel.com, 2014b). These locations are assumed to have significant influence on the business model innovation process which this thesis aims to understand, as they are production sites and sales centers as well R&D Centers (AkzoNobel Asphalt Applications, 2014). Furthermore, due to the fact that business model innovation does not occur in a vacuum (Giesen et al., 2009; Sustainability, 2014; Wells, 2013) there is a need to sketch out an overview of the industry in which Asphalt Applications operates within. Ideally both the US and the Swedish markets would be given the same attention. However, in regards to time constraints and, as mentioned chapter 1.3, the limitations on data availability, the scope is limited to the Swedish market.

According to Statistiska Centralbyrån (SCB) the road construction industry is a part of the general construction industry, which also includes railways, harbors, sewage systems etc. (Trafikanalys, 2012; Sni2007.scb.se, 2014). The construction industry amounted to about 85-95 billion SEK in 2010 where general repair and maintenance equated to about 10-20 billion SEK (Trafikanalys, 2012). The Swedish market for maintenance, reconstruction and new construction of road coatings is a small part of the general construction industry and amounts to around 5 billion SEK/year (Trafikverket, 2011). Approximately half of that money is purchased by the state, that is to say Trafikverket, while municipalities and private actors account for the other half (Trafikverket, 2011). The municipalities account for the lion share of the approximated remaining 2,5 billion SEK/year (Interview 140521; Trafikverket, 2011). The coherent public investments in maintenance, reconstruction and new construction of road coatings has kept the market stable in face of economic turmoil and has possibly influenced parts of the market characteristics (Trafikanalys, 2012).

The market for maintenance coatings as well as new construction is seasonal dependent as it is only possible to lay asphalt during the warm months of the year⁷. Further, the market is dominated by four vertically integrated companies and characterized by high entry and exit barriers. Smaller and local actors are able to compete for contracts on regional level but have limited ability to compete for larger construction projects (Trafikanalys, 2012). Additionally, having a local asphalt production plant has a significant impact on a company's competitiveness in local and regional procurement processes (Trafikverket, 2011). The main road owners in Sweden are the government, represented by Trafikverket, and the municipalities. In the case of asphalt coatings there are additionally two more owners; air ports and large parking lot owners such as shopping malls and sports centers. Though, Trafikverket and the municipalities own the largest chunk at around 90% or more of all of the roads (Interview 140521). Thus, most of the procurements of asphalt coatings are done through public procurement (Trafikanalys, 2012). The demand of asphalt is consequently mainly regulated through public procurement which impacts the demand construction companies have on AkzoNobel's asphalt application chemicals. Public procurement in Sweden is based on EU directives (Upphandlingsbolaget Göterborgs stad, 2014) where the offer which fulfills the preset specifications and has the lowest price or is the most economically beneficial receives the contract

⁷ Roughly april-october give or take a month depending on where in Sweden construction is being made (Interview, 140521; Trafikanalys, 2012)

(konkurrentverket.se, 2014). That is to say: price is the main criteria for receiving a public procurement deal. The Asphalt Application products are in essence add-ons to the asphalt mix of bitumen and aggregate, thus increasing the cost of producing asphalt which creates incentives for construction companies to exclude or minimize their use when producing a procurement offer (interview 140521). However, as mentioned in chapter 2.4, adhesion promoters are required due to regulation in Sweden (Interview 140505; interview 140602; interview 140604). Other types of asphalt enhancement are not required as of yet.

As mentioned previously above, local anchoring is important for the competitiveness of a company in terms of winning the procured contract. Local anchoring allows a construction company to draw from local resources thus minimizing transportation costs connected to employees, machinery and production. The local ties are so important that they act as barriers of entry for other potential competitors (Trafikanalys, 2012).

In the case of maintenance and repairing coatings, the parts of Swedish road system owned by the state are divided into different areas of which all have assigned project leaders. The project leaders are responsible for monitoring the roads in their area and decide which roads need maintenance and what type of maintenance is needed. However, the project leaders have regulations regarding environmental issues and road quality set by the government. Once the need of a specific road is identified and checked with regulations Trafikverket specifies and procures the road for maintenance (Interview 140605).

2.4 Chapter Summary

The choice of AkzoNobel is due to their long term work with sustainable development, which is regarded as a three dimensional notion. Furthermore, the thesis focuses on AkzoNobel Asphalt Applications and specifically narrows down on WMA technology and HMA technology in the form of the Rediset additive and the Wetfix adhesion promoters. Rediset is interesting in the context of sustainable development since it represents a new technology, which seemingly creates environmental and social benefits relative to peer technologies such as HMA.

As for the general overview of the industry the focal point is on Sweden where there are four vertically integrated actors who act nationally and several smaller actors who mainly compete in a local context. The industry has high entry and exit barriers and is regulated in terms of environmental and road quality issues. Furthermore, the road owners are mainly public organizations that procure asphalt coatings through public procurement.

3. Methodology

A qualitative single case study needs to make effort in creating accounts for the methodology applied due to the uncertainty about how to conduct a “good” case research (Dubois and Gadde, 2014). Thus this chapter is an attempt to explain the choice of research strategy, philosophical starting point, research design, method and the general structure of this thesis. A deeper discussion regarding neglected approaches will however not be conducted.

3.1 Philosophical Starting Point

Reading several sources (Chesbrough, 2007; Daly, 2007; Dresner, 2008; Amit and Zott, 2010) the concepts of sustainable development and business model innovation are seemingly seen as social constructs which are created, recreated and reinforced by the actions of social actors. Following such logic the ontological view of this thesis is based on a constructivist position admitting that social phenomenon are produced and continuously change through social interaction of social actors (Bryman & Bell, 2011). The ontological starting point is reflected in the epistemology, which is the study of knowledge, where an interpretivistic approach is taken. Researchers adopting an interpretivistic starting point consider:

“(...) that the subject matter of the social sciences – people and their institutions - is fundamentally different from that of the natural sciences. The study of the social world therefore requires a different logic of research procedure, one that reflects the distinctiveness of humans as against the natural order.” (Bryman and Bell, 2011:16)

That being said, natural phenomenon such as climate disruption as well as resource scarcity are not seen as social constructs but are seen as forces existing independent of social actors but which develop over time and affect as well as can be affected by the actions of social actors (Rockström and Wijkman, 2012).

Business models and the operationalization of sustainable development vary across industries, being a source of competitive advantage (Chesbrough, 2010; Wells, 2013), thus making it difficult to uncover a single and objective truth. Researchers having an interpretivistic starting point usually rely on qualitative methods (Bryman and Bell, 2011).

3.1.1 Approaching theory

Bryman and Bell (2011:7) define theory as “an explanation of observed regularities”. Further the theoretical perspective is characterized by a higher level of abstraction in relation to research findings. Theory can be seen as something that influences and guides the collection of data as well as the analysis of the gathered information, thus research is done to answer a theoretical consideration. Viewing research as something that starts with theoretical considerations is called deduction and is the most common view on the relation between theory and research. However, theory also occurs after collection and analysis of data namely through induction (Bryman and Bell, 2011).

For this thesis neither a purely deductive nor a purely inductive approach was considered, instead systemic combining was used. Systematic combining is a non-linear and non-positivistic approach

which allows a researcher to set some initial preconceptions through theory while allowing them to evolve and change during a study in order to reflect the empirical observations. Further, going back and forth between theory and observations allows the researcher to gain an expanded understanding of both the theory and the empirical observations (Dubois and Gadde, 2002). I have used theory as a starting point where three main focal points of interest: sustainable development, the business model and business model innovation, were explored in theory prior to the collection of empirical data. However, during the collection of empirical data and the following analysis the theory needed to be adjusted and new theoretical understanding was needed in order to explain the empirical findings. The objective of the systemic combining approach is to match theory with empirical observations (Dubois and Gadde, 2002). Davidson and Patel (2011) describe a similar approach which combines induction and deduction. However, the first step of the approach presented by Davidson and Patel (2011) is inductive where empirical data from a specific case is used to formulate a theory from which a hypothesis is deduced and tested in other contexts.

3.2 Systemic Combining and a Qualitative Strategy

Based on preceding interest and knowledge setting some initial preconceptions, three main theoretical areas (sustainable development, business model and business model innovation) were chosen as theoretical foundation. The research within these theoretical areas was adjusted based on the empirical finding following the systemic combining logic described in 3.1.1. Further based on the philosophical starting point a qualitative strategy was chosen in order to answer the research questions stated in 1.4. A qualitative strategy allows for an inductive approach to theory as well as enabling the author to experience the point of view of interviewees, thus allowing for a richer and deeper data set explaining certain contexts. Additionally, a qualitative strategy allows for flexibility in the research, thus opening up for unexpected data as well as allowing for a holistic picture of the topic at hand (Bryman and Bell, 2011).

The drawback in using a qualitative strategy is the extensive use of interpretation of the collected data which creates a risk for researcher bias. Additionally, the results from qualitative research are difficult to generalize across organizations and industries, consequently making such research context specific. Further, the research might be hard to replicate since people and companies develop across time (Bryman & Bell, 2011).

3.3 Research Design

According to Yin (2009) the case study allows investigators to retain a holistic and meaningful characteristic of real-life events. Further, case studies allow means of theory development through the use of in-depth insights of an empirical phenomenon (Dubois and Gadde, 2002). Yin (2009) refers to the case study as a method but Bryman and Bell (2011) argue that the terms “method” and “design” are often confused. Design is a framework for the collection and analysis of data where a method is a technique for collecting data (Bryman and Bell, 2011). In this thesis, case studies are seen as design and methods are the tools and techniques used to collect data. A single case design is used as a framework for the data collection in this thesis. The single case design is used in order to gain an in-depth insight (Bryman and Bell, 2011; Dubois and Gadde, 2002) in how business model innovation is conducted within the context of AkzoNobel Asphalt Applications. Further, using systemic combining and a single case design allows for theory development and rich, holistic

explanation of the research topic (Dubois and Gadde, 2014). Regarding development of theory several authors (Eisenhardt, 1989; Yin, 2009) argue that multiple cases and replication is crucial in order to create an understanding of the explored topic and develop a theory. Dubois and Gadde (2002) however claim that the choice between a single or a multiple case study should be conducted on basis of the issue explored. If the research can focus on a few specific variables then multiple case studies are useful. However, when research is directed towards a number of interdependent variables in complex structures, such as a business model (Gassmann et al., 2012), going deeper into one case can possibly give a more in depth and holistic understanding. There is a use of multiple cases in this study as well however, as the comparison between two product businesses models can be seen as two internal cases within the larger main case.

3.4 Research Methods and Data Collection

The methods are the techniques used to collect data (Bryman and Bell, 2011; Davidson and Patel, 2011). The methods used in this thesis are the following:

- *Unstructured and semi-structured interviews*
- *Unstructured and structured literature review*
- *Documents*
- *Direct observations*

3.4.1 Interviews

Due to the qualitative nature of this study unstructured and semi-structured interviews were mainly used. According to Bryman & Bell (2011) qualitative interviews give rich and detailed data, allow for flexibility in the question and allow for interviewees to be interviewed on several occasions. Unstructured interviews are similar to conversations whereas semi-structured interviews are based on a series of questions, referred to as an interview guide (Bryman & Bell, 2011). According to several sources (Rasiel, 1999; Bryman & Bell, 2011) it is preferable to be two conducting an interview. The possibility to divide tasks such as taking notes and asking questions as well as the possibility of discussing different views on what happened is a huge advantage of interviewing in pairs. Unfortunately, I am writing this master thesis alone. However, in order to gain confirmation regarding the authors understanding of the interview and to mitigate bias as well as loss of information, a transcription of the interview was sent to the interviewee for confirmation.

All interviews (except interviews 140519; 140505; 140530) were recorded and during all interviews the author took note simultaneously in case of technical failure and to highlight thoughts for further questioning. This allowed for re-experiencing the interviews during transcription. All interviews were transcribed and sent to the interviewees for confirmation. Preluding all interviews the author explained the purpose of the study, the research questions and the ethical standpoint in a similar way.

Date	Type	Respondent Position	Duration	Organization	Language	Interview type	Recorded
2014-04-02	Face-to-face	Research assistant	20min	HKR	Swedish	Unstructured	N
2014-04-03	Face-to-face	Consultant	30min	Terra Institute	Swedish	Unstructured	Y
2014-05-05	Telephone	Business Development Manager	30min	AkzoNobel	Swedish	Unstructured	N
2014-05-07	Face-to-face	PhD	40min	GU	Swedish	Unstructured	Y
2014-05-07	Face-to-face	PhD	40min	GU	Swedish	Unstructured	Y
2014-05-13	Face-to-face	PhD	40min	GU	Swedish	Unstructured	Y
2014-05-14	Telephone	Klusterleader	30min	Ineos	Swedish	Unstructured	N
2014-05-19	Telephone	Managing director	20min	Perstorp	Swedish	Unstructured	N
2014-05-21	Face-to-face	Business Development Manager	1h15min	AkzoNobel	Swedish	Semi-Structured	Y
2014-05-22	Face-to-face	Manager Sustainable Development	50min	AkzoNobel	Swedish	Semi-Structured	Y
2014-05-27	Telephone	Previously Innovation Manager	1h6min	AkzoNobel	Swedish	Semi-Structured	Y
2014-05-27	Face-to-face	Sustainability Specialist	55min	AkzoNobel	Swedish	Unstructured	Y
2014-05-28	Telephone	Account Manager Nordic	1h20min	AkzoNobel	Swedish	Semi-Structured	Y
2014-05-30	Telephone	Application Specialist	30min	AkzoNobel	Swedish	Unstructured	N
2014-06-02	Telephone	Account Manager East Europe	1h10min	AkzoNobel	Swedish	Semi-Structured	Y
2014-06-04	Face-to-face	Application Specialist	2h	AkzoNobel	English	Semi-Structured	Y
2014-06-05	Telephone	National Coordinator for energy efficient asphalt applications	55min	Trafikverket	Swedish	Unstructured	Y
2014-06-11	Telephone	Laboratory & technical manager	35min	PEAB	Swedish	Unstructured	Y
2014-06-13	Telephone	Business Development Manager	1h15min	AkzoNobel	Swedish	Semi-Structured	Y
2014-09-16	Telephone	Account Manager Nordic	45min	AkzoNobel	Swedish	Semi-Structured	Y
2014-09-18	Telephone	Application Specialist	58min	AkzoNobel	English	Semi-Structured	Y
2014-09-22	Telephone	Former marketing and sales manager Asphalt Applications	1h7min	AkzoNobel	Swedish	Semi-Structured	Y
2014-12-03	Telephone	Account Manager Nordic	15min	AkzoNobel	Swedish	Unstructured	N

Table 3.1: Interviews conducted for the gathering of data

Regarding the semi-structured interviews all questions found in the interview guide (see appendix I) were not asked in all interviews due to time constraints and interviewee knowledge. Additionally the questions were not asked in a certain order nor were they formulated exactly as in the interview guide. Further, the author became better as time progressed in conducting interviews, thus closing in on the topics of interest quicker etc., which might affect the final results.

Additional follow up questions to some interviews were conducted and the figures present in this thesis, which were created by me on the basis of several interviews, were verified by the interviewees. It should be noted that gathering data through interviews have limitations due to the risk of bias or incomplete representation when dealing with people's memories (Moingeon et al, 2010). However, interviewing several individuals and using other sources of data has made it possible to triangulate the empirical findings.

3.4.2 Documents

According to Davidson and Patel (2011) there are different types of documents such as official and private documents (protocols and letters), literature as well as medial documents (homepages and

video clips). Documents are typically secondary empirics who somebody else has produced (Bryman & Bell, 2011).

Yin (2009) mentions three strengths of documents:

- *Documents allow for verifying information from interviews*
- *Documents allow comparison between sources of information*
- *Documents allow for inference of new questions.*

In the early phase of research literature as well as medial documents was used to gain an overview of the different areas encompassed in this thesis. The literature was found using Google, Google Scholar, Scopus and EBSCO. Table 3.2 shows the initially used search words.

Business model	BMI
Business model innovation	Natural capital
Sustainable business model	Planetary boundaries
Business model for sustainability	Limits of growth
Sustainable development	

Table 3.2: Search words

Literature was selected based on title, number of citations and a brief skim over the abstract. References in the chosen literature were further investigated. Once the empirical data was being collected the author adjusted the focus of the literature review according to the information given in the empirical data, thus trying to match and explain the empirical data with previously unviewed theory. Medial documents were used throughout the project and sources, such as homepages and digital video clips, were found through google.com, youtube.com and ted.com.

3.4.3 Direct observations

According to Yin (2009) direct observations can include formal observations where instruments are developed as well as informal observations which include more casual data collection. Data is derived from attending meeting, factory work as well as field visits. Further, the data collected from direct observations is useful for providing additional information about the studied topic. To increase reliability of the observations multiple observers at a site is recommended (Yin, 2009).

Since I am writing this thesis alone the possibility of multiple observers has not been available. I did however go to a production plant in Stenungsund and visited two asphalt application laboratories within that site during the interview conducted 2014-06-04 (see table 3.1). These observations gave me a deeper understanding of how the asphalt adhesion promoters, additives and emulsifiers are screened, tested and developed.

3.4.4 Case selection

Due to the small sample of interviews and the qualitative nature of the study random sampling was not considered as necessary (Eisenhardt, 1989). Instead, purposive sampling was used; Bryman and Bell (2011:442) point out that *“the goal of purposive sampling is to sample cases/participants in a strategic way so that those sampled are relevant to the research questions being posed.”* In such light the context in which the case company in this study operates within was selected on the basis of

being highlighted in Kullendorff (ed. 2012) and recommended by staff at IEE⁸. Using systematic combining it is not foreign that the case selects the researcher instead of the other way around (Dubois and Gadde, 2014), for this thesis the case company was selected, on the basis of the main theoretical areas⁹, after several interviews with actors who in one way or another were part of the Sustainable chemistry 2030 vision. Through the process of snowball sampling, a form of non-probability sampling where *“the researcher makes initial contact with a small group of people relevant to the research topic and then uses these to establish contact with others.”* (Bryman & Bell, 2011:192), the author was presented a case within AkzoNobel Asphalt Applications. Further interviewee for the gathering of empirical data was also found through the process of snowball sampling. As a note all companies are assumed to have a business model (Chesbrough, 2007; Sosna et al., 2010).

3.5 Data Analysis

Data gathered was from primary and secondary sources as explained in chapter 3.4. As mentioned I used systematic combining going back and forth between empirical data and theory, thus an iterative process was conducted where collecting and analyzing data was conducted simultaneously (Dubois and Gadde, 2014). The primary data derived from interviews was coded during transcription in a process which connected the interviews to theory, thus allowing a tandem data collection and data analysis. I did theoretical reflections while collecting both secondary and primary data. As seen in appendix 1 the semi-structured questions were labeled under certain categories which were derived from the initial theoretical framework. Through those interviews new findings appeared, thus allowing me to neglect certain aspects of the theoretical framework while focusing on other aspects which were previously not highlighted. The theoretical framework further evolved (Dubois and Gadde, 2002) around business model innovation and I later introduced a deeper look at sustainability innovation and the innovation lifecycle as an effect of the empirical findings and the perceived shortcomings of the analysis. Furthermore, additional theory was needed in order to explain the difficulties of appropriating value from Rediset LQ on the market. Additional empirical data was also needed in order to explain the process of business model innovation.

3.6 Research Quality

According to Davidson and Patel (2011) the research quality of qualitative research includes the overall research process. However, there is still reason to explore the concept of validity and reliability for qualitative research (Yin, 2009).

3.6.1 Validity

In quantitative research, validity explains if the indicators used actually measure what they claim to measure (Bryman and Bell, 2011; Davidson and Patel, 2011). Bryman and Bell (2011) argue that measurement is not a major preoccupation of qualitative research. Validity can be increased in qualitative research through the use of multiple sources of evidence, establish a chain of evidence and have key informants review the draft of the study. Validity is also a way of testing if the results of the study can be generalized beyond the specific cases (Yin, 2009). Generalizability is low in this study

⁸ Institute of innovation and entrepreneurship at Gothenburg University

⁹ Sustainable development, the business model and business model innovation

due to the small sample and the use of snowball sampling (Bryman & Bell, 2011). However Payne and Williams (2005 found in Dubois and Gadde, 2014) argue that achieving generalization is not the main mission of case study research. Rather the mission is to show the studied case and its unique features.

Several authors (Bryman and Bell, 2011; Yin, 2009) argue that triangulation (using several sources of data) increases the validity of research, thus I have used multiple sources of evidence in terms of interviews, medial documents, direct observations and contrasting views from literature to triangulate empirical evidence and theory. Further, when analyzing data the transcripts and key understandings from the interviews were sent to the interviewees in order to confirm the understanding of the data. Finally, the structure of the report and the information available in appendix 1 creates a chain of evidence allowing a reader to track the link between research question and conclusion. Yin (2009) argues that creating a chain of evidence and confirming interviews with interviewees are ways of increasing validity.

3.6.2 Reliability

Reliability demonstrates if the study can be repeated by another researcher with the same results (Yin, 2009). According to Bryman and Bell (2011) reliability is difficult to assure when conducting a qualitative study since social settings and their circumstances are impossible to freeze. Yin (2009) proposes different strategies such as using a case study protocol and developing a case study data base. I have recorded everything conducted in a project journal and all written interview transcripts as well as the digital recordings of the interviews are available for future examination.

3.6.3 Research ethics

Bryman and Bell (2011) present four main areas of debate regarding ethical principles within business research:

- **Harm to participants** - *includes several dimensions such as physical, psychological and environmental harm where the environmental harm entails future career prospects.*
- **Lack of informed consent** - *includes withholding information from a participant thus preventing the participant from making an informed decision about participating or not in the study.*
- **Invasion of privacy** - *Mitigating the lack of consent principle indirectly also mitigates the Invasion of privacy issue.*
- **Deception** - *“occurs when the researcher represents their research as something other than what it is” (Bryman & Bell, 2011:136)*

These can be seen as principles that need to be mitigated. I have taken measures to ensure that no harm, physical or psychological, come to the interviewees by being humble when asking for their time and giving the participant the opportunity to set time and place for the interview. Further information regarding the purpose of the study, the research question and the anonymity provided in the final publication as well as in the transcripts of the interviews has been provided to the interviewees. All interviewees have seen and confirmed the content of the interview transcriptions prior to their use in this thesis. It can be argued that the anonymity provided through table 3.1 is not enough but all interviewees have seen and approved the level of anonymity provided in this thesis.

3.7 Chapter Summary

Methodology	Thesis methodology
Philosophical starting point	A constructivist oncology and an interpretivistic epistemology
Research strategy	Qualitative strategy using systematic combining
Research design	Case study
Data collection methods	Unstructured and semi-structured interviews, documents such as literature and company as well as medial documents and finally direct observations
Unit of analysis	Primarily a single business model, however a multi product comparison between two business models is also conducted
Research quality	Validity is attempted through triangulation of data sources, verification of findings as well as setting up a chain of evidence. Attempts to achieving reliability has been conducted through a project journal and through interview transcriptions and digital recording of interviews. Finally, research ethics have been considered thus anonymizing interviewees and ensuring approval of material prior to print.

Table 3.3: Summary of methodology chapter

4. Theory

This chapter presents the exploration of theoretical frameworks which are used in later chapters in order to analyze the empirical data. Writing this chapter has also been a way to quench curiosity thus not all aspects within this chapter are visible in the final analysis. Although sustainable development is seen as a driver of innovation as explained in chapter 1.2 the business model and business model innovation are at the epicenter of this thesis thus, the first parts of this chapter explore the concepts of business model and business model innovation. Subsequently, a theoretical overview of the sustainability drivers as well as a deeper exploration of sustainability innovation is presented.

The different subchapters in the theoretical framework presented throughout chapter 4 are all interconnected. Consequently, the subchapters can be regarded as a flow through which the different research questions pass through in order to be answered.

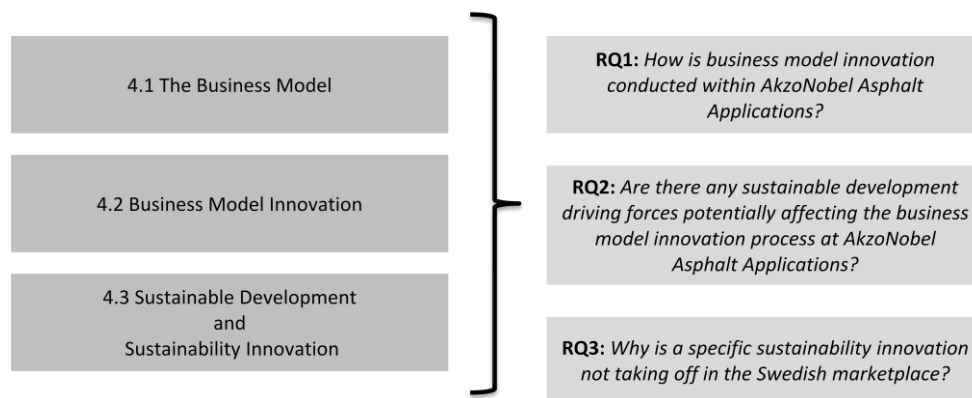


Figure 4.1: Overview of research questions and theoretical chapters.

4.1 The Business Model

“The economic value of a technology remains latent until it is commercialized in some way via a business model. The same technology commercialized in two different ways will yield two different returns.” (Chesbrough, 2010:354)

The business model has been fundamental for trading and economic behavior since long before it was conceived as a concept by researchers (Teece, 2010). Being regarded as a concept, meaning an abstract idea that represents and supports higher-level thinking (Bryman and Bell, 2010), the business model lacks an established definition (Amit et al., 2011; Schneider & Spieth, 2013; Teece, 2010). The lack of definition has caused practitioners to sometimes confuse the business model as short hand for business strategy (Santos et al., 2009). However, *“(…) the business model is not the same as product market strategy (…) or corporate strategy.”*(Amit et al., 2011:1032). A strategy includes *what* the organization offers, *who* the customer is and *how* the value is delivered to the customer. It is in the *how*- dimension through which the choice of business model comes into play (Sosna et al., 2009, Amit and Zott, 2010). Nevertheless, as the different dimensions are interrelated the business model still needs to include all dimensions in order to make sense (Schneider and Spieth, 2013). Other authors proclaim that the difference between business model and strategy is that the business model is the *“logic of value creation and value capture”* (Casadesus-Masanell and

Ricart, 2009:2) whereas strategy refers to *“the choice of business model through which the firm will compete in the marketplace”* (Casadesus-Masanell & Ricart, 2009:2).

Amidst the plethora of business model definitions (Amit et al., 2011) Chesbrough (2007) claims that every company has a business model where the function of the value creation and value capture is central. According to Amit et al. (2011) the research about the concept became widespread around the mid-1990s with the increasing diffusion of the internet. Another driver of interest for the concept has been a rapid growth of emerging markets thus shedding light on social issues (Yunus, 2010). Furthermore, environmental concerns (Sommer, 2012; Wells, 2013), innovation and technology management (Chesbrough 2010) as well as shifting into an alternative economic paradigm different from neoclassical theory (Stubbs & Cocklin, 2008) are all additional perspectives through which business models have been scrutinized. Additionally, the business model has been referred to as a description, a representation and a conceptual tool (Amit et al., 2011).

Most of the established literature has taken a static perspective on the business model (Schief and Van Putten, 2012) where it is seen as a conceptual tool which specifies the core business logic of an organization by abstracting *“(...) the complexity of a company by reducing it to its core elements and their interrelations (...)”* (Gassmann et al., 2012:184) during a certain point in time. Thus, the implicit assumption is that business models remain steady over time (Schief and Van Putten, 2012). Business models tend to become somewhat crystallized and hard to change due to proven efficiency and reliability, and their stability is reinforced as organizations search for efficiency and predictability (Doz and Kosonen, 2010; Schief and Van Putten, 2012) however they are not necessarily fixed over time. It can be necessary for an organization to change their business model as a result of organizational and/or technological change. Further, changes in the market can make previous business models redundant, thus forcing organizations to change their business model (Wells, 2013). This dynamic view seemingly brings new dimensions to the concept of the business model. In an attempt to gain a more tangible grasp of what a business model is, the static and dynamic perspectives are further explored in chapter 4.1.1.

4.1.1 Different perspectives on the business model

4.1.1.1 The static perspectives

Osterwalder and Pigneur (2010:15) define the business model as *“the rationale of how an organization creates, delivers and captures value”*. Kaplan (2012 cited in Girotra and Netessine, 2013:4) adds three dimensions of sustainability to the definition of Osterwalder and Pigneur (2010) when defining the business model as *“the rationale of how an organization creates, delivers and captures value (economic, social or other forms of value.)”*. These perspectives put a holistic focus on the system of interlinked activities which depicts how business is done (Amit and Zott, 2010). The holistic perspective is a common point of view through which the business model concept is seen as a tool that allows managers to zoom in and out of particular elements of the firms activities. The holistic perspective is thus not limited to the scope of the internal elements of the firm or its external environmental factors, but is inclusive of both. As such, the business model also gives an integrated view of the focal firm and the interrelatedness of the organization’s different activities (Schneider and Spieth, 2013). Gassmann et al. (2012) add that the holistic perspective insinuates that the business model is a boundary spanning concept which explains how a focal organization is embedded and interacts with its surrounding eco-system. However, within the mainstream business model

literature, the focal firm's business model has often been assumed of being embedded in neo classical economics and thus researchers have neglected the business model's relation to environmental issues and the context in terms of stakeholders and government (Wells, 2013).

The holistic perspective also allows one to see the business model as a unit of analysis through which relevant internal and external factors of the firm can be considered simultaneously (Gassmann et al., 2012; Schneider & Spieth, 2013). Regarding the business model as an abstraction that helps the viewer to simplify the complexities of business, makes it possible to compare similarities and differences at the cost of accuracy (Wells, 2013). Additionally, the literature review conducted by Davidson and Lambert (2013), reinforces this picture and further suggests that the business model can be seen as a strategic analysis tool. As such, the mapping of a focal business model could be used to analyze and communicate strategic choices and thus propose how an organization can create value, how it will capture value, and identify the internal sources of the organization's advantage (Brink and Holmén, 2009 cited in Davidson and Lambert, 2013). Furthermore, the focal subject need not be a firm but can also be a system, business unit or a product (Wirtz, 2011).

Summing up what is said above, the business model is a conceptual construct (Gassmann et al., 2012) that helps explain the basis through which a subject creates and captures value (Osterwalder and Pigneur, 2010). It gives a holistic picture of a focal subject, be it a system, firm, business unit or technology (Chesbrough, 2010; Wirtz, 2011) and consists of several interdependent elements which are aligned to create and capture value (Amit and Zott, 2010; Schneider and Spieth, 2013). The value can in turn be of economic, environmental and/or social character (Kaplan, 2012 in Girotra and Netessine, 2013).

4.1.1.2 Dynamic perspective

Building on the static perspective of the business model, the dynamic perspective essentially adds the flow of time to the concept, thus making the business model a subject of change (Giesen, 2009; Implement, 2012; Wells, 2013). Changes in the different elements of a business model takes time, and needs to be aligned with an organization's long-term strategy, culture and core capabilities. A new business model is therefore difficult to copy and thus creates a sustainable competitive advantage (Gassmann et al., 2012). However, due to business models being more generic compared to business strategy, successfully implemented business models do not inherently assure competitive advantage. It is a matter of a few years, or even months, before they are shared by multiple competitors to some degree (Teece, 2010). Some authors further suggest that the business model is increasingly seen as a new subject of innovation which involves new forms of collaboration and cooperation (Amit et al., 2011; Schneider and Spieth, 2013). As such, it complements the traditional subjects of innovation mentioned by OECD (2005): product, process, organizational and marketing. Teece (2010) argues that adjusting or improving a business model is complex and that such a process is likely to involve iterative processes.

Further, new business models do not only represent innovation, but also facilitate innovation (Teece, 2010) thus acting as a means to an end. Chesbrough (2010) argues that technology has no inherent value and that the economic value of technology needs to be released through a business model. Again, this perspective emphasizes the role of value creation and the consequent capturing of

value as technology¹⁰ is not an innovation until it has reached a market and created value (Keeley et al., 2013). New business models combined with new technology is also seen as a means for large infrastructural change. By shifting the focus from technology to creating new systems using novel business models a systemic change can be fostered (Johnson and Suskewicz, 2009). Lüdeke-Freund (2013) adds sustainable development to the argument of seeing business models as a means to an end when arguing that a business model is a mediator which bridges the gap between the business case for sustainability and sustainable innovation. The necessity for an organization to wield a business model with a certain “market fit” makes it difficult to directly apply a universal best practice business model solution across industries and cultures (Wells, 2013). A deeper look at the dynamic perspective is found in chapter 4.2.

In summary, the dynamic perspective builds on the static perspective seeing the business model as a strategic and conceptual tool, but adds change through the flow of time and thus the business model in itself can be subject to innovation (Amit et al., 2011). As such, the business model can be used as a mediator creating a market fit thus aligning a business case for sustainability with a sustainability innovation. In other words, by viewing a business through the lens of the business model concept, and modifying it accordingly, a market fit can be created for a sustainability innovation thus realizing the identified business case for sustainability which in turn can lead to an industry transformation towards a more socially and environmentally sustainable state (Lüdeke-Freund, 2013).

4.1.2 The business model building blocks

As mentioned in the static view, the rationale of how an organization creates and captures value¹¹ consists of several interrelated elements (Amit and Zott, 2010). These elements can in turn be broken down into nine interrelated building blocks (Osterwalder and Pigneur, 2010):

- *Customer segment*
- *Value proposition*
- *Distribution channels*
- *Customer relationships*
- *Revenue streams*
- *Key resources*
- *Key activities*
- *Key partnerships*

These building blocks are further explained below and subsequently aggregated into different business model elements.

4.1.2.1 Customer segment

This building block answers the question of “who is the customer?” (Gassmann et al., 2012). Osterwalder and Pigneur (2010) argue that customers need to be segmented according to common needs, behaviors or other attributes. Further, segmentation can be based on channels, types of relationships, levels of profitability or willingness to pay. Once the customer segment(s) is decided upon, an organization can design the business model around the understanding of a specific

¹⁰ In terms of an invention.

¹¹ That is to say, the business model

customer segment (Osterwalder and Pigneur, 2010). Several authors (Sommer, 2012; Wells, 2013) argue that the notion of customer is too narrow for business models which are intended to be sustainable. These business models, argues Sommer (2012), often need to appeal to additional groups including different stakeholders such as actors within society or the environment (Bocken et al., 2013).

4.1.2.2 Value proposition

Each value proposition targets the need of a specific customer segment(s) and is based on the capabilities of the organization and/or its partners (Osterwalder, 2004; Chesbrough, 2006). The value proposition is defined as “...an aggregation, or bundle, of benefits that a company offers its customers.”(Osterwalder and Pigneur, 2010:22) and can further be broken down into different attributes of an offering. One such attribute is reasoning, which according to Sommer (2012), is the core of why an offering is expected to be useful to the customer. Osterwalder (2004) divides reasoning into *use*, *risk* and *effort*. Use is the core of the value where value is created when the user uses the offering. Reducing a risk for the customer is also value creating where mitigated risks include financial or performance risks (Sommer, 2012). Value can also be created through the reduction of effort, including lowering search, evaluation and acquisition costs, as well as reducing maintenance, operations and training costs (Osterwalder, 2004).

The lifecycle is another attribute which includes the creation, purchase, use, renewal and transfer of value. Additional attributes include price and value level (Osterwalder, 2004). However, seeing that the value proposition is too narrowly defined as it only focuses on the customer (Bocken et al., 2013; Sommer, 2012) there is reason to develop the value proposition building block further.

Bocken et al. (2013) argue that a sustainable business needs to take a holistic view of the value proposition thus include benefits and costs to other stakeholders than just the customers of the firm. Connecting to the three dimensions of sustainable development, Bocken et al. (2013) argue that society and the environment should also be seen as stakeholders. Such value could then be defined as “thick” (Haque, 2011). The difference between “thin” and “thick” value is manifold, “thin” value is:

- **Artificial** – *only transferring value from one actor to another.*
- **Cannot be sustained** – *thin value sacrifices tomorrow for the benefit of today and is not built to last in the long run. It is those shoes you buy for 100SEK today which 6 months later fall of your feet as rags.*
- **Meaningless** – *thin value fails to make social and environmental stakeholders durably better off. Eating a Big Mac might taste good but it can have negative impact on an individual's health, not to mention the negative impact it has on the environment.* (Haque, 2011)

In contrast “thick” value includes returns on the full spectrum of the cost of capital, not only focusing on the financial returns to debt and equity holders. “Thick” value returns “(...) the many different kinds of capital utilized in production – natural capital, social capital, and human capital, to name just a few.” (Haque, 2011:22). Sommer (2012) highlights that activities within other building blocks such as customer relationship or distribution channels also bring perceived value to the customer. For example, a strong brand could potentially reduce the perceived risk of product failure, and well-functioning distribution channels that deliver products or services just in time, might reduce the maintenance costs (Sommer, 2012). Further, the value proposition can be extended and thus include

not only buying customers but also actors benefiting from the offer (Moingeon et al., 2010). Thus, it can be concluded that is a difficult task to provide a comprehensive evaluation of the perceived value proposition by all stakeholders (Sommer, 2012).

4.1.2.3 Distribution channels

This building block incorporates how an organization communicates and delivers its value proposition to its customer segment(s) which includes communication, sales and distribution channels (Osterwalder and Pigneur, 2010). Delivery can be either direct or indirect. A sales force or a website are both examples of direct delivery, while intermediaries or partners are examples of indirect delivery (Osterwalder, 2004). According to Osterwalder and Pigneur (2010) it is important to find the right mix of phases through which a specific customer segment wants a value proposition to be delivered. In short the phases are:

- **Awareness** - *which explains how an organization creates awareness about itself and its value proposition(s)*
- **Evaluation** - *describes an organization intends to help customers evaluates its value proposition(s)*
- **The purchase phase** – *explains how the customer purchases a value proposition*
- **Delivery** – *depicts how the values is delivered*
- **After sales** - *describes the provided post-purchase customer support*

(Osterwalder and Pigneur, 2010)

One channel can cover all or some of the phases.

4.1.2.4 Customer relationship

The type of relationship an organization has to its customers is described in this block thus the building block influences the overall customer experience (Osterwalder, 2004). Relationships can change over time and an organization can have different co-existing types of relationships with a customer segment. Relationships range from *close* to *distant*. Community, personal-service and co-creation are examples of close relationships, whereas automated services and self-service are examples of distant relationships (Osterwalder and Pigneur, 2010). Further, Osterwalder (2004) mentions *customer acquisition, retention* as well as *up-selling* as drivers of customer relationships. According to Sommer (2012) customer acquisition tends to be more expensive compared to retaining existing customers. However, not all customers are equally profitable which suggests pursuing differentiated retention approaches such as through lock-in effects or loyalty programs (Sommer, 2012). Further, up-selling to existing customers tend to be more profitable than selling to new customers (Osterwalder and Pigneur, 2010). Up-selling can be done through the sale of add-ons which is not confined to selling related products or services but also includes unrelated products (Sommer, 2012).

The customer relation building block also includes *brand, trust, and personalization*; all of which can contribute to the value proposition (Osterwalder, 2004; Sommer, 2012). In short, personalization allows a close connection between customer and company. It includes one-to-one human relationships between customer and company representative, as well as mass customization of a product where the customer is allowed to customize a product or service. Personalization helps create trust between the customer and the company, which is an important prerequisite for any business transaction. Extending the concept into sustainability, Sommer (2012) argues that green

labels are one way of communicating whether or not a product can be conceived as sustainable and thus trust for such a label becomes value adding and a means of differentiation. Finally, well-defined brands “(...) *help to ensure alignment between business model design and communication to the customer.*” (Sommer, 2012:61). The perception of a brand in terms of sustainability often plays a key role for success. Further, that perception is increasingly driven out of corporate brand managers’ control as user generated branding allows individuals and organizations to publish brand related information at a great reach and with high speed through social media (Sommer, 2012). One example is the Greenpeace campaign against dirty palm oil which has had impact on the P&G brand (Greenpeace.org, 2014; Adnews.com.au, 2014). Brands can also be perceived as a key resource (Sommer, 2012).

4.1.2.5 Revenue streams

This building block represents the value, cash if you will, which the organization manages to capture from its value generating activities. Osterwalder (2004) identifies five types of revenue streams; *selling, lending, licensing, piece of a monetary transaction* and *advertising*. Sommer (2012) adds *servicing* which aims at substituting the selling of physical artifacts with the use of services instead. Revenue streams can have different pricing mechanism: being fixed (i.e. pay-per-use or subscription), differential (i.e. customer segment dependent or feature dependent) or market dependent (i.e. auctions or bargaining) (Osterwalder, 2004; Sommer, 2012). Pricing mechanism can have impact on the environmental sustainability of the business model. For example, subscriptions encourage consumption while pay-per-use creates incentives for restrained consumption (Sommer, 2012).

4.1.2.6 Key resources

Resources “...are the *productive assets owned by the firm*” (Grant, 2010:127), they can further be broken down into *tangible, intangible* and *human*. Tangible resources have a physical form and could be machines or buildings whereas intangible resources, such as intellectual property or brand recognition, are not physical in nature. Human assets are the people who make up the workforce (Grant, 2010). Different resources are relevant for different business models (Osterwalder & Pigneur, 2010) and resources form organizational capabilities which allow an organization to create and offer a value proposition through which a competitive advantage can be created (Osterwalder & Pigneur, 2010; Grant, 2010). Further, new capabilities can be gained through acquisitions, mergers or alliances as well as through internal development (Grant, 2010).

4.1.2.7 Key activities

Depending on the type of business model and organization, the key activities differ. However, Osterwalder (2004) argues that the key activities in an organization focused on production (as opposed to organizations focusing on problem solving or mediation in a network) can be explained by using the value chain (see figure 4.2) as described by Porter (1984, found in Grant, 2010). The primary activities are those which are involved in the creation of the value proposition as well as its marketing and delivery. Support activities such as HR management and R&D are the primary activities (Porter, 1984; found in Grant, 2010)

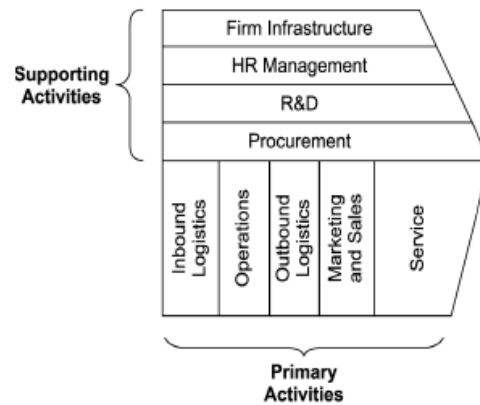


Figure 4.2: The value chain. **Source:** Porter, 1984; found in Grant, 2010

According to Sommer (2012), the key activities identified by Osterwalder (2004) are similar to the key processes element described by Johnson et al. (2008). Johnson et al., (2008) emphasize the norms (i.e. size of opportunity needed for investment) as well as rules and metrics (i.e. supplier terms or required profit margin for investment) as important parts of the key activities (Sommer, 2012). The key resources and activities are linked since key activities share resources (Osterwalder, 2004; Johnson et al., 2008). The ability to create or adapt combinations of resources and activities is referred to as dynamic capabilities (Teece et al., 1997 found in Sommer, 2012).

4.1.2.8 Key partnerships

Partnerships are agreements which allow organizations to create value (Sommer, 2012). Further, partnerships allow organizations to gain access to external resources, capabilities and activities. Partnerships “(...) can be vehicles for new organizational learning, helping firms to recognize dysfunctional routines, and preventing strategic blindspots” (Teece & Pisano 1994; cited in Sommer, 2012:71). Osterwalder (2010) points out three motivations for organizations to create partnerships: *Optimization and economy of scale, reduction of risk and uncertainty* as well as *acquisition of particular resources and activities*. Optimization and economy of scale, are the most basic form of partnerships and can be characterized by a buyer – supplier relationship. These types of partnerships reduce costs and often involve shared or outsourced infrastructure. Reduction of risk and uncertainty are a type of partnerships which can help reduce risk in an environment characterized by uncertainty. Bringing new technologies to market is a typical scenario for when such types of partnerships occur. Finally, acquisition of particular resources and activities are a way for organizations to extend their own resources and capabilities. These kinds of partnerships are often motivated by the need of acquiring knowledge or licenses (Osterwalder, 2010).

4.1.2.9 Cost structure

This final building block describes the costs inferred through operation of the business model. Johnson et al., (2008) include cost of key assets, direct costs and indirect costs. Osterwalder and Pigneur (2010) additionally point out variable and fixed costs. Further, cost advantages associated with economics of scale and scope are also included in this building block.

4.1.3 The business model elements

The different building blocks can be aggregated into larger elements thus facilitating the holistic perspective on the business model and highlighting the interrelatedness of the building blocks. The business model elements are central for managing a business model and are thus necessary for

understanding and conducting business model innovation (Schaltegger et al., 2011). Sommer (2012) argues that the fundamental part in the understanding of business models is the division of value creation and value capture.

Central to any business model is the value proposition which essentially depicts a holistic view of what value is created in terms of a bundle of products and/or services that are offered to customers (Bessant and Tidd, 2013; Gassmann et al., 2012; Moingeon et al., 2010; Osterwalder and Pigneur, 2010; Schaltegger et al., 2012). Some authors (Bessant and Tidd, 2013; Moingeon et al., 2010) specify the customers within the value proposition while others argue that customers are to be put in other elements (Gassmann et al., 2012; Schaltegger et al., 2012). In short, the value proposition is about *what value is delivered*. The customer, together with activities related to customers relations and value delivery, specify *how value is delivered* (Bessant and Tidd, 2013; Gassmann et al., 2011; Schaltegger et al., 2011).

Another element frequently mentioned (Bessant and Tidd, 2013; Schaltegger et al., 2012) is an organization's position in a network of stakeholders, essentially depicting *how value is created*. This element includes an organization's position in a value chain (Bessant and Tidd, 2013; Schaltegger et al., 2011) as well as the internal and external resources and capabilities needed to create value (Gassmann et al., 2012; Keeley et al., 2013; Moingeon et al., 2010).

The financial aspects are a final element often mentioned (Bessant and Tidd, 2013; Gassmann et al., 2012; Keeley, 2013; Osterwalder and Pigneur, 2010; Schaltegger et al., 2012). In other words, the element includes the cost structure and the mechanisms through which *revenue is generated* (Gassmann et al., 2012; Schaltegger et al., 2011). This element cuts through the other elements and is thus interconnected to all of them in one way or another (Moingeon et al., 2010; Schaltegger et al., 2011). Others (Moingeon et al., 2010) point out that the revenue model is distinguished from the structure of costs and employed capital as it focuses on the revenues captured.

Table 4.1 below outlines a brief overview of the generic elements of the business model found in contemporary literature¹² and includes the different building blocks.

¹² A table over elements found in contemporary articles can be found in appendix IV

Elements	Description
What value is delivered	Includes the value proposition, the specific job to be done, what is sold and what the customer is willing to pay for it. Further explained in: <ul style="list-style-type: none"> 4.2.2.2 Value proposition
How value is delivered	Includes customer segments, customer relations as well as an organization's role and relationships across a value chain. Risk, rewards and synergies etc. are included. Further explained in: <ul style="list-style-type: none"> 4.2.2.1 Customer segments 4.2.2.3 Customer relations 4.2.2.4 Distribution channels
How value is created	Concerns key internal resources, knowledge, activities, processes and external partnerships needed to create and distribute the delivered value. Further explained in: <ul style="list-style-type: none"> 4.2.2.6 Key resources 4.2.2.7 Key activities 4.2.2.8 Key partnerships
How revenue is generated	Describes the revenue model. The element also includes the cost structure and cuts across the organization. Further explained in: <ul style="list-style-type: none"> 4.2.2.5 Revenue streams 4.2.2.9 Cost structure

Table 4.1: Summary of the elements of the business model

4.1.4 Connecting the elements and building blocks into a canvas

Using the “business model canvas” (Osterwalder, 2004; Osterwalder & Pigneur, 2010) the elements and building blocks mentioned above and mapped in table 4.1 are merged into a framework (figure 4.3) which can be used with empirical data to gain an overview a business model.

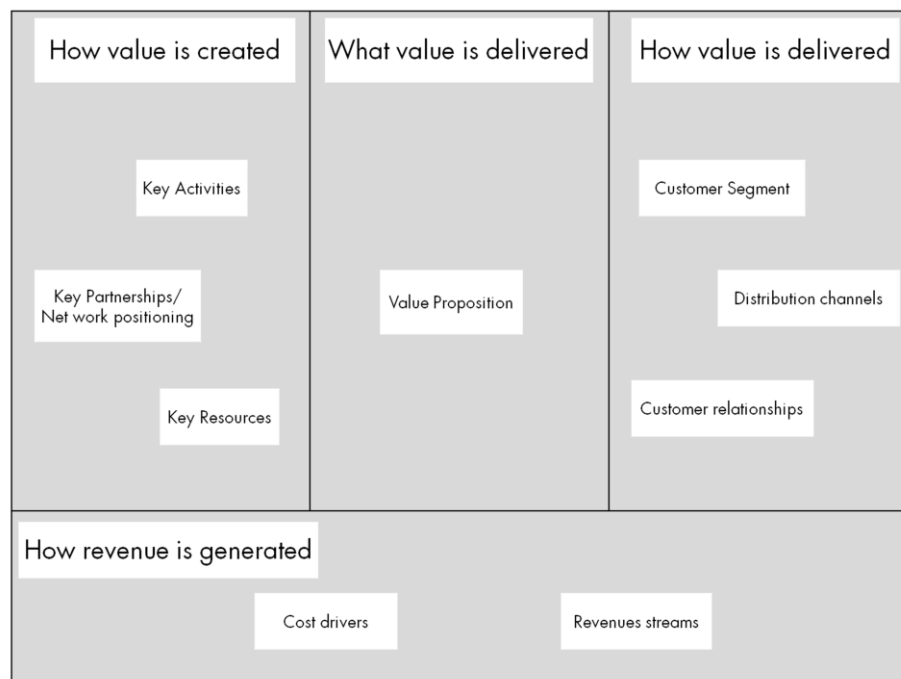


Figure 4.3: How the elements and building blocks fit together

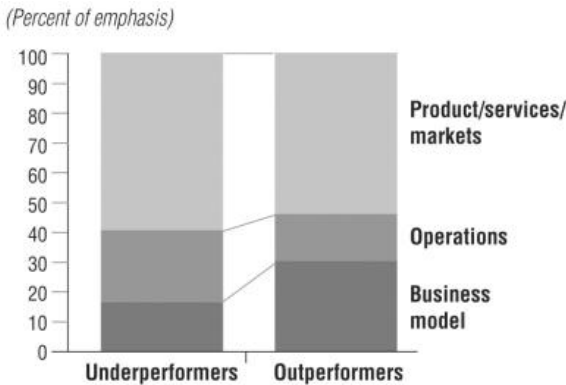
Source: My remake of Osterwalder and Pigneur (2010) and Implement (2012) business model canvas

Again however, Wells (2013) argues that the mainstream literature on business models, from which I draw the elements and building blocks of the business model framework in figure 4.3, neglect the relationship to the environment as well as that to the wider society in which the business model is operated. Further, the perspective presented above is of static nature thus somewhat neglecting the flow of time (Schief and Van Putten, 2012). In order to answer RQ1, we need to explore the business model as a subject of innovation.

4.2 Business Model Innovation

“The biggest reason for companies to embrace business model innovation is the threat that current models will ultimately slip or even fail in the face of changing market conditions.”
 (SustAinability, 2014:19)

Not being static, a successful business models tend to be stable over time (Doz and Kosonen, 2010; Schief and Van Putten, 2012) as they prove to be efficient and reliable. In such context scaling of well-proven activities appears to be the obvious path (Doz and Kosonen, 2010). This type of path-dependency might constrain incumbents in finding new ways for creating and capturing value creation, as they prefer to stay close to what is familiar, building on existing resources and capabilities as well as rely on a continuation of past successes (McGrath 2010; Grant, 2010; Schnider and Spieth, 2010). Nevertheless, business model innovation is critical for success in the fast-changing and increasingly complex environment facing business today (Giesen et al., 2009). Although there is no general coherent definition of business model, or business model innovation, studies show that executives increasingly believe that business model innovation is an increasingly important source of competitive advantage (Economist intelligence unit, 2005). Further, the IBM 2006 Global CEO study (Pohle and Chapman, 2006) suggests that organizations conducting business model innovation generally outperform organizations that do not (see figure 4.4). Thus, business model innovation can have a positive impact on the operating margins of organizations (Chorn, 2012; Pohle and Chapman, 2006). Furthermore, incumbent firms with successful business models do have *“a stable source of income from old business models that can cross-subsidize new business models”* (Sosna et al., 2010: 403).



Note: Based on operating margin growth over five years as compared to competitive peers

Figure 4.4: Innovation priorities of under- versus over performers.

Source: Pohle and Chapman, 2006

Finally, business model innovation can be necessary in order for business adapt and withstand disruption as well as when aiming for the creation of disruption in a marketplace (Chorn, 2012; Lüdeke-Freund; 2013).

4.2.1 Business model innovation – process or result?

As previously mentioned there is no precise definition of how to define business model innovation. However, regarding the business model as a stable and almost static concept could lead one to seeing business model innovation as a transition from one static state to another. Consequently, business model innovation can be seen as the *“discovery of a fundamentally different business model in an existing business”* (Markides, 2006:20). However, Demil and Lecocq (2010) argue that a business model is in a permanent state of disequilibrium since environmental as well as internal factors are under constant change thus affecting the focal business model. Consequently, business model innovation can be seen as a continuous and evolutionary process as opposed to state to state episodic changes (Davidson and Lambert, 2013; Demil and Lecocq, 2010). Regarding the business model as a process is further confirmed by Amit and Zott (2010:2) who define business model innovation as *“[the process of] designing new, or modifying the firm’s extant activity system”*. SustAinability (2014:10) presents a complimentary definition where a business model innovation can be seen as *“creating a novel form of exchange at some point along a company’s value chain.”* Further, the scope of business model innovation can shift between the business logic of a specific product or service and span across the focal organization (Wirtz, 2011) thus including its interface with customers, partners and the external environment (Schneider and Spieth, 2013). The boundary spanning characteristic of the business model is also reflected in the concept of business model innovation where Davidson and Lambert (2013) argue that it is connected to the concept of open innovation.

Gassmann et al. (2012) highlight that process and/or product innovations could lead to business model innovation, that is to say a change in an organizations activity system, since all elements of the business model are interrelated. Novel business models have can in turn trigger new value propositions such as technological innovations (Boons et al., 2013; Demil and Lecocq, 2010). Markides (2006) however claims that business model innovation does not require new products, services or technology, nor does new technology always lead to new business models (Boons et al., 2013). Rather, business model innovation can be used to redefine existing products, services or technology, and the ways they are used to create value (Markides, 2006). Wells’ (2013) finding support Markides by showing how the concept of low cost airlines created new business models without fundamental change in technology. Thus, business model innovation can be utilized during times of scarce resources by resolving the trade- off between R&D costs and benefits by redefining how business is done (Amit and Zott, 2012). Further, business model innovation can create novel competitive space within an industry and does not need to come from a new entrant (Wells, 2013).

4.2.2 When does the business model innovation “occur”?

If business model innovation is seen as a process which includes the creation of new or modified activity systems and/or novel forms of exchange across a focal subject’s value chain (be it an organization, product, service or system) (Amit and Zott, 2010; SustAinability, 2014; Wirtz, 2011). When do continuous changes, as explained by Demil and Lecocq (2010), in the activity system constitute a business model innovation? That is to say, at what level of change does the change constitute a business model innovation? Santos et al. (2009:14) offer an explanation where *“Business*

model innovation (BMI) is a reconfiguration of activities in the existing business model of the firm that is new to the product/service market in which the firm competes” thus emphasizing a reconfiguration of the activities and highlighting a result which is a de-novo model. A de-novo model would be entirely new to the state of the art and thus not only contained to being new to the focal firm (Amit and Zott, 2010). Johnson et al. (2008:58) go even further by claiming “*there is no point in instituting a new business model unless it is not only new to the company, but in some way game-changing to the industry or market.*” Opportunities for novel business models can be found in combining digital and physical infrastructure, turning products into services as well as developing new delivery technologies which change the value chain (Nidumolu et al., 2009). Furthermore, Giesen et al. (2009) present three types of business model innovation (seen in table 4.2) which in some way or another are “game-changing”. One of these “game-changing” types, the industry model innovation, is a label for an innovation in an industry supply chain which can be done through horizontal moves into new industries as well as through redefining existing industries. An example of the latter is a computer company who eliminated intermediaries by going directly to the customers thus redefining the industry business model (Giesen et al., 2009). Another “game-changer” is the revenue model innovation which involves changes in how revenue is generated through reconfiguration of offering (products/services etc.) and/or introduction of new pricing models. New pricing models are apparent in the digitized music market where actors offer music through subscription services. Finally, the enterprise model innovation focuses on redefining organizational boundaries through innovation in organizational structure and/or changes in the role an organisation plays in a new or existing value chain. Enterprise model innovation can be achieved through specialization thus focusing on core-competencies and outsourcing other activities, using collaboration with external partners is also included in this type of business model innovation (Giesen et al., 2009).

Nevertheless, novel business models are seldom new, Gassmann et al., (2013) argue that 90% of the business model innovations mapped in their studies were mainly re-combinations of previously existing concepts. Often business model innovations “*are slight variations of something that has existed elsewhere, in other industries, or in other geographical areas.*” (Gassmann et al., 2013:3). Amit and Zott (2010) suggest that incremental changes in the business model of an organization can create benefits for the focal firm although they do not disrupt the industry. Davidson and Lambert (2013) further imply that incremental changes within an enterprise can aggregate into a driver for a change in the business model, again highlighting the interconnectedness of the different elements of the business model as argued by Osterwalder (2004) and Johnson et al. (2008). Consequently, the reconfigurations of activities constituting a business model innovation seem to cover incremental to radical changes. Within the incremental reconfigurations Schaltegger et al. (2012) draw mainly from Mitchell and Coles (2003) when they propose four degrees of reconfiguration: adjustment, adoption, improvement and redesign. Business model adjustment is defined as modifications of one or a minor number of building blocks within each business model element excluding the value proposition. Business model adoption is mainly about catching up on competitors’ value propositions as the goal is to no fall behind in the competition. Adoption requires changes in the value proposition but can include changes in the other elements as well since they are interrelated. Business model improvements are characterized by substantial and simultaneous changes in the business model elements. In order to be classified as an improvement changes in customer relation approaches, changes in the how to create value –element as well as the financial logic need to replace the existing business model at a given point in time. The value proposition is however unaltered. Finally, business

model redesign connects to the idea of a de-novo business model as it is defined as the aggregated changes in a business model from previous steps which lead to a new business logic and new offers. An example would be a car vendor who goes from selling cars to providing mobility services such as car – sharing (Schaltegger et al., 2012). The different levels are presented in table 4.2 below.

De novo types of business model innovation	Explanation
Industry model innovation	Innovation in an industry supply chain. It can be done through horizontal moves into new industries as well as redefining existing industries
Revenue model innovation	Includes changes in how revenue is generated through reconfiguration of offerings and/or introduction of new pricing models
Enterprise model innovation	Innovation through redefining organizational boundaries. Enterprise model innovation can be achieved through focusing on core-competencies and outsourcing other activities. Additionally collaboration with external partners is common
Incremental degrees of business model innovation	Explanation
Business model adjustment	Modifications of one or a minor number of building blocks within each business model element, excluding the value proposition, constitute an adjustment
Business model adoption	Changes that primarily focus on matching competitors' value propositions, thus building blocks such as customer relationships, key resources and key activities as well as partners might also be subject to change
Business model improvement	When most building blocks are changed. The changes are simultaneous and all elements are affected. The value proposition is however unaffected
Business model redesign	Builds upon the business model improvement degree and is used to classify the event of when improvements lead to a completely new value proposition

Table 4.2: *Types of business model innovation*
Source: *Giesen et al., 2007; Osterwalder, 2004; Santos et al., 2009; Shaltegger et al., 2012*

In summary, there seems to be an ongoing discussion regarding what actually constitutes a business model innovation. Nevertheless, there seems to be a spectrum of different levels of activity adjustment, such as minor building block modifications to a de-novo business model, which all can be labeled as business model innovation. Consequently, viewing business model innovation as a

process, any observable change over time in a business model element exposed to a market is regarded as a business model innovation in this thesis.

4.2.3 Perspectives on the process of business model innovation

Even though there has only been limited research done on the process of business model innovation (Demil and Lecocq, 2010; Gassmann et al., 2012). There seems to be different perspectives on how business model innovation is conducted at incumbent organizations. According to Chesbrough (2010) the business model innovation process can pro-actively managed through experimentation and Gassmann et al. (2012) proposes four generic steps for managing business model innovation processes. Another perspective highlights an ongoing evolutionary learning process (McGrath, 2010; Schneider and Spieth, 2013; Sosna et al., 2010) characterized by a continuous reaction to changes in the environment (Demil and Lecocq, 2010). The different perspectives need to be somewhat explored if to be useful in an analysis.

4.2.3.1 Managerial perspective

Authors taking the managerial perspective stress that a business model, being subject to constant change, needs to be managed over time in order to remain viable (Chesbrough, 2010). Although business model innovation is a chaotic and non-linear process (Gassman et al, 2012) and often evolving (Abernathy and Utterback, 1975) through iterative trial-and-error based learning (Sosna et al., 2010; Wells, 2013), managing and formally experimenting with business models is potentially needed in order to succeed with business model innovation (Chesbrough, 2010).

Gassmann et al., (2012) present four generic phases for managing business model innovation: *analyze, design, implementation and control*. The analyze phase might last several years and is primarily concerned with managers gaining insights and thoroughly understanding the changes affecting their industry and, in the long term, their business models. The business environment and timing are the main dimensions to consider when analyzing factors affecting a focal business model, chapter 4.2.4 gives a brief outline of these perspectives. As an introduction the business environment can be broken down into four knowledge perspectives which help managers explore and analyze the factors affecting their business model and timing is connected to industry lifecycles (Implement, 2012; Wells, 2013).

The design phase includes an iterative process where *“various solution alternatives have to be developed and the subsequent feasibility study is regarded as crucial.”* (Gassmann et al., (2012:190). According to Osterwalder and Pigneur (2010) the design phase incorporates the information and the ideas from the previous step and translates that to business model prototypes which are then tested in real life, albeit in a small scale on selected parts of the market (geographic and/or customer segment) (Gassmann et al., 2012; Montignon et al., 2010). A small scale in relation to the ongoing business increases the probability of internal and external stakeholders approving of the initiative (Sosna et al., 2010). The experiment can be benchmarked against competitive models as well as potential market demands (McGrath, 2010). In times of technological change where search for a dominant design is conducted experimentation and insights gathered from failed experiments are necessary to identify a dominant design (McGrath, 2010). Similarly, the prototyping and experimentation are central elements in the business model innovation process since they allow organizations to try out a new model while mitigating its inherent risks as well as learning how to adjust the business model to better fit market needs (Gassmann et al., 2012). Consequently, trial-

and-error learning using double looped learning is a key capability to develop if an organization is to succeed at business model innovation (Moingeon et al., 2010; Sosna et al., 2010). Sosna et al. (2010) argue that there is a difference between design and implementation of new business models where initial experimentation is followed by a continuous fine tuning also based on a trial-and-error approach. Fine tuning is necessary to ensure long-term value creation and scalability of the business model. Further, the implementation phase can require mobilization of scarce resources, structures which promote learning, change and adoption as well as organizational realignment. Moingeon et al. (2010) highlight that implementation often requires ambidexterity, that is to say the ability to implement the current business model while simultaneously introducing a new one. Gassmann et al. (2012) claim that ambidexterity requires an independent organizational unit in the shape of a spin-off or a business unit which leverages various synergies with other business units. However, *“The degree of independence is rather a continuum than two extremes, and companies can leverage all types of organizational set-ups to find the right balance between required independence and the desired utilization of synergies”* (Gassmann et al., 2012:191). As previously mentioned however the business model innovation process is non-linear (Gassmann et al., 2012) thus moving back and forth between the design and implementation phases is part of the trial-and-error learning process.

Monitoring and measuring all internal and external changes to the business model as well as controlling its success, thus ensuring internal and external alignment, is a continuous activity which characterizes the final phase of managing business model innovation (Davidson and Lambert, 2013; Gassmann et al., 2012). Alignments imply *leveraging core capabilities* and *enforce consistency* across all levels of the focal business model which in turn builds customer value (Giesen et al. 2009). As previously mentioned, the building blocks of a business model are interrelated (Osterwalder, 2004; Sommer, 2012, Johnson et al., 2008), thus it is critical to map and understand how they are related and how changes in the business model will affect these relationships (Giesen et al. 2009). Effective business model innovation is also characterized by external alignment with partners, suppliers and customers through open innovation. Data derived from measurement is additionally used to estimate the potential economic impact of the new model as well as create foresight which is used to design future business models (Giesen et al., 2009).

Finally, Wells (2013) argues that although there are no templates for sustainable business models there are some principles which are useful in the innovation process. A more in-depth look at these principles can be found in chapter 4.2.5.

4.2.3.2 Evolutionary perspective

The design and implementation stages of the business model innovation process can also occur without active management. Demil and Lecocq (2010) argue that some emerging changes in a business model are unintended and cannot be managed. Such changes may source from environmental factors but also internal voluntary decisions by individuals or unexpected effects of decisions made by managers. Sosna et al., (2010) draw attention to how an organization’s business model evolves over time through trial-and-error learning in an uncertain environment. The trial-and-error process is of an iterative nature which involves actions that produces desired results as well as results which are discarded due to unsatisfactory results (Sosna et al., 2010). Thus, it differs from more traditional forms of knowledge acquisition such as market research and interviews which are more analytic processes (Moingeon et al., 2010). The iteration *“(…) allows the organization to introduce variations that produce results that converge with goals, and also fosters*

collective/organizational learning (...) promoting organizational change or stability at different times." (Sosna et al., 2010: 386). Each trial generates new knowledge regarding a problem which is fundamental in solving problems where critical information is unavailable and solutions are uncertain (Moingeon et al., 2010). However, there are different types of learning, single looped learning from errors does not result in the questioning of *"the fundamental design, goals, and activities of their organization"* (Sosna et al., 2010:386). Instead, single looped learning means dealing with a problem by applying usual solutions by modifying strategies within an existing frame of reference. In contrast, double loop learning from errors includes the questioning of the acquired prevailing way of doing things and thus learn new way of doing things (Moingeon et al., 2010). Thus, having the ability to learn from failed experiments as well as the resilience to continue experimenting constitutes an important capability for business model innovation (Sosna et al., 2010). Learning from previous failures however makes business model experimentation highly path-dependent and knowing what type of business model will succeed is practically impossible (McGrath, 2010).

4.2.4 Factors affecting a business model

Whatever perspective on business model innovation one assumes, the process is not conducted in a vacuum (Demil and Lecocq, 2010; Giesen et al., 2009; Sustainability, 2014, Wells, 2013). Wells (2013) develops this notion by arguing that business model innovation needs to be grounded in time and place, in a socio-culturally specific moment where technological, economic, political and a myriad of other enabling factors are present. Business model innovation requires an understanding of the business environment as well as knowing if the timing is right for business model innovation (Giesen et al. 2009).

4.2.4.1 Business environment

In order to understand the business environment Implement (2012) highlights four knowledge perspectives which need to be explored prior to innovating a business model: *customers, competitors, capabilities and context*. The customer centric perspective is a core part of traditional business model literature (Sommer, 2012; Wells, 2013). A business model innovator needs to understand customer preferences in terms of goods, services and distribution channels. Further, identifying new customer segments who would require delivery of different products, services or delivery methods is an important factor which affects the business model (Giesen et al. 2009). Analyzing competitors not only gives an understanding of *"customer wants and needs which are not currently satisfied in the marketplace."* (Implement, 2012:13) but also helps spot industry mental models and orthodoxies which could be challenged (Implement, 2012). Analyzing competition further gives an organization and understanding of whether or not new innovations are introduced which potentially could disrupt its business. It is also important to scan for new entrants who potentially could introduce new business models which would disrupt the industry (Giesen et al. 2009).

The knowledge perspective focused on capabilities is used in order to explore both internal and external capabilities and resources. Mapping internal capabilities and resources (C&R) can give an understanding of what is available as well as insights about underuse or potential business opportunities (Giesen et al. 2009; Implement, 2012). Further, mapping of internal C&R might give insight to what new capabilities, skills, processes or resources are needed in order to bring a new value proposition to market (Grant, 2010; Giesen et al. 2009). Additional internal insight could point out why an organization is performing better or worse compared to peers in the industry. External

capabilities and resources include value chain changes and supply chain actors (Giesen et al. 2009). Mapping external C&R can give insights on potential partnerships and collaborations (Implement, 2012). Finally, the context knowledge perspective includes macro factors such as societal trends, legal or regulatory changes as well as emerging technologies which affect an industry. Within this perspective social and environmental sustainability factors which impact an organizations current business model or industry should be mapped and reacted to as well (Giesen et al. 2009). According to Davidson and Lambert (2013) evidence in literature suggest that technological and market-related forces drive business model innovation by forcing organizations to try to adapt. The different knowledge perspectives presented above are connected to the figure 4.3 canvas in figure 4.5 below.

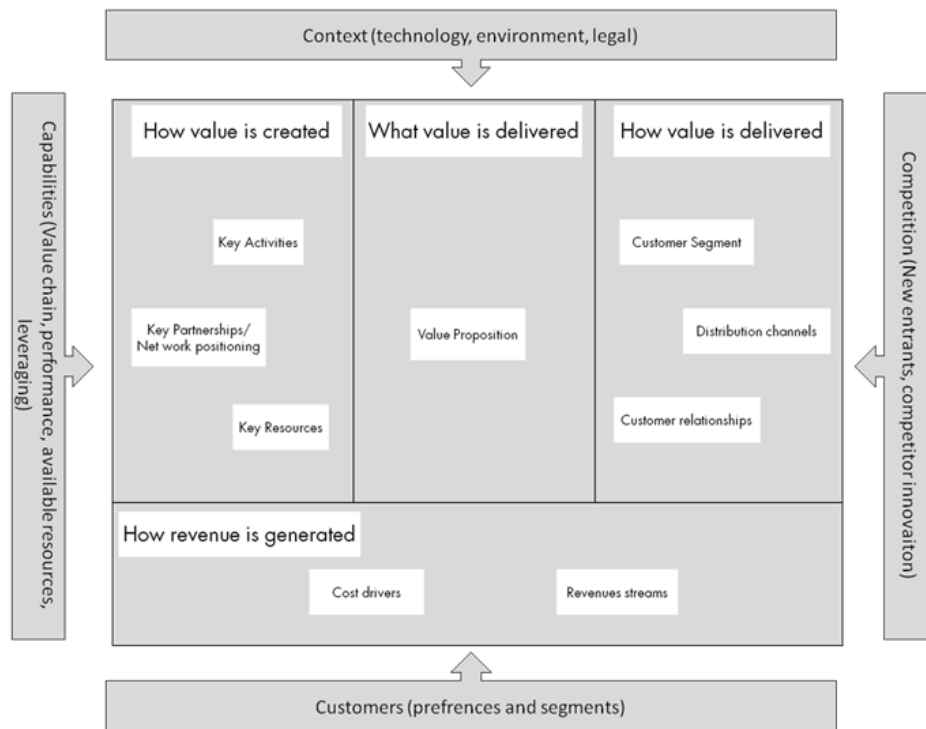


Figure 4.5: Knowledge perspectives and canvas. **Source:** Implement (2012)

The insights gained from the different knowledge perspectives are needed in order to create a market fit for the business model (Gassmann et al., 2013; Giesen et al. 2009). Further, the different knowledge perspectives can be seen as drivers for business model innovation (Giesen et al. 2009) where new business opportunities can be identified at the intersection of the four perspectives (Implement, 2012). Consequently, it seems that a business model needs to be in harmony with the business environment while being flexible enough to adapt to different forces of change (Demil and Lecocq, 2010; Implement, 2012). Table 4.3 summarizes the different knowledge perspectives highlighted above. However, they are not static and are thus subject to change over time. Consequently the contemporary timing is also an important factor affecting the business model (Demil and Lecocq, 2010; Wells, 2013).

Knowledge perspectives	Explanation
Customers	Understand customer preferences and identify new customer segments
Competitors	Identify mental models, new innovations and new entrants
Capabilities	Identify changes in value chain, potential partners, performance relative to peers: Further, identify underutilized capabilities and/or resources and get insights into what is needed for future development
Context	Identify regulatory, environmental, social and technological factors which can have impact on the industry

Table 4.3: Knowledge perspectives. Sources: Giesen et al. 2009; Implement, 2012

4.2.4.2 Timing

According to Wells (2013) the time dimension is problematic since the concept of the business model includes stability and change and is generally understood as *“the relatively fixed structures and practices of a business”* (Wells 2013:61). Giesen et al. (2009) claim that during stable periods within the industry landscape it is satisfactory for organizations to do incremental adjustments to the current business model, in essence keeping their current one. However, during periods of industrial change an organization needs to do more radical changes to its business model (Giesen et al., 2009). The periods of stability and change can be explained through the innovation lifecycle theory¹³ where a product, service or technology evolves through a set of stages over time (Birchenhall and Windrum, 1994; Kaplan, 2014; Rogers, 2003). The speed through which the lifecycle develops and declines is industry specific (Kaplan, 2014). According to Christensen (2003:44) several scholars have stated that *“the essence of strategic technology management is to identify when the point of inflection on the present technology’s S-curve has been passed, and to identify and develop whatever successor technology rising from below will eventually supplement the present approach.”* The S-curve diagram referred to by Christensen (2003) is a way of depicting the lifecycle of a product, service or technology. On the Y-axis one can find “market adoption” in terms of cumulative sales performance while the X-axis presents the time in terms of years (see figure 4.6) (Kaplan, 2014; Rogers, 2003). Consequently, the different stages of the lifecycle (*introduction, growth, maturity and decline*) are connected the diffusion process of an innovation. Early in a diffusion process of any product/technology adoption rate is slow as technologically curious innovators (who only represent around 2,5% of the market) and early adopters (who represent around 14% of the market) only represent a small portion of the potential market (Asthana, 1995; Rogers, 2003). These actors ignore uncertainty regarding product performance and the initial high price of the product/technology due to curiosity, interest and/or the potential benefits of the product/technology (Asthana, 1995).

¹³ Basically the same as industry lifecycle with a more clear focal point on product, service and technology

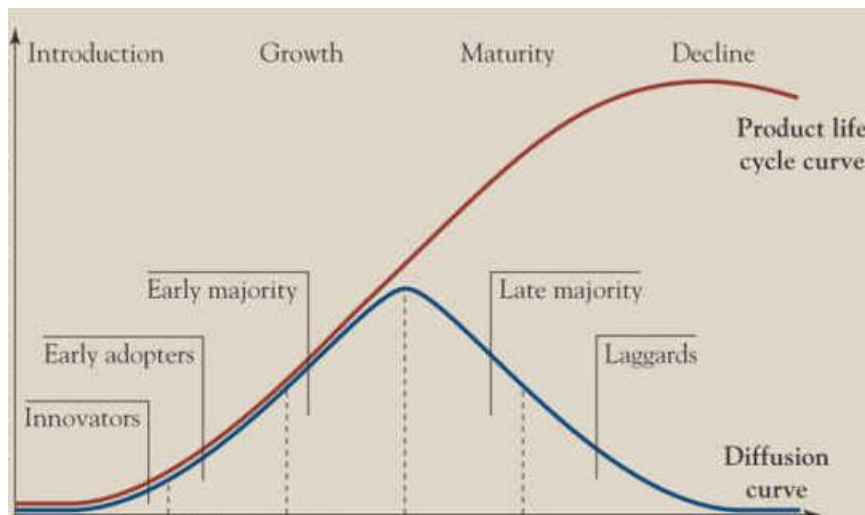


Figure 4.6: Innovation lifecycle and diffusion rate
 Source: *highered.mheducation.com*, 2014

However, as time passes adoption rate increase as a dominant design¹⁴ emerges and the majority buyers, who are mainly risk adverse and shy away from new technology since they are unable to understand or appropriate its benefits or generally uninterested, become confident enough to buy the product/service/technology (Asthana, 1995; Rogers, 2003; Teece, 1986). The majority usually waits until the product/technology is perceived as reliable and trusted actors approve of its functionality (Asthana, 1995). Thus, the primary aim of a marketing strategy during the early phases of the lifecycle is to educate the market, create market awareness and prove the product performance. As awareness of builds up, early majority buyers begin to purchase the product which act as a catalyst for other majority adopters (Asthana, 1995). When the lifecycle reaches maturity it can be extended through incremental improvements until decline and substitution for another sustaining technology or disruption occurs (Christensen, 2003; Kaplan, 2014; Rogers, 2003). Consequently, the beginning of a curve relates to the creation of a market opportunity whereas the final part of the curve represents the decline of market adoption for the product, service, or technology (Kaplan, 2014). During sustaining technological changes the end of one S-curve marks the emergence of a product, service or technology which replaces the previous one as seen in figure 4.7 (Christensen, 2003; Kaplan, 2014).

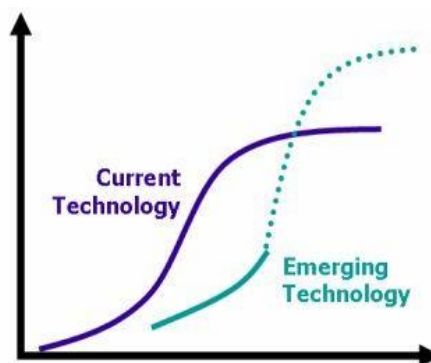


Figure 4.7: Current and emerging technology s-curve
 Source: *media.tumblr.com*, 2014

Organizations often find it difficult to “jump” onto another emerging S-curve as these often are associated with technological and market uncertainty. “Technological uncertainty arises from the

¹⁴ Further developed in 4.3.4.2

unpredictability of technological evolution and the complex dynamics through which technical standards and dominant designs are selected.” (Grant, 2010:308). Uncertainties related to the market are due to the unknown market size and growth rates connected to a novel innovation (Grant, 2010). These uncertainties are in turn associated with business risk, potentially novel customers and/or competitors and novel resources and capabilities (Asthana, 1995; Kaplan, 2014). The unknown market adoption of a new product/technology coupled with a slow diffusion rate at best makes it risky and difficult for organizations to “jump” to another S-curve. However, the ability to create new markets and simultaneously manage the current profitable option is a key business model innovation management capability (Moingeon et al., 2010; Teece, 2010). Furthermore, focusing too much on current customers and competitors might prevent incumbent organizations from seeing new potential markets or potential disruptions which could render the current sustaining technology S-curve or the jump onto a new S-curve within the same value network obsolete (Asthana, 1995; Christensen, 2003). Exploring novel customers and stakeholders as well as mapping the surroundings is also a task necessary for and facilitated through the business model concept (Gassmann et al., 2012; Implement, 2012; Wells, 2013). Consequently, one can argue that a novel S-curve is a sign of a state of industry change which forces organizations to manage changes in business models affected by the industry change (Giesen et al., 2009).

4.2.4.3 Connecting the factors affecting a business model to the business model concept

Viewing the literature presented in 4.2.4.1 and 4.2.4.2 it seems that business models need to be grounded in the contemporary business environment and take into account different changing factors (Giesen et al. 2009; Implement, 2012; Wells, 2013). Consequently different environmental contexts would affect the same focal business model in different ways. Adding to the complexity is the innovation lifecycle perspective which indicates the adoption rate of an innovation and thus also if there is a state of technological change where a “jump” in S-curve is needed. In times of technological change business model innovation is needed (Giesen et al., 2009). Consequently, different business models can be different innovation lifecycles during the same moment in time and be subject to same or different environmental factors depending on context. Figure 4.8 shows the conceptual relation between business models under influence of the dimensions presented in the knowledge perspectives and the innovation lifecycle S-curve during the same point in time.

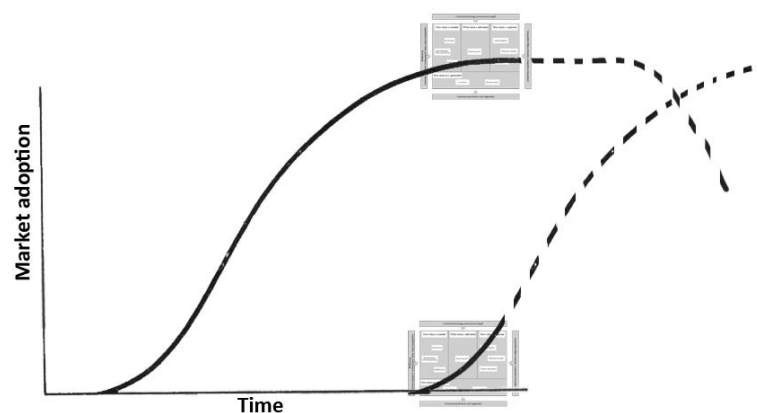


Figure 4.8: A current product business model S-curve in relation to an emerging product business model S-curve at the same point in time.

4.2.5 Principles for business model innovation for sustainable development

Wells (2013) argues that although there is no definite template for business models being sustainable, adhering to six principles can be a way to create business models which contribute to a sustainable development. Most of the principles are concerned with socio-economic issues however and can thus be seen as part of the context knowledge perspective mentioned in 4.2.4

The principles are:

- *Resource efficiency*
- *Social relevance*
- *Localization and engagement*
- *Longevity*
- *Ethical sourcing and supply*
- *Work enrichment*

Resource efficiency is described as a driver for sustainable development by several authors¹⁵ (Schaltegger et al., 2011; Elkington, 1994) whereas the principle of social relevance is *“that any product or service should contribute to the health and happiness of humanity, and should thereby serve social needs.”* (Wells, 2013:68). However, the social relevance is a complex issue lacking any coherence and shifts over time (Wells, 2013). The principle of localization and engagement is connected to the view of businesses being anchored in a local social context, thus tailored to serve local needs and employ local people. From such point of view, a business is assumed to contribute to local wealth creation and social stability and thus develop a mutual dependency with its context which in turn increases firm resilience. Localization is not exclusive to small entrepreneurial ventures, large multinationals are able to localize as Philips in Eindhoven exemplifies. Further, a fundamental principle of sustainability which could transfer into business and the products and services it produces is longevity which essentially means prolonging product lifetime and able upgrading through modularity. The combination of longevity and localization sets favorable preconditions for sustained competitive advantage. As an example companies which are over 100 years old are mainly small, family owned, and not only intended to maximize profit but do serve local markets and are rooted locally (Wells, 2013). According to Gittleson (2012; referenced in Wells, 2013:71-72) *“the average company in the Standard & Poor’s top 500 list in the 1920s had an average life in the list of 67 years; by 2012 that had fallen to 15 years – suggesting that corporate volatility has increased(...)”* Longevity can also be achieved through an adaptation of a business models to external change thus *“migrating”* into new business areas, as an example Peugeot migrated from crinoline frames via bicycles into car manufacturing (Wells, 2013).

In an interconnected reality, a business cannot be an isolated island single handily driving towards sustainable development. From a business model perspective interconnectedness and cooperation with partners is a necessity for an organization to successfully innovate its business model towards sustainable development. Arguably, ethical sourcing and supply is therefore a matter of policy and governance within an organization. However, it is important to note that corporations are limited by *“their insertion into global economic practices and structures that are fundamentally unequal.”* (Wells, 2013:75). That is to say, sourcing and supply need to be economically viable where available choices are affected by the macro-economic environment in which a business operates (Wells, 2013).

¹⁵ And is further developed in chapter 4.3.1

Finally, the principle of work enrichment intends to reverse the effects of repetitive tasks which require little autonomy through the redesign of tasks. Targeted effects include boredom, lack of flexibility and employee dissatisfaction (Mione, 2006). The principle of work enrichment should aim at taking the “workers’ health” agenda further than the traditional “health and safety” issues, thus striving towards workers gaining happiness and self-fulfillment through the tasks they perform. Consequently, a more sustainable business can be created which attracts new employees and fosters innovation (Wells, 2013).

4.3 Sustainable Development in a Business Context and Sustainability Innovation

“There is no doubt: the sustainability megatrend will change the business world. In fact, the economy has already started to respond, for example in the form of green marketing efforts (...), changes in product portfolios (...) or capital flows (...). Some scholars even proclaim the emergence of a new form of capitalism.” (Sommer, 2012:5)

As mentioned in chapter 4.2.4 contextual factors, such as sustainable development, are external forces which affect business models. In order to understand what forces business need to deal with and why these forces of sustainable development are relevant there is a need to point out the potential sustainable development drivers for business as well as the role of public policy in facilitating sustainable development among social actors. Additionally, commercializing innovation often requires the creation of new markets and stimulation of willingness to pay. Such tasks are business model task according to Teece (2010). Lüdeke-Freund (2013) draws an analogy on Teece’s statement, thus arguing that the process of bringing products, services or product-service-systems with social and environmental benefits to market is not purely regulated by supply and demand structures. They require public policies as well as business models. Thus, it seems sustainability innovations are dependent of “market fit” business models as well as public policy to be successful on the market.

4.3.1 The relevance of sustainable development for business?

Schaltegger et al. (2011) claim that there is no general answer to whether or not it is profit-driving to be green as a business so why should you care? Heinberg (2007) argues that we are moving towards a time of resource scarcity thus implying an increase in prices for resources such as oil¹⁶, phosphor and rare earth minerals. Cost reduction through resource efficiency is thus, according to several authors (Nidumolu et al., 2009; Schaltegger et al., 2011), a main driver for sustainable development for businesses. The input of energy and raw materials is necessary for a business to function, as these are costs, addressing waste of energy and achieving reduction in material flows reduces cost thus impacting the bottom line of a business (Schaltegger et al., 2011; Elkington, 1994). Resource scarcity also implies that organizations which rely on resources which are expected to become scarce will need to change in order to survive (Kiron et al., 2013; Businessinsider.com, 2014). Mitigation and the reduction of risk are also relevant when discussing sustainable development for business (Nidumolu et al., 2009; Schaltegger et al., 2011). Connected to the costs are general risks such as unforeseen potential or actual costs as well as risks connected to technical, political and societal development. Kiron et al., (2013) highlight the societal developments in Europe where consumers and employees are becoming more aware of the issues connected to the lack of sustainable development such as

¹⁶ See Appendix III for graph on oil prices

climate change and deforestation (Rockström & Wijkman, 2012). These trends tie into brand value and reputation where customers prefer and are ready to pay a premium for sustainable products (Kiron et al., 2013). Employee attractiveness, as mentioned by Schaltegger et al. (2011), is also affected since working towards a bigger cause attracts and retains employees (Businessinsider.com, 2014). Further, Nidumolu et al. (2009) points out that the process of reducing materials and energy input facilitates process and product innovation which potentially increases revenue thus sustainable development can be seen as *“the mother lode of organizational and technological innovation that yields both bottom-line and top-line returns.”* (Nidumolu et al., 2009:3).

Finally, opportunities regarding sustainable development are changing corporate business models. According to a study conducted by MIT Sloan management review and Boston Consulting Group nearly 50% of the companies in the survey claimed that they had changed their business models in response to sustainability opportunities (SustAinability, 2014).

Business case drivers	Potential effects of sustainable development
Cost reduction	Energy savings, material flow reduction
Risk reduction	Reduction of political, societal and technological risks
Sales and profit margins	Increased sales through new products and services, new markets and customers
Reputation and brand value	Social awareness, innovativeness,
Employer attractiveness	Attract and retain talented employees
Foster innovation	Provokes new product, process and business model innovation
Keeping up with competition	Competition gaining a competitive advantage through sustainable development
General sustainability opportunities	Changes in business models

Table 4.4: *Relevance and effects of sustainable development*
Sources: Businessinsider.com, 2014; Nidumolu et al., 2009 Shaltegger et al., 2011; SustAinability, 2014

As summarized in table 4.4 there are a plethora of reasons to why business needs to engage in sustainable development.

4.3.2 The need for public policy to support sustainable development

The dominant model of the corporation draws on shareholder value maximization logic where the primary obligation of the corporation is to maximize shareholder profits (Fligstein, 2001) leading to environmental and social goals being subordinated economic goals. Thus inherently, such logic, limits the ability of any social actor to effectively address social and ecological degradation (Jackson, 2009; Stubbs and Cocklin, 2008). Further, organizations operating on competitive markets cannot adapt a no-growth policy without going bankrupt in the long term and are thus subject to a growth imperative (Gordon & Rosenthal, 2003). This further enhances the belief of the company only being an instrument for the creation of profit for the shareholders (Fellman et al., 2008), consequently self-reinforcing an unsustainable economic logic. Desrochers (2010) argues that organizations who strive for profit can lead towards sustainable development, once a certain level of knowledge and technology is met within society. Through the profit incentive companies strive to become efficient in terms of material use, additionally this strive can lead to new innovations (Desrochers, 2010; Nidumolu et al., 2009; Schaltegger et al., 2011). Lüdeke-Freund (2013) highlights the potential pivotal

role of sustainability innovation¹⁷ for an industry transformation towards an environmentally and socially more sustainable state based on business opportunities. In such cases the use of core business capabilities can convert market imperfections into business opportunities. According to Schaltegger & Wagner (2006; found in Lüdeke-Freund, 2013) discovering and exploiting business opportunities allow a realization of business cases for sustainability which are *“based on the creation and management of positive interrelations between economic and business success as well as contributions to a sustainable development of the economy and society”* (Lüdeke-Freund, 2013:7). The existence of a business case for sustainability is based on the appropriability of social and environmental benefits. If these benefits cannot be appropriated the business case is insufficient thus the incentives to invest in sustainability innovations are reduced (Schaltegger and Wagner, 2008) One is however mistaken to believe that pure profit incentives are enough to drive sustainable development. In an example concerning Standard Oil Desroches (2010) shows that it is only when the company adheres to regulations, set by the regulatory authority, that a more sustainable behavior as well as innovation is fostered. Public policy, as part of the legal system, can be seen as an institution and thus being *“the humanly devised constraints that shape human interaction”* (North, 1990:3). Being an actor who shapes human interaction gives the means to incentivize actors within the economy to incrementally strive towards sustainable development. According to Jacobsson and Bergek (2004) public policy can foster sustainable development among actors within the economy through incentivizing the creation of new knowledge, guide the search direction in terms of technical and non-technical innovation through legislation and subsidies as well as create markets for innovations with social and/or environmental benefits.

In summary, several authors seem to suggest that sustainability innovation has an important role to play in industry transformation towards a more environmentally and socially sustainable state where a business case for sustainability is needed to create market based incentives to invest in such innovations. However, progressive public policy is also needed as a driver for sustainable development and innovation.

4.3.3 Sustainability innovation

If sustainability innovation is important for industry transformation towards sustainable development (Lüdeke-Freund, 2013), exploring what it is and how sustainability innovation differs from the general notion of innovation is necessary. Consequently, a somewhat deeper exploration of the notion of innovation is also called for. However, prior to any exploration of the term *innovation*, there is a need for a clarification of the differences between idea, invention and innovation (Sandberg, 2008). In the context of innovation research, ideas are the starting point of any innovation (Sandberg, 2008) where an idea can be a concept, a thought or a collection of thoughts (Trott, 2012). An invention then, is the first step in a process of bringing an idea to widespread use (Bessant and Tidd, 2013) where inventions which have the potential to create positive social and ecological effects are possible sustainability innovations (Lüdeke-Freund, 2013). Innovation then, is seen as a process where ideas are turned into reality and value is captured from them (Bessant and Tidd, 2013). The development of new knowledge or the combination of existing knowledge is also important to highlight since new and existing knowledge can create inventions which become potential innovations if delivered successfully to a market (Grant, 2010). Reaching a market is, according to Sandberg (2008), emphasized in several definitions of innovation such as the one by Dodgson et al.

¹⁷ Further developed in chapter 4.3.3

(2008, p.2) where innovation is defined as “*the successful commercial exploitation of new ideas*”. The level of success depends on the amount of value created by an innovation and the share of that value appropriated by the innovator (Grant, 2010). Thus, innovation is more complicated than invention as it includes decisions in areas such as strategy, organization, finance and other business activities which are necessary for a successful commercialization of new ideas (Dodgson et al., 2008). Prior to further exploring the notion of sustainability innovation it should be noted that there is a plethora of innovation categories such as technological innovation (Christensen, 2003[2000]; Dodgson et al., 2008), open innovation (Chesbrough, 2003), product, process and organizational innovation (OECD, 2005¹⁸) as well as business model innovation (Amit and Zott, 2011; Gassmann et al., 2012). These categories are all perspectives to which the notion of innovation can be applied. Further, these perspectives have their own characteristics, definitions, challenges and success factors. Nevertheless, in its basic form innovation is the process of successfully bringing an idea to market (Bessant and Tidd, 2013; Dodgson et al., 2008).

The notion of sustainability innovation stems from *sustainable innovation* (Lüdeke-Freund, 2013) which is defined as “*a process where sustainability considerations (environmental, social, and financial) are integrated into company systems from idea generation through to research and development (R&D) and commercialization.*” (Charter and Clark, 2007:9). Boons et al. (2013) uses the same definition to explain sustainability innovation. Furthermore, the concept *eco-innovation* is an alternative term which includes the process of developing products, processes or services which significantly decreases environmental impact while creating value for customer and businesses. Eco-innovation mainly focuses on the environmental aspects however, whereas sustainable innovation (and consequently sustainability innovation) additionally includes the social and financial aspects (Charter and Clark, 2007). Consequently, the notion of sustainability innovation adds another layer of complexity to the concept of innovation (Boons et al., 2013) and eco-innovation by including all the dimensions of sustainable development¹⁹. Sustainability innovations thus are products and services, new technologies, processes as well as business models and organizational changes which are different from general innovation as they improve performance according to social, environmental and economic criteria (Lüdeke-Freund, 2013).

It should be noted that there is a spectrum of levels, from incremental to radical, which help define the environmental improvement of eco- and sustainability innovations as seen below:

- **Level 1 (incremental)** - *Incremental or small, progressive improvements to existing products*
- **Level 2 (re-design)** - *Major re-design of existing products*
- **Level 3 (functional or ‘product alternatives’)** - *New product or service concepts to satisfy the same functional need e.g. teleconferencing as an alternative to travel*
- **Level 4 (systems)** - *Design for a sustainable society*

(Charter and Clark, 2007:10)

Although the levels are not separated by absolute or quantifiable boundaries the primary focus and aim of sustainability innovations is to achieve the higher levels thus potentially contributing to significant reduction of environmental impact (Charter and Clark, 2007; Lüdeke-Freund, 2013). As the

¹⁸ http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/OSLO/EN/OSLO-EN.PDF [accessed 2014-09-12 17:30]

¹⁹ That is to say the economic, environmental and social dimension

higher levels are associated with radical change aiming at achieving those levels implies a radical nature embedded within sustainability innovations. Note that the lower levels (1 and 2) are associated with eco-innovations (Charter and Clark, 2007) and they focus solely on environmental impact thus neglecting other dimensions of sustainable development.

4.3.4 Appropriating value from product innovation

Successfully bringing an invention to market includes diverse challenges such as identifying customer segments and their needs, production up-scaling and capturing a share of the profits (Lüdeke-Freund, 2013). In such context it is often other actors such as suppliers or fast moving competitors who profit most from a first mover innovation (Dodgson et al., 2008). Through the “profit for innovation” (PFT) framework Teece (1986) explains how strategic positioning together with internal and external factors influence the ability to capture value from an innovation. The PFT – framework presents the *appropriability regime*, the *dominant design paradigm* and the *complementary assets* as three dimensions which can be used to predict and analyze commercialization success (Teece, 1986).

4.3.4.1 The appropriability regime

The appropriability regime describes how legal protection and the type of innovation determine the likelihood of capturing value from an innovation. Legal protection consists of patents, copyrights and trade secrets while the innovation type is determined by the degree in which knowledge is tacit or codified where codified knowledge is easier to communicate (Teece, 1986).

- | | |
|---------------------|------------------------|
| ● Legal instruments | ● Nature of technology |
| - Patents | - Product |
| - Copyrights | - Process |
| - Trade secrets | - Tacit |
| | - Codified |

Figure 4.9: Key dimensions of appropriability regime
Source: Teece (1986)

Further, Teece (1986) distinguishes between tight appropriability regimes (where legal protection is strong and where the nature of the innovation prevents imitators from gaining access to relevant knowledge) and weak regimes (“e.g. manufacturing processes that can be copied without defying copyrights or trade secrets.” (Lüdeke-Freund, 2013:10)). Within tight appropriability regimes an innovator is able to capture a large share of the created value whereas in a weak regime other actors appropriate most of the value (Grant, 2013).

4.3.4.2 The dominant design paradigm

According to Teece (1986) the innovation diffusion and evolution process explored in chapter 4.2.4.2 can be explained as two main stages, the preparadigmatic and the paradigmatic, which are similar to the evolutionary development of science in any given branch. The first stage is characterized by “(...) there being no single generally accepted conceptual treatment of the phenomenon (...)” (Teece, 1986:287). In the second phase there is generally a body of theory which has gained a scientific acceptability and involves the acceptance of agreed upon standards from which further scientific discoveries can be achieved. These standards remain until overturned by new ones (Teece, 1986). The preparadigmatic phase is characterized by competition among designs. “(...) product designs are fluid, manufacturing processes are loosely and adaptively organized, and generalized capital is used

in production.” (Teece, 1986:288). Additionally, the uncertainties associated with emerging S-curves presented in chapter 4.2.4.2 are connected to the preparadigmatic as well.

At some point in time, following the preparadigmatic time of trial-and-error, a more narrow designs emerges which is able to meet a whole set of user needs thus also lowering the entry barrier for majority adopters. This dominant design shifts competition away from design and focuses it on price (as seen in figure 4.10). Consequently, economies of scale and learning become increasingly important which reduces the price of the product and uncertainty over product design is reduced which allows for specialized long term investments (Grant, 2010; Teece, 1986).

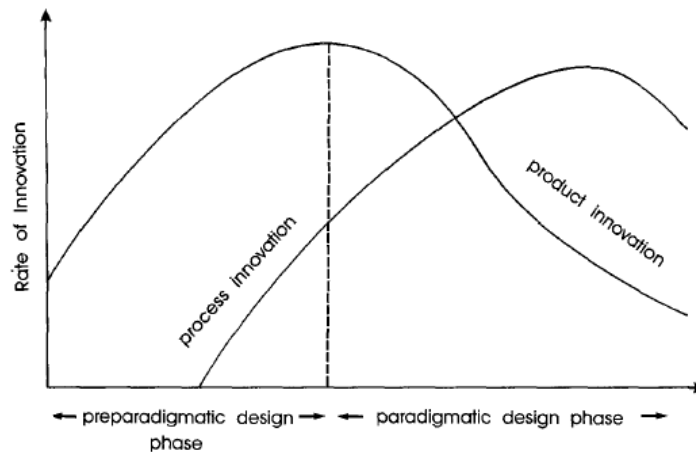


Figure 4.10: Innovation in the different phases
Source: Teece (1986)

According to Bessant and Tidd (2013) the different phases have a set of characteristics which can be seen in table 4.5. The authors argue that the phase in-between the preparadigmatic and paradigmatic phases has its own characteristics.

Innovation characteristics	Preparadigmatic phase	Transitional phase	Paradigmatic design phase
Competitive emphasis placed on...	Functional product performance	Product variation	Cost reduction
Innovation stimulated by...	Information on user needs, technical inputs	Opportunities created by expanding internal technical capability	Pressure to reduce cost, improve quality, etc.
Predominant type of innovation...	Frequent major changes in products	Major process innovations required by rising volumes	Incremental product and process innovation

Table 4.5: Characteristics of the different innovation phases
Source: Bessant and Tidd (2013)

Suarez (2004) identifies four firm-level factors and four environmental-level factors which help determine the dominant design. In relation to its peers technological superiority is important. Furthermore, chances of creating a dominant design increase with a large install base as well as having credibility. Finally the strategic maneuverability (consisting of four elements: timing of entry to industry, pricing strategy, the way relationships with complementary goods and services are handled and the intensity of marketing and public relations efforts) is an important factor determining a dominant design.

As for the environmental-level factors favorable regulations and a strong appropriability regime are important for success probability. Further, network effects created by the consumption of complementaries can create momentum for a specific technology in relation to peers. Such effects are further affected by switching costs. Finally, the characteristics of the technological field set a context from which to compete within (Suarez, 2004).

4.3.4.3 Complementary assets

Teece (1986) argues that a successful commercialization of an innovation requires a combination of other capabilities and assets such as after-sales, marketing, support and competitive manufacturing. In case of more systemic innovations complementary products and services are often obtained by or in alliance with third party actors (Grant, 2010; Lüdeke-Freund, 2013). Complementary assets can be specialized or unspecialized where specialized ones are associated with large costs since they require specific investments in knowledge, production capacity and supplementary components. Through sharing the costs with different actors the complementary assets can become unspecialized thus lowering entry barriers but simultaneously putting innovators in a stronger position to capture value (Grant, 2010).

4.3.4.4 Appropriating value from sustainability innovation

According to Lüdeke-Freund (2013) the dimensions mentioned in 4.3.4.1 - 4.3.4.3 are universally valid and can be seen as challenges for commercializing any innovation. Sustainability innovations however, have their own set of challenges. Sustainability innovations maintain or increase the overall capital stock (in terms of economic, natural and social capital) of an organization, thus internalizing negative external effects. They can also produce “net positive effects”, consequently sustainability innovations can be substituted to cost disadvantages from deliberate internalization of environmental and/or societal costs. Additionally, sustainability innovations need to deal with spillover effects from R&D which allow other third party actors to potentially profit from the innovation without bearing the development costs. These spillover effects can be due to knowledge transfer to third parties or dependency on complementary assets owned by other actors. Spillover effects are not exclusive to sustainability innovations but when coupled with the internalizing of negative external effects this double externality barrier makes it difficult for an innovator to appropriate value from a sustainability innovation (Hockerts & Wüstenhagen 2010; Lüdeke-Freund, 2013) Further, the fluent definition of what a sustainability innovation consists of in different industry contexts – two reasons being that different industries and companies within the same industries define and measure the dimensions of sustainable development differently as well as put emphasis on the dimensions where the perceived impact is highest - creates a barrier where such innovations need to be embedded and agreed upon within the temporal and social context (Lüdeke-Freund, 2013; Uyarra et al., 2014; Wells, 2013).

Sustainability innovations are often assumed to be of radical or systemic character thus replacing technological regimes and unstable dominant designs (Lüdeke-Freund, 2013). In order to innovate within systems it is necessary to be able to adapt to shifting market conditions. Organizations need to be able to build new markets and dampen or avoid the impacts from dramatic systems shifts (Sustainability, 2014). The creation of new markets can be seen as a business model task (Teece, 2010) and business models can be seen as conceptual tools which give a holistic picture thus helping to explain how a focal subject is embedded within and interacts with its surrounding eco-system

(Chesbrough, 2010; Gassmann et al., 2012; Wirtz, 2011). Consequently, utilizing business model innovation can be seen as a way of facilitating innovation within systems. Facilitating the commercialization of sustainability innovations through a “market fit” business model would then drive industry wide sustainable development since sustainability innovations are assumed to create and extend opportunities and business cases for sustainability (Lüdeke-Freund, 2013). Furthermore, seeing beyond obvious short-term business cases and focusing on system factors enables innovation within systems (Sustainability, 2014). Additionally, experimentation of revenue models such as leasing or selling usage instead of products can be used to change a business model (Lüdeke-Freund, 2013). Such and other types of business model experimentation can be done through accumulation of incremental changes which is also seen as a transformative force (Andersen, 2008 found in Lüdeke-Freund, 2013). Seeing sustainability innovations as radical, that is to say an innovation which is characterized by creating de-novo markets which are disruptive for customers and manufacturers implies that such innovations often target small niche markets which are unattractive for large firms (Schaltegger and Wagner, 2008). Additionally, sustainability innovations are often conducted by small niche actors who, in order to reach a mass market and thus creating a transformative effect, need to cooperate with large actors (Schaltegger and Wagner, 2011). Consequently, large firms benefit from a fast second strategy. That is to say, large firms are not the ones colonizing a new market but can move in prior to a dominant design being apparent and utilizing their capabilities in order to “*consolidating radical into mass markets:*” (Schaltegger and Wagner, 2008:41)

The potential transformative nature of sustainability innovations also require a shift in the common understanding among individuals of what their business is and how they create value. According to several sources (Chesbrough, 2010; Sustainability, 2014) such mental models are powerful barriers of innovation, especially in relation to business models in existing companies (Moingeon et al., 2010). On an individual basis mental models are the “*Beliefs, ideas, images, and verbal descriptions that we consciously or unconsciously form from our experiences and (...) guide our thoughts and actions (...) These representations of perceived reality explain cause and effect to us, (...) and predispose us to behave in certain ways.*” (businessdictionary.com, 2014). Translated into an organizational context mental models are defined as:

“(...) organizations’ past experiences, retained in their routines and beliefs, influence their actions and how they adapt to environmental changes.”

(Sosna et al., 2010:386)

These mental models are rigid and are helpful in order to prevent data overload and intolerable levels of uncertainty. Consequently, the mental models act as filters which bring about fast and reliable decisions as well as better forecasting and control of the environment (Hill and Levenhagen, 1995). Furthermore, mental models help avoid inappropriate decisions when social actors are faced with crisis which are perceived as short-lived (Gordon, 1991). Too rigid mental models however limit the ability to interpret information in non-routine situations and can, if seen as “truths”, lead to resistance to change and missed opportunities (Moingeon et al., 2010). The key to break free from impeding routines and beliefs is through trial-and-error experimentation and learning (Sosna et al., 2010).

Finally, the authors screened in chapter 4.3.2 suggest that public policy is necessary for sustainable development and consequently it can also play a significant role in the successful diffusion of sustainability innovations. According to Jacobsson and Bergek (2004) one way through which public

policy can foster sustainable development among actors within the economy is through the creation of markets for innovations with social and/or environmental benefits. Public procurement is one tool through which markets can be created, as such procurement is more likely to generate innovations compared to R&D subsidies and is further effective in stimulating innovation (Uyarra et al., 2014). Nevertheless, the lack of public procurement is an issue for organizations which produce products with environmental benefits (Dee et al., 2008). Barbier (2011) highlights institutional inertia, that is to say institutional path dependence, as a reason to why public organizations do not procure sustainability innovations to a larger extent. The inertia is caused and reinforced through a process of social behavior and relationships which reinforce the existing social order. One reason explaining this process is that *“institutions and the social order become geared towards reducing transaction costs (...) of existing production and market relationships.”*(Barbier, 2011:60). Consequently, as societies become more complex their institutions become more difficult to change. Risk aversion within public organizations is another issue which acts as a barrier for procuring innovations with environmental and social benefits. The risk aversion can be connected to the precautionary principle²⁰ which flavors public procurement in Sweden (Riksdagen.se, 2012; Miljöstyvningsrådet, 2014). Thus, the precautionary principle creates incentives for procuring the cheapest alternative as well as refraining from procuring chemicals in cases where the perceived risk of harm to the public or the environment lacks scientific consensus regarding the chemical not being harmful (Miljöstyvningsrådet, 2014; precautionaryprinciple.eu, 2014). Further, according to Uyarra et al. (2014) there are strong expectations regarding accountability and transparency which affect decision making within the public sector thus requiring solid risk management in terms of systematic processes for evaluating and addressing risk in a cost effective way as well as commercial skill among procurers. However, public organizations do not always have proper risk management or procurement capabilities thus the lack of such capabilities create another barrier for sustainability innovations. An additional public procurement issue which can act as a barrier is the nature of the tender specifications. Generally specifications focusing on outcomes or performance are better than detailed and rigid specifications if one intends to foster innovation (Uyarra et al., 2014). Thus, clearly defining what sustainability innovation means from a public policy perspective so that higher sustainability performance can be specified and rewarded is a way of facilitating markets for sustainability innovations (Charter and Clark, 2007). However, Uyarra et al. (2014) point out that the procurement barriers mentioned above appear depending on context, thus different parts of the public sector subject suppliers to different challenges.

Table 4.6 below summarizes the different challenges of capturing value from sustainability innovation identified in literature. It is based on a table found in Lüdeke-Freund (2013:13) and adds additional challenges which are presented in above.

²⁰ *“When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm.”* <http://www.precautionaryprinciple.eu/> [accessed 2014-10-16 17:01]

Challenges related to...	Explanation	Potential opportunity
Appropriability regime	The ability to capture value from innovation is determined by the type of knowledge (i.e. tacit), innovation (i.e. process) and protection (i.e. patent)	Identify and position along the most advantageous regime.
Dominant design	Competition through different design standards in preparadigmatic phase and search for dominant design results in great uncertainty. Once a dominant design emerges competition shifts towards process innovation.	Strive towards owning the dominant design or the complementary assets for it.
Complementary assets	Generic assets such as after-sales, marketing, support and competitive manufacturing are necessary for successful commercialization. Third party cooperation important.	Identify an advantageous position towards asset and capability owners.
Discursive ambiguity	The definition of sustainability innovation and sustainable development is contextual in terms of time, space and culture.	Define how a specific innovation is "sustainable" or how it moves forward in terms of sustainable development.
Measurement	There is a lack of trusted methods which are able to prove the claimed sustainability of an innovation.	Assess, measure and make the method as well as its flaws transparent.
Anticipatory risk	The effects of an innovation in terms of economic, environmental and social dimensions can merely insufficiently be anticipated.	By monitoring progress towards set goals and avoiding early lock-ins costs can be avoided.
Radical innovation	Sustainability innovation is often assumed to be of radical or systemic character thus replacing technological regimes and unstable dominant designs.	Aiming at co-evolution between large and small actors and using transformative power of incremental steps.
System-level change	System-level changes are often required to transform technological regimes and current dominant designs.	Inclusion of multiple actors and artifacts increase transformative potential. Utilizing business model innovation and the ability to look beyond short term profit further increases the success factor of such changes.
Double externality	<i>"The double externality problem means that part of the value of an innovation cannot be appropriated due to innovation spillovers, while at the same time external costs are borne by the innovator"</i> (Hockerts & Wüstenhagen 2010 found in Lüdeke-Freund , 2013:13).	Lobby for public sustainability policies and raise awareness among customers.
Mental models	The common understanding among individuals of what their business is and how they create value is a barrier to novelty and innovation.	Question prevailing logic, trial and error experimentation and double loop learning.
Public procurement	The extent to which innovations are supported by public procurement is dependent on the formulation of the tender specification, the skill available in terms of risk management and commercial skills as well as the ability to handle institutional inertia and general risk aversion.	Procuring actors need to be aware of and handle institutional inertia, formulate tender specifications based on outcomes or performance, develop risk management and commercial skill capabilities.

Table 4.6: Challenges and opportunities related to capturing value from sustainability innovations.

Source: Lüdeke-Freund, 2013; Moingeon et al., 2010; Sustainability, 2014; Teece, 1986; Uyarra et al., 2014

4.4 Chapter Summary

In this chapter I have concluded that a business model differs from strategy and that it can be seen as a conceptual representation of the logic through which an organization captures and creates value. The concept reduces the complexities of an organization into several interrelated building blocks, which in turn can be aggregated into different elements. Furthermore, the concept can be viewed from a static and a dynamic perspective, where the dynamic one builds on top of the static perspective, essentially adding the flow of time. Viewed from a dynamic perspective the business model becomes a subject of change and innovation which additionally facilitates a “market fit” for other types of innovations such as product sustainability innovations. There is an ongoing discussion among scholars regarding what constitutes a business model innovation. Nevertheless, business model innovation is mainly seen as a process where any level of activity system adjustment can be labeled as such. Consequently, I define business model innovation as any observable change over time in a business model building block or an element exposed to a market. Furthermore, a business model and consequently business model innovation is affected by internal and external factors where sustainable development is one such factor for which several business case drivers have been identified. Realizing an identified business case for sustainability through a sustainability innovation could lead to an industry transformation towards a more socially and environmentally sustainable state. There are however several barriers which impede the appropriation of value from a sustainability innovation. Additionally, pure profit incentive is not enough to able organizations, which are pressured by growth imperative and shareholder value maximization logic, to invest in sustainability innovation and thus strive towards sustainable development. Consequently, incentives created through public policy are necessary.

5 Empirical Findings

This chapter is divided into two interconnected parts. The first part focuses on the static view of two business models in an attempt to outline any differences which could imply that a business model innovation process has taken place. The subsequent part focuses on the business model of the Rediset additives and presents the empirical data according to the logic presented in chapter 1.2 where sustainable development and innovation are mutually reinforcing (see figure 5.1).

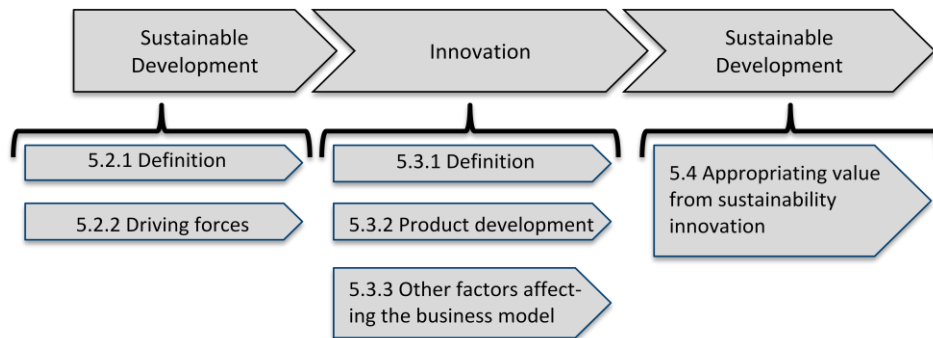


Figure 5.1: Structure of the empirical findings from a dynamic point of view.

Understanding how AkzoNobel defines sustainable development is necessary since much of the empirical data regarding sustainable development in the context of AkzoNobel Asphalt Applications is derived from interviews or documents sourced from the organization. Further, as RQ2 aims at understanding the specific sustainability drivers potentially affecting Asphalt Applications special emphasis is put on mapping them. Subsequently, data regarding business model innovation is presented where the company definition, the Rediset product development process and a somewhat semi-static view of the general business context is presented. Chapter 5 concludes with a presentation of the aggregated challenges of appropriating value from Rediset LQ identified during the empirical data gathering.

Part I

5.1 The Business Models

5.1.1 The HMA adhesion promoter Wetfix

Hot mix asphalt (HMA) is the standard type of asphalt. AkzoNobel Asphalt Applications sell the Wetfix family of adhesion promoter products which create strong chemical bonds between the binder (bitumen) and the aggregate (stone material) in hot mix temperatures. Thus, increasing the water resistance of the asphalt concrete mix and consequently increasing durability of the pavement (Interview 140604; AkzoNobel.com, 2014a). The Wetfix products peered in this thesis are in relatively mature markets and have not seen any significant changes in business model building blocks or elements since 2004.

Access to sales data is unfortunately restricted. However, one interviewee states that sales volumes vary over time and are sensitive to weather fluctuations such as rainfall and varied temperatures. Other external factors which affect the sales volumes are the governmental budget for road maintenance and construction as well as the localization of the maintenance and construction. “In

some parts of Sweden concrete is mainly used as adhesion promoter and if a lot of jobs are in those areas our volumes [on Wetfix products] are affected.”²¹

5.1.1.1 Value proposition

The general value proposition of any adhesion promoter is that it prolongs the durability of the asphalt concrete. Adhesion promoters are needed in asphalt concrete where the demands on quality and life time are high. Further, certain stone types attract bitumen while others don't. In order to make the ones that don't bond with bitumen adhesion promoters are used. One interviewee argues that enabling the use of local stone material is an indirect part of the value proposition.

In Sweden, regulations demand that adhesion promoters are added to the asphalt concrete. Thus, the *“unknowing customer just buys because they have to”²²*. To capture the knowing customers, the value proposition of Wetfix is quality for a competitive price. There are competing adhesion promoters such as other chemical compounds, cement and hydrated limestone. At AkzoNobel Asphalt Applications, support in how to use the product is included in the value proposition on certain markets while being excluded in other markets. The inclusion is dependent on factors such as customers, competition and price level. In the Swedish market support is included and several interviewees acknowledge other stakeholders, such as the general public (referred to as taxpayers), as important when looking at the value proposition since a prolonged duration of the road potentially saves tax money.

Regarding the customer perception of value several of the interviewees point out that, in most cases, the road owner (mostly a public entity such as a state or a municipality) demands the inclusion of adhesion promoters in the asphalt concrete since it is required by law and such products increase the expected lifetime of the pavement as well as decrease maintenance costs.

5.1.1.2 Customer segment

The Wetfix-products are sold globally and markets are segmented according to country. *“So you can say that our primary customer is always the one who paves the road but the deciding customer can be somebody else.”²³* The primary (that is to say paying) customers are mainly construction companies who produce asphalt and pave the roads but paying customers also include actors who produce and sell asphalt concrete as well as municipalities. The deciding customers represent the road owners, generally the taxpayers.

In Sweden the road owners are mainly Trafikverket and the different municipalities (there are private road owners in Sweden, being both deciding and paying, but they only make up roughly 2% of the total market according to an interviewee). Thus, most paving contracts are procured through public procurement. It is important to note that the deciding customers are not conducting any monetary transactions with AkzoNobel Asphalt Applications. They are nevertheless regarded as customers since they procure the roads and generally specify the type of products needed in the asphalt concrete mix.

Aside from politicians and deciding customers, tax payers are seen as stakeholders, both in terms of users and payers of the road, even though an interviewee admits that *“(…) we have never tried to*

²¹ Interview 141127

²² Interview 140613

²³ Ibid.

access [them] in a talented way, we've never managed to find a conceptual model."²⁴ Further, Råddningsverket and carrier companies are important stakeholders since they put pressure on Trafikverket to keep high road standards.

Clarifying note: Throughout the empirical findings and the analysis of this thesis there is a distinction between *paying customers* and *deciding customers* who are defined as mentioned above. However, when only referring to *customers* both types are represented. What may be confusing is the reference to *customers* in the quotes. In cases where distinction between deciding and paying customers are made in the context of the quote but not actively stated I have added a clarification within brackets based on context and follow up questions.

5.1.1.3 Distribution channels

"(...) we're talking about [paying] customers often having requirements for delivery at very short notice." (Interview, 140521)

Generally the products are delivered in barrels to distributors who keep a stock and in turn deliver products to the paying customers²⁵. According to one interviewee the use of distributors is due to relatively small shipments to many delivery points and the paying customer requirement of short notice delivery. One interviewee proposes that the ability to deliver products on a short notice is part of the value proposition in general. However, large delivery points can receive bulk delivery directly from the AkzoNobel Asphalt Applications factories. Large asphalt producers are able to order quantities to few delivery points which affect the production at the Asphalt Applications factories, thus these companies are also able to get direct shipment from AkzoNobel.

5.1.1.4 Customer relationships

"(...) we have a (...) comprehensive program and can therefore tailor a solution for the customer but we do not tailor it in such a way that we build new chemistry every time." (Interview, 140613)

Sales are done through distributors and agents and there are sales agents who actively contact customers regarding new products. According to one interviewee municipalities require more active sales compared to construction companies in general. Large paying customers have personal connections with an account manager. Some account managers also have direct contact with deciding customers such as municipalities and Trafikverket. Distributors have contact with paying customers as well. The contact is a two way communication where mainly paying customers report issues they experience with the product and AkzoNobel Asphalt Applications develops the product for the specific need of the paying customer. To be clear however the chemicals are generally tailored for certain types of stone material or bitumen and somewhat tweaked in order to fit deciding and paying customer demand. The two way communication is not limited to product issues and can include delivery issues etc. Further, all customers can send stone and bitumen samples and thus receive technical support free of charge. Other types of support regarding product dosage and such are given to paying customers through visits and telephone.

Additionally, Wetfix and AkzoNobel as brand names are, according to several interviewees, well known in the business. According to an interviewee, the AkzoNobel brand within asphalt solutions

²⁴ Interview 140521

²⁵ Companies who produce asphalt and pave the roads as well as actors who produce and sell asphalt concrete and municipalities.

generally stands for quality, knowledge and reliability, both in terms of delivery and in terms of being a stable large company.

5.1.1.5 Revenue streams

The sole revenue stream generated by the Wetfix products are product sales measured as SEK/kg. However, individual pricing based on factors such as what market the customer operates within and size of order is applied.

5.1.1.6 Key resources

“Having only ten chemists is not enough; we need to have someone that actually knows what a road is.”

(Interview 140613)

The AkzoNobel and Wetfix brand and reputation are also key resources. Other key resources are the laboratories where new chemical compounds are tested and developed as well as developed customer relations. Further, a reliable raw material base which satisfies the necessary quantities of production, production capabilities and the distribution network are all key resource. One interviewee stresses the importance of the production at Asphalt Applications, claiming that it would be very difficult to make enough money in order to retain and attract knowledge without having their own production. Finally knowledge, in terms of chemistry and application is important.

5.1.1.7 Key activities

Key activities include technical support in terms of testing and tailoring chemicals for customer needs as well as general support, supply chain management securing reliable delivery, educational activities such as attending university courses as well as creating knowledge. Attending certain conferences and presenting in-house research through papers and on seminars is important. Finally, upholding close and personal relationships with paying and deciding customers are important activities.

5.1.1.8 Key partnerships

Several interviewees argue that partnerships aren't that important for Wetfix in Sweden since HMA is an old technology and the adhesion promotion chemicals are so well known. The testing methods are well developed and comply to set authority standards. In other markets, where adhesion promoters are not yet required by legislation, testing institutes and universities are important in order to produce test results. The test results are used to convince decision-makers that adhesion promoters create value for road owners by increasing the durability of the road.

5.1.1.9 Cost structure

“[The largest cost is] by far (...) the raw material. Roughly you could claim that out of our costs of producing 1kg Wetfix, over half is the raw material.”

(Interview 140613)

Production, development costs, screening, sales, further expansion into new markets and distribution channels are all part of the cost structure. The raw materials are the largest cost source.

5.1.1.10 Summary

Key Partnerships/ Network positioning <ul style="list-style-type: none"> • Test institutes • Universities • Suppliers • Distributors 	Key Activities <ul style="list-style-type: none"> • Support • Supply chain management • Educational activities • Uphold personal relationships • Attending conferences 	Value Proposition <ul style="list-style-type: none"> • Prolonged durability of the asphalt concrete • Enabling the use of local stone material • Required by regulation • A decrease in asphalt maintenance cost due to prolonged asphalt durability 	Customer relationships <ul style="list-style-type: none"> • Distributors and agents • Personal contact with large paying and deciding customers • Municipalities require a more active sales effort. • Two way communication • Support • Tailored products 	Customer Segment <ul style="list-style-type: none"> • Paying customers such as construction companies and municipalities • Deciding customers such as Trafikverket and municipalities • Stakeholders such as taxpayers and Räddningsverket • Country segmentation
	Key resources <ul style="list-style-type: none"> • Brand • Laboratories • Customer relations • Reliable source of raw material • Production capacity • Distribution network • Knowledge 		Distribution channels <ul style="list-style-type: none"> • Barrels to distributors • Delivery on short notice through distributors • Large paying customers can receive delivery from factory 	
Cost drivers <ul style="list-style-type: none"> • Production • Screening • Sales • Expansion into new markets • Raw material • Distribution channels 		Revenues streams <ul style="list-style-type: none"> • Sales based on SEK/kg sold • Individual pricing is applied 		

Customer not necessarily = end user. Above is a representation of adhesion promoter Wetfix (HMA-technology)

Figure 5.2: General Wetfix business model

5.1.2 The WMA additive Rediset LQ

Rediset LQ represents a WMA technology and is a liquid additive which is mixed into the general stone/bitumen mix during production of the asphalt concrete mix. The product includes adhesion promotion capabilities which bind stone material and bitumen and displaces water. Further, the product allows for lower production temperatures as well as lower paving temperatures (Interview 140604; AkzoNobel Surface Chemistry, 2012).

Unfortunately access to sales volumes is restricted. However, one interviewee states that market adoption in Sweden is slow and that the road owners aren't really ordering WMA technology in significant quantities as of yet. There are some customers who order Rediset LQ for tunnel paving or multistory car parks as the lowered temperatures make it easier to handle in indoor environments as fumes are reduced however the sales volumes are modest. Some municipalities which want a "green" profile order Rediset LQ but mostly for test purposes.

5.1.2.1 Value proposition

"(...) our product saves money for our customers".

(Interview 140604)

The main value proposition embedded in the WMA technology as such is the allowance of producing asphalt concrete at lower temperatures. The value proposition embedded in Rediset LQ is not only temperature reduction but also adhesion promotion which prolongs asphalt durability. By adding

Rediset LQ a lowering of the production temperature of asphalt concrete is possible which decreases fuel consumption. Further, a decrease in fuel consumption decreases the CO2 emissions since most asphalt factories burn oil in some form to heat the stone material and bitumen.

Additionally added Rediset LQ allows the asphalt to be paved at lower temperatures thus decreasing the amount of emissions of volatile substances workers are exposed to while paving. Further, the asphalt producers do not need to make any adjustments to their factories in order to use the product. In comparison, foam or KGO technologies require the asphalt producers to make adjustments to the factory and in case of the KGO-method production capacity decreases somewhat.

Due to the increased operations radius enabled by lowered paving temperatures, redundant asphalt factories can be discarded. Additionally, an increased operation radius implies a potentially larger market since construction companies can bid in areas where they couldn't operate before. Yet another part of the value proposition is, according to several interviewees, that asphalt producers can increase the paving season since the lowered paving temperatures allow for paving in colder climate. Thus, creating a potential competitive advantage if projects are delayed or deciding customers procure later in the paving season.

On the Swedish market, technical support similar to that for Wetfix is included in the value proposition.

The perceived value proposition however differs, according to one interviewee the Russian customers do not care about energy consumption or environmental benefits for the workers; instead they value the increase in operations radius of the asphalt plants. In Sweden however the working environment and the energy savings are what is perceived value in addition to the adhesion promotion.

5.1.2.2 Customer segment

The paying customers are the same construction companies who are target groups for Wetfix products. However, one interviewee argues that since Rediset LQ is a new product and WMA technology is still in its cradle, the main target companies for Rediset LQ are the ones which AkzoNobel already has established strong customer relations with. Several interviewees acknowledge stakeholders other than the paying customers. In addition to the stakeholders mentioned for Wetfix, unions are mentioned as a potential future stakeholder who can put pressure to reduce the emissions of volatile substances on the construction companies and on Trafikverket. Further, Rediset LQ is aimed at being sold globally and customers are segmented according to county.

5.1.2.3 Distribution channels

Distribution channels are exactly the same as with Wetfix-products. Global paying customers order and get delivery from distributors. Larger paying customers can order delivery from AkzoNobel directly.

5.1.2.4 Customer relationships

"It is all about communication, it is important to know what the customer wants.

Customers in different countries want different things even though they use the same product."

(Interview 140601)

This building block does not largely differ in comparison to Wetfix-products. Sales are done through distributors and agents and there are sales agents who actively contact customers regarding new products. According to one interviewee, municipalities require more active sales compared to construction companies in general. Large paying customers have personal connections with an account manager. Some deciding customers have direct contact with account managers as well. Distributors have contact with paying customers. The contact is a two way communication where mainly paying customers report issues they experience with the product and AkzoNobel Asphalt Applications tweaks the product for the specific need of the paying customer. The two way communication is not limited to product issues and can include delivery issues etc. Further, all customers can send stone and bitumen samples and receive technical support free of charge. Other types of support regarding product dosage and such are given to paying customers through visits and telephone.

According to several interviewees the deciding customers are often “*processed and educated*” in a different way in order to increase the likelihood of them putting in requests for WMA products in the procurement process. Further, the value propositions included in the product, such as less fume emissions during paving, open up for new frontiers against new potential stakeholders such as unions who can make demands on their employers.

5.1.2.5 Revenue streams

The sole revenue stream generated by Rediset LQ is product sales measured as SEK/kg. However, individual pricing, based on factors such as what market the customer operates within and size of order, is applied. There is no experimentation with other ways of revenue stream generation.

5.1.2.6 Key resources

Since the Rediset LQ is a new product the brand value has yet to be developed thus the AkzoNobel brand has been used as a resource in terms of gaining credibility and communicate quality and performance. Other key resources are same as for Wetfix. Thus a reliable raw material base, production capabilities and the distribution network are important as well as knowledge, in terms of chemistry and application is important. However new knowledge through consultancies has been necessary in order to develop the product as well as investments in new laboratory equipment. Further, much of the development of the Rediset-product family has been conducted at the AkzoNobel laboratory in New York and cooperation between that lab and Stenungsund has been conducted during development of the product.

5.1.2.7 Key activities

The key activities for Rediset LQ are the same as for Wetfix products; that is to say research and development, technical support, information activities such as presenting test results at different conferences in order to gain product credibility and upholding close and personal relationships with customers.

Further, governmental agencies and municipalities are actively engaged through different “information” activities in order to create a customer demand.

5.1.2.8 Key partnerships

In order to convince the market about the benefits of Rediset LQ effort is put into removing uncertainty regarding the product performance. This is done through partnerships with key

customers producing real life test results and further product development. Cooperation with test institutes regarding measurements of potential soft benefits (such as emission reduction during paving) and hard benefits (such as durability of the road) are conducted. Further, in house laboratory tests are replicated by institutes and universities and test methods are developed together with universities in order to gain credibility. Key customers are also used as alternative marketing channels where they are expected to explain to other potential paying customers about the benefits of the Rediset LQ additive.

5.1.2.9 Cost structure

In addition to the costs related to Wetfix products Rediset LQ also has research and development as well as continuous tests proving the products credibility as cost drivers. Additionally new laboratory equipment has been invested into in order to further test the product.

5.1.2.10 Summary

<p>Key Partnerships/ Network positioning</p> <ul style="list-style-type: none"> • Test institutes • Universities • Partnership with key customer • Suppliers • Distributors 	<p>Key Activities</p> <ul style="list-style-type: none"> • Support • Supply chain management • Research and development • Information activities • Uphold personal relationships • Attending conferences 	<p>Value Proposition</p> <ul style="list-style-type: none"> • Prolonged durability of the asphalt concrete • Producing asphalt concrete at lower temperatures • Energy savings • Reduced emissions during paving • Increased operations radius of asphalt production site • Increased paving season • Enabling the use of local stone material • Decreased CO2 emissions during production of asphalt concrete 	<p>Customer relationships</p> <ul style="list-style-type: none"> • Distributors and agents • Personal contact with large paying and deciding customers • Municipalities require a more active sales effort. • Two way communication • Support 	<p>Customer Segment</p> <ul style="list-style-type: none"> • Paying customers such as construction companies and municipalities • Deciding customers such as Trafikverket and municipalities • Stakeholders such as taxpayers, unions and Räddningsverket • Sales are focused on customers where good relations exist. • Country segmentation
<p>Cost drivers</p> <ul style="list-style-type: none"> • Production • Research and development • Proving product performance • Sales • Raw material • Distribution channels • New laboratory equipment 	<p>Revenues streams</p> <ul style="list-style-type: none"> • Sales based on SEK/kg sold • Individual pricing is applied 			

Customer not necessarily = end user. Above is a representation of the additive Rediset LQ (WMA-technology)
Figure 5.3: General Rediset LQ business model

5.2 Business Model Innovation

5.2.1 Defining sustainable development

Officially, the company recognizes that there are three dimensions to sustainability: *the environmental, the economical and the social* (AkzoNobel, 2014). This is reflected in most but not all interviewees. Some interviewees have a hard time defining sustainable development while others acknowledge it being an important topic which incorporates different dimensions.

“(...) in our company we follow the Bruntland definition but then you can question what you include when you are saying that future generations should have it at least as good and the same preconditions as today's generation”. (Interview, 140522)

The economic dimension is fundamental to the company and is thus also superior in importance compared to the environmental and social dimensions. Further, the business context in which the company operates within is seen as important when operationalizing the three dimensions stated in *“our common future”* (WCED, 1987). In a comparison to other companies and contexts an interviewee states *“(...) we focus mainly on the environmental aspect and that is because we in the industry we are in (...) we have a big impact on the environment and we can decrease our own load but also the burden caused by our suppliers, customers and end customers (...) if we had been H&M, then there are child laborers who sew clothes in Southeast Asia which we would have focused on.”*²⁶

That being said, the social dimension is not entirely neglected on a corporate level. The company claims it is dedicated to employee wellness and stakeholders are included as source of information for the company sustainability report. Feedback from stakeholders flavors the implementation of strategic targets and the management of risks and opportunities (AkzoNobel, 2014). In the case of Asphalt Applications stakeholders are considered during product development as well as seen as actors who can influence customers.

There is an added time dimension to the notion of sustainable development at AkzoNobel where sustainable development is not seen as an absolute state but something that changes. Sustainable development is thus seen as a direction in which the company is heading as opposed to an absolute goal that is to be reached.

²⁶ Interview 140522

Dimensions	Focus	Comment
Economic	Economically viable investments outweigh other dimensions.	
Environmental	Important since the majority of the negative impact AkzoNobel does is believed to be of environmental nature.	There seems to be a context sensitive focus of what sustainable development implies in terms of what dimensions to focus on.
Social	Awareness is available but this dimension has least focus.	
Time	Sustainable development is a direction of development not an absolute state.	

Table 5.1: Summary of the dimensions of sustainable development at AkzoNobel

5.2.2 Driving forces for sustainable development

“Sustainability helps us to enhance our existing business, create new business opportunities and minimize risks. - reviewing our sustainability risks and opportunities against global trends – population growth and the new middle class, urbanization, long-term constraints of natural resources and climate change – and how these will impact our key market segments by 2050.” (AkzoNobel, 2014:165)

On a macro level there are several drivers behind AkzoNobel working with sustainable development. One interviewee points out pull factors such as customer requests, another one points out that *“We know that Europe will be, within the chemical industry, the big loser.”*²⁷ and points out the increase in production capacity in the US due to shale gas exploitation. *“There haven’t been investments in cracker plants in the US for thirty years...now they are investing everywhere in stuff like that.”*²⁸ In the Middle East competition comes from forward integration thus plants in both the US and the Middle East can produce basic chemicals at very low cost making it hard for European plants to compete on price. In order to differentiate and create competitive advantage, plants in Europe are directed towards sustainable development. An interviewee points out that there are enormous sums already invested in European plants thus possibly making it cheaper to shift towards sustainable development compared to divest and invest in new production capacity in the Middle East or the US. Further reasons for focusing on sustainable development in Europe are the available knowledge and the possibility to co-create new markets. Other driving forces are related to the context in which the company operates where an emphasis is put on the society in which the company operates within.

“(…) when you are a big corporation and you work within a society you need to adhere to the trends within that society”. (Interview ,140521)

²⁷ Interview 140521

²⁸ Ibid.

Adhering to sustainable development trends attracts capital, creates good PR and thus attracts knowledge in the form of new employees. Further, working with sustainable development creates trust for the company among stakeholders such as politicians which materializes into credibility and access to spheres of influence previously unattainable. Additionally, there is an idea at the company that working with sustainable development and sustainability innovation further increases brand value thus attracting new customers.

Looking at internal factors at AkzoNobel, working with sustainable development also creates employee engagement and drives innovation. Further, an interviewee states that there is a connection between companies having a sustainable profile and a long term favorable share development. Since AkzoNobel has large long term owners, such as pension funds, long term thinking is of importance. The driving forces of sustainable development for AkzoNobel are summarized in table 5.2 below.

Driving forces for sustainable development	Effects on corporation in general
Customer requests	Understand customer preferences
Plant competition	Focus on sustainable development in European plants
Context	Adhere to regulations and social values
Attract capital and knowledge	Long term thinking and adhering to regulations
Improve brand value and generates trust	Adhere to regulations and social values.
Risk mitigation	Accelerating resource efficiency through the value chain, Being proactive in order to adhere to dawning regulations
Employee engagement	Sustainable development as a driver for innovation
Product competition	Keeping up with competition and adhering to an industry trend (See 5.2.2.1)
Cost reduction	Switching material flows and energy reduction
Brand value	Increased credibility among customers and other stakeholders

Table 5.2: Drivers for sustainable development at AkzoNobel Asphalt Applications

5.2.2.1 Driving forces of WMA-technology R&D at Asphalt Applications

Being proactive and adapting to megatrends such as increasingly scarce resources and new legislations also plays an important role in why AkzoNobel invests in sustainable development on a macro level (AkzoNobel, 2014).

“(…) we need to be prepares for what’s to come with rising energy prices, scarce resources and new legislation in chemical substances or whatever it is. Being on the leading edge makes us more suited for tomorrow, then we have a business advantage.”

Interview (140522)

Looking at the micro-level and specifically at product development within Asphalt Applications, the development of more environmentally beneficial products has been a result of sustainable development driving forces. The reactive development the Rediset-additive family was an outcome of the search for products which would help make more environmental friendly asphalt thus adhering to contextual driving forces. That is to say, the search was not initially focused on finding solutions to reduce asphalt production temperature. What made focus shift towards reducing asphalt production temperatures? The main drivers causing the shift were:

1. Cost drivers manifested in customer demand of products lowering fuel consumption due to the increased price of oil.
2. Potential increase in sales margins, through a potential competitive advantage versus HMA adhesion promoters such as cement and hydrated limestone.
3. Keeping up with competition and adhering to an industry trend in finding ways of reducing asphalt production temperature.

5.2.3 Defining business model innovation at AkzoNobel Asphalt Applications

“What did you call it, business model innovation? That I don’t know (...)

(Interview 140528)

At AkzoNobel Asphalt Applications there does not seem to be a common language or understanding of what business model innovation is. Further, an interviewee states that business model innovation, in terms of revolutionary models which basically change the way the company does business, is not explored at Asphalt Applications. However, although interviewees admit that they have tried to push the Rediset-product family to market through the same activity system as with Wetfix-products there is an awareness among some interviewees that other options might be possible.

One interviewee compares AkzoNobel’s way of creating market opportunity for Rediset LQ to another company selling WMA additives. This other company signed a license agreement with a large European contractor thus giving the contractor exclusive rights to the use of their WMA solution. In contrast the interviewee argues that Asphalt Application have chosen another model where a close collaboration with large Nordic contractors would give credibility to the Rediset-product family.

5.2.4 Development of the Rediset-product family

“In the 90s, nobody gave a damn about asphalt, you used what you had but in 2000 people started to realize that maybe we should try to make our asphalt a little more environmental friendly.”

(Interview 140928)

Around 2005, the US based AkzoNobel Asphalt Applications R&D center was searching for ways of doing greener asphalt. Prior, an ongoing trend had started within the industry where actors aimed to reduce temperatures when producing and paving asphalt. The trend was caused by the ongoing public debate about climate change as well as increases in oil prices and theories regarding the possibility to reduce the production temperature of asphalt. Another driving force for the US Asphalt Applications R&D center was that lowered production temperatures makes limestone inappropriate as an adhesion promoter. A large part of the competition on the US adhesion promotion market was created by limestone adhesion promotion producers thus there was an interest at the US office to create a more competitive adhesion promoter chemical. In the process of lowering the temperatures however, several technical problems occurred. While in theory there had been an ideal image, it had

no solution. Thus, there were companies who “were just throwing out ideas (...) saying “hey we have got this and it can do that.””²⁹

5.2.4.1 WMX, the first generation

(...) generally almost everything in asphalt and road development is a trial-and-error process. It is barely calculable (...) (Interview 140922)

Through screening of a product that was developed for other reasons the people at the US R&D center understood that adding certain types of wax to the bitumen changes its characteristics thus allowing it to have a desirable viscosity at a lower temperature. However, a lower temperature (see figure 2.2) also means that the aggregate still contains water, thus there will be an adhesion problem leading to lower asphalt durability. As a solution to the problem an adhesion promotion chemical was added to the wax and thus the product was ready for testing. It should be noted that the development of the product included external knowledge through consultancy. Since the US R&D center did not have adequate resources to test the new product they cooperated with universities and institutes to understand what combinations of wax and adhesion promotion would give the most desirable result. This was an iterative trial-and-error process. Performance tests were also conducted in the Stenungsund R&D center in 2007-2008. Once a desirable and working combination was found and enough test results were available to prove the product function the Rediset WMX was ready for sale.

The WMX product was produced in the US and brought to the Swedish market where several road trials were done with customers in Sweden. There were plans to invest in production capacity in Stenungsund as well but the market breakthrough that would motivate such investments was lacking. Although there was positive feedback regarding the product performance the Rediset WMX was a solid product thus making it difficult to insert it into the bitumen compound. Further, due to the injection systems at the asphalt plants being built for liquid injections using the solid WMX product meant that a full tank of 20 tons of bitumen suddenly was committed to WMA. Using a liquid based additive would give asphalt producers more flexibility in choosing how much WMA to produce. Another issue regarding the WMX product was the price of producing it was high due to expensive raw materials and in order to get a desired effect on the temperature as well as a strong adhesion promotion larger quantities of the product was needed compared to using just an adhesion promoter further increasing costs for customers.

5.2.4.2 Developing the LQ

In order to create a more manageable and cheaper product with temperature benefits the R&D centers in New York and Stenungsund started to simultaneously (somewhere around 2009-2010) search for ways to develop a liquid version of the WMX. The centers had a frequent knowledge exchange. At the time there were competing liquid products on the market with limited functionality so as a first step these products were reverse engineered and modified in order to create new liquid Rediset versions. Through trial-and-error testing new and better chemicals were developed and in Stenungsund a product called LQ1 was created and patented. The US lab had developed another version called LQ1102 which proved to give better test results compared to the LQ1. Due to REACH regulations the LQ1102 needed to be somewhat modified in order to be allowed in the European market. Once the trials were completed with the new version, LQ1102CE, the product was ready for

²⁹ Interview 140918

sale and the trials with key customers were initiated. The customers were selected on the basis of resources and technical capability. That is to say reputable companies with the resources to conduct full scale road trials and documented technical knowledge which would give credibility to the test results.

It should also be noted that the US R&D center was mainly testing the effects of the additive on the bitumen while the Stenungsund center, due to investments, was able to conduct tests on the additive when bitumen and stone material was combined. As mentioned the main driving force to develop the Rediset – product family was the decrease of temperature consequently also CO2 emissions. However as customers tested the products several other benefits, such as decreased emission levels, longer operations radius etc., were detected and consequently introduced as further value propositions.

5.2.4.3 Current development and measurement challenges

Currently the Rediset LQ is produced in Stenungsund and there is no further development of the WMX. The LQ is, according to an interviewee, a premium product. There are plans for creating a new generation of LQ, with the goal of making it better in an environmental, technical and economic perspective, and there exists several ideas on how develop it further. However, due to lacking market demand leading to modest sales of the Rediset LQ and a company reorganization these plans are currently on hold. Currently, the progress done in terms of test results are communicated to deciding and paying customers at different settings but the market growth in Sweden is, according to an interviewee, slow. According to several interviewees the idea is to get selected key customers to talk about their WMA projects where they have used Rediset LQ thus creating rings on the customer water surface, *“It has been our idea to get the customer to explain how good our additive and systems works.”*³⁰

The development process described above was not straight forward, when conducting trial-and-error tests with the asphalt the test methods needed to be developed simultaneously since traditional test methods didn't seem to work satisfactory. Several interviewees explain that a correlation is wanted between how the asphalt behaves when paved and the ratio of components included in the additive. However lab results only give rough estimates and it is difficult to say what ratio of different components correlated with a certain type of effect. Further, the final verification is always done on real road trials however the lack of standards when testing WMA makes it difficult to compare the results with other actors. Additionally, there exists mental models of how tests should be conducted and these tests are not adapted for warm mix according to some interviewees. Consequently, the test methods are still under trial-and-error development in the US and Swedish R&D centers.

5.2.5 Other factors affecting a business model

The general business context in Sweden is described in chapter 2.3 while some of the general drivers for sustainable development which potentially affect a business model are seen in table 4.4 and the drivers affecting Asphalt Applications are mentioned in this chapter as well as in chapter 5.2.2.1. Additionally, it is important to mention that WMA-technology is capable of replacing HMA-technology since it provides adhesion as well as a lower temperature when producing asphalt. Some interviewees are certain that WMA is the future of asphalt production technology.

³⁰ Interview 140922

“I am convinced that in X years (...) this type of system, Rediset and other similar systems, will be what is valid considering all pressure we are under regarding saving energy, reduce emissions, less chemicals in nature and so on.” (Interview 140613)

5.2.5.1 Context

(...) the first driving force was to reduce CO2 emissions (...)

(Interview 140922)

There are several ongoing changes in the macro environment for Asphalt Applications. As previously mentioned several interviewees note that there has been an ongoing trend within the industry to reach lower temperatures when producing and paving asphalt. The trend is due to the ongoing public debate on climate change as well as increases in oil prices and theories regarding the possibility to reduce the production temperature of asphalt. The CO2 reduction goals are set within EU and the Swedish government and are then translated into goals for Trafikverket. Further, there are several competing technologies, designs if you will, providing WMA solutions thus construction companies need to hedge their bets *“We invest in all of them, we are very wide in that sense.”*³¹ The amount of WMA designs and products which are claimed to deliver performance in terms of temperature reduction are different and plenty which creates confusion among deciding customers of which products and designs to trust. Due to the fact that a paved road which prematurely breaks or a road construction which is delayed is interconnected with huge societal costs, deciding customers are reluctant to invest in WMA technology until they are sure of the advantages.

In the Nordics societal awareness regarding workers health is a factor which pulls the adoption of certain WMA-technologies.

“In Norway, they have set up a bonus system for WMA but only for foaming so they do not allow chemicals (...) but they include the aspect of working environment so they have no environmental criteria really (...)”

(Interview 140528)

Using the power of the unions is seen by AkzoNobel as a way of getting deciding customers on board with ordering WMA solutions.

The general focus on environmental benefits in European chemical plants is also a factor according to interviewees. The potential increase in energy costs due to a rise of oil prices is a driver for demand in energy efficient solutions as well as a working market for CO2 emission allowances. An interviewee points out that there needs to be requirements from government making it more expensive to release CO2 emissions. Further, the value of being proactive is acknowledged *“(...) if there are requirements (...) from the government (...) putting a higher tax on fuel oil so that it becomes more expensive (...) we cannot start working then, we must be one step ahead all the time.”*³² implying that the potential in public policy in directing demand cannot be neglected. Further, legislative development such as the REACH³³ regulation for chemicals affects the business context forcing chemical companies to *“(...) show that it is not dangerous for humans or the environment”*³⁴. Several interviewees

³¹ Interview 140611

³² Interview 140611

³³ REACH is short for Registration, Evaluation, Authorisation and Restriction of Chemicals and is an EU-regulation on chemicals. For more information see http://ec.europa.eu/enterprise/sectors/chemicals/reach/how-it-works/index_en.htm [accessed 2014-06-12 12:56]

³⁴ Interview 140528

complain that the REACH regulation has made it more difficult to create new innovations as well as making it hard for new entrants to rejuvenate the industry in the long term. Another legislative factor is the responsibility of asphalt functionality put on paying customers during the warranty time.

5.2.5.2 Customers

According to an interviewee the customer demand is different in different geographical areas. In countries such as Russia, paying customers are not interested in the environmental or the social benefits of the WMA technology. Instead it is other parts of the value proposition, such as the increased operations radius and increased paving season, which are important. Paying customers are hedging on different WMA technologies as well as being part of developing WMA technologies, either in cooperation with chemical companies or on their own. Foaming is a technology which is used among some potential paying customers. Meanwhile, there is a plethora of attitudes towards WMA technology among deciding customers. Some are very sure about what they want to promote, as in the case of Norway. Others are not sure about what they want but they know they want an environmental friendly solution which strengthens their environmental profile. Yet others claim:

“It’s not that we somehow are against the use of warm mix products but (...) we do not really know how to design our procurement requests (...)” (Interview, 140605)

Additionally there is a patented WMA technology in Sweden called KGO which is licensed by Trafikverket, thus KGO appears in some procurement requirements. The license however expires sometime in 2015 which creates an uncertainty among paying customers. The uncertainty is due to the lack of information regarding if the deciding customer will continue to require KGO technology or procure other WMA technologies in their future procurement designs. The uncertainty thus affects chemical additives such as Rediset LQ.

From a customer perspective there are further uncertainties regarding Rediset LQ product performance and its benefits due to a lack of standard measurements for WMA technologies. Paying customers who trial Rediset LQ are mostly satisfied with the results but since deciding customers are only procuring WMA in limited degree further market development is slowed down. There are additional uncertainties caused by the share amount of WMA designs on the market as well as the large costs associated with asphalt failure. These uncertainties further make deciding customers doubtful regarding procurement of WMA. Finally, the increased cost of procuring Rediset LQ compared to standard HMA technology should create a benefit large enough to motivate the increased cost. This benefit is, due to all uncertainties, obscured.

5.2.5.3 Competition

There are other large competing corporations to AkzoNobel who also produce chemical additives which provide similar value proposition as Rediset LQ does. Additionally, some asphalt producers and construction companies are experimenting with different types of WMA technology. Furthermore, different actors are experimenting with different types of WMA technology according to an interviewee. In many geographical areas there are small local actors who compete by selling HMA technology but are unable to provide WMA technology at this point in time. As mentioned previously there are different WMA-technologies and consequently products which create confusion and uncertainty regarding what to invest in.

5.2.5.4 Capabilities

Not available however looking at the mapped business models in 5.1.1.10 and 5.1.2.10 give some insights.

5.2.5.5 Summary of factors affecting a business model

Dimension	Summary
Context	Technology going towards cooler mixes, competing technology in providing cooler mixes, societal awareness of workers health, societal awareness of environmental issues, products decreasing energy consumption and CO2 emissions are preferred, legal changes such as a working market for CO2 emission allowances, REACH impede chemical innovation while directing innovation toward not harming environment or humans)
Customers	Different geographical areas have different demand, customers hedge on different WMA technology, paying customers co-develop or develop technology on their own, deciding customer know what they want or want a product to boost their environmental profile or are not sure how to procure WMA technology
Competition	Competitors have developed WMA additives, competing technology is present, many small actors on local market that have no means of producing warm mix solutions as of yet
Capabilities	N/A

Table 5.3: Summary business context

5.3 Appropriating Value from Sustainability Innovation

"...we thought (...) that it would take off immediately and that we would be able to sell with little effort since the product would be cheaper for the customer, better for the environment, creating a better working environment..." (Interview, 140527)

During the some of the unstructured interviews barriers for bringing Rediset LQ to market was brought into light. Primarily it is important to note that according to interviewees the knowledge needed to produce or replicate a chemical such as Rediset LQ is relatively difficult to come by. Further patent protection is relatively strong for chemical compounds (Google.com/patents, 2009) and processes (Lüdeke-Freund , 2013).

As noted in chapter 5.2.4, Rediset LQ is not the first generation Rediset additive and AkzoNobel were not first on the WMA market. Although some actors entered the market with WMA products in 2004 one interviewee claims that there has been little to no market for WMA products in Sweden. Another interviewee states that the key is getting road owners to order WMA technology on a larger basis thus kick-starting the WMA market in Sweden.

In 2008, AkzoNobel was conducting tests and trying to sell the first generation Rediset (WMX) and although there have been signs of growth in the US for WMA technology there is still no real signs of growth in Sweden. In the US market however, its primarily foaming technology which is showing signs of growth which is due to low investment costs in foaming production capability. According to an interviewee the regulatory environment in the US also plays a role in the relative success of foaming technology. After a state approval of a new

technology, such as WMA, paving projects in that state start demanding WMA technology and there can even be bonus subsidies facilitating the penetration of the technology. Finally, the responsibility of the road life time is lifted from the construction companies shoulders, thus after a 1 year warranty time the responsibility of the road durability is put on the road owner. In Sweden, the responsibility of the road is in the hands of the construction companies for a longer period of time.

"(...) the warm mix products need to be at least on par with hot mix alternatives (...)

(Interview, 140611)

WMA technology is used during the production of asphalt, thus the end product is still asphalt. End consumers (road owners and essentially tax payers) do not get a different end product which means that the perceived value among end customers is essentially the same. What WMA technology does however is to decrease production and paving temperatures which is beneficial for asphalt producers and asphalt paving crews.

The price for Rediset LQ is somewhat higher per kg compared to Wetfix-products. An interviewee argues that although the deciding customers support the environmental benefits the product offers they are not willing to pay for the increased costs. If the cost of CO2 emissions would increase however, the interviewee believes that production prices on HMA would go up thus affecting the cost for deciding customers who mainly procure based on price. Consequently, the likelihood of deciding customers ordering more WMA would thus increase. Another interviewee argues that, for paying customers, the increased price of purchase is saved through a decrease in costs due to decreased energy consumption. Additionally, the increased operations radius of paving, which is facilitated by the ability to pave at lower temperatures, allows asphalt producers to increase their potential market. Yet another interviewee argues that the societal savings achieved through preventing workers from inhaling emission should be calculated as well thus reducing the net cost of purchasing even more.

Another barrier identified is the uncertainty regarding the performance and the lifetime durability of WMA. In theory the lifetime of the bitumen increases since it is subjected to lower temperatures compared to HMA, that claim is yet to be empirically proven though. Further, a WMA-technology with adhesion promotion should deliver at least the same amount of durability as a HMA with adhesion promotion. However, due to the fact of there being a plentitude of WMA products with different characteristics, all of which have not been tested for a longer period of time, uncertainty regarding general WMA-technology lifetime durability consists. Regarding performance of the Rediset LQ there are interviewees claiming that even though lab tests are positive, the performance is not always as expected. According to one interviewee the performance issues are due to the test methods and the difficulties in measuring and correlating chemical component ratio in the asphalt mix. Why is this relevant? Deciding customers set performance requirements on different dimensions of the road and if they are not met it is the paying customers who need to pay up within the given warranty time. Thus, the paying customer bears a risk which AkzoNobel needs to reduce through proving product performance.

As mentioned in 2.3.1.2 there are several WMA technologies competing in the marketplace and within each technology type there are a plethora of products. The different WMA solutions available

and the obscurity regarding which one will become the dominant design is another source of uncertainty among deciding as well as paying customers. This uncertainty forces paying customers to hedge on different solutions while it inhibits deciding customer investments in certain types of WMA technologies while facilitating other types.

A factor briefly mentioned above which is a source of uncertainty is the lack of standardized performance test methods for WMA. Testing is done with standardized HMA methods but not all of them work with WMA which has created the needs for new test methods. These new methods have been developed through trial-and-error processes which differ between actors within the industry. The bottom line, according to one interviewee, is that AkzoNobel and their key customers need to prove the functionality of Rediset LQ.

"(...) is it environmental friendly? Nothing that is environmentally friendly works!"

(interview, 140527)

There are yet other barriers connected to the culture of the industry. According to several interviewees there have been negative attitudes against environmentally better products. Further barriers connected to a general culture are that the construction industry is generally slow to change where attitudes like *"yes, but we have done like this the last 50 years and it has worked out so we are not changing now"* make it hard for innovations to find fertile soil. Workers handling the asphalt production and the paving are also skeptic about Rediset LQ since chemicals attracts negative attitudes in general. *"If you insert chemicals they [workers at plants and at paving sites] think it's nasty "what is oozing out of those fumes?". There has been a history where workers have felt odors from the fumes and got a headache (...)"*³⁵ The emission reduction aspect of Rediset LQ is thus important in order to shift attitudes however, there exists difficulties in proving the benefits. *"(...) we can describe the emission levels based on the tests (...) we can describe it with conventional mathematical models (...) but it is not the same as testing it in reality. (...) how does the nose perceive it? How do humans perceive it?"*³⁶ thus uncertainty regarding perceived reduction of emission levels becomes yet another barrier.

Ironically it is difficult to communicate the sustainable aspects of Rediset LQ without highlighting the relative negative aspects of previous products, as one interviewee puts it:

"It's somewhat dangerous to go out and open the discussion regarding "what is sustainable?" (...) we don't know what customers will say if we go out and say that "this is not dangerous!" then instantly the question comes back "what do you mean? Are your older products dangerous?""

(Interview, 140528)

Thus, there is a communication challenge grounded in previous product performance where AkzoNobel needs to promote the new more sustainable product without blacklisting previous products externally. Additionally, one interviewee states that once a customer starts using any WMA technology and realize the benefits included there is no turning back,

³⁵ Interview 140521

³⁶ Interview 140613

thus creating a customer lock-in effect. “(...) *there is an inherent resistance to buy something that suddenly becomes a requirement (...)*”³⁷.

There are further cultural barriers regarding the potential of WMA technology becoming the new standard of asphalt production thus outcompeting limestone and concrete based adhesion promoters. Some seem to prefer the tangibility of such products compared to chemicals.

“Those who (...) think it is nasty to use chemicals think it's safer with cement or limestone, they know what that is.”

(Interview, 140613)

Additional external barriers include the regulatory environment, as previously mentioned adhesion promoters are required in the asphalt production in Sweden. Thus, regulations create a large market for Wetfix-products and other types of adhesion promoters for HMA. There is no similar regulatory framework which promotes WMA technology in Sweden, however in Norway there is an experiment with a bonus system for using foaming WMA technology thus potentially igniting a market for WMA foaming technology. In Norway they have specified foaming as preferred technology thus Rediset LQ and other additives are not gaining any benefits from the bonus program. Another regulatory barrier is due to the public procurement requirements seldom including WMA technology. One reason for this is because large road owners such as Trafikverket claim that they do not know how to formulate a proper requirement for WMA technology. Another reason is that public procurement mainly focuses on price (Riksdagen.se, 2014; Upphandlingsbolaget Göteborgs stad, 2014)

A successful market penetration of Rediset LQ would cannibalize on the Wetfix market and eventually substitute the HMA technology adhesion promoter since the WMA additive offers several benefits on top of adhesion promotion, which is the main value proposition of the Wetfix-products. This situation could cause internal resistance within AkzoNobel Asphalt Applications as people might see their jobs threatened. However, according to an interviewee, there is no risk of people at AkzoNobel Asphalt Applications losing their jobs since all knowledge is needed in order to further develop the Rediset additives.

The barriers are summarized and grouped below in table 5.4.

³⁷ Interview 140521

Barrier	Category
No visible changes to end product	Product
Internalizing external costs	Double externality
Uncertainty regarding durability	Measurement
Uncertainty regarding test methods	Measurement
Workers hesitant	Mental models
Uncertainty regarding perceived emission reduction	Mental models
Not forced by regulated	Legislation
Not facilitated through in public procurement	Legislation
Communication	Discursive ambiguity
Internal cannibalization	Internal barriers
Potential disruption of HMA adhesion promoters	Radical innovation
Skepticism against sustainable products	Mental models
Potential customer lock-in	Mental models

Table 5.4: *Barriers of market success for Rediset LQ*

6 Analysis

This chapter expands the logic of chapter 5 and is divided into three interconnected parts where the first part focuses on a static comparison and analysis of the business models of the Wetfix-products and Rediset LQ. The subsequent part develops the findings in the first part and explains them from an innovation lifecycle perspective as well as identifies and explains some challenges related to appropriating value from Rediset LQ. In the end of part II the stage is set for a dynamic process analysis which brings us to part III which is the business model innovation analysis. Part III includes a mapping and analysis of sustainability drivers, an evolutionary explanation as to how the differences in Part I occurred and identifies additional challenges for appropriating value from Rediset LQ. The analyses of the findings associated with RQ3 are spread out over chapter 6 which, in a way, reflect the process of how they were obtained. However, there are summarizing subchapters within part I and part III which summarizes the different difficulties associated with appropriating value from Rediset LQ in T1 or during the process.

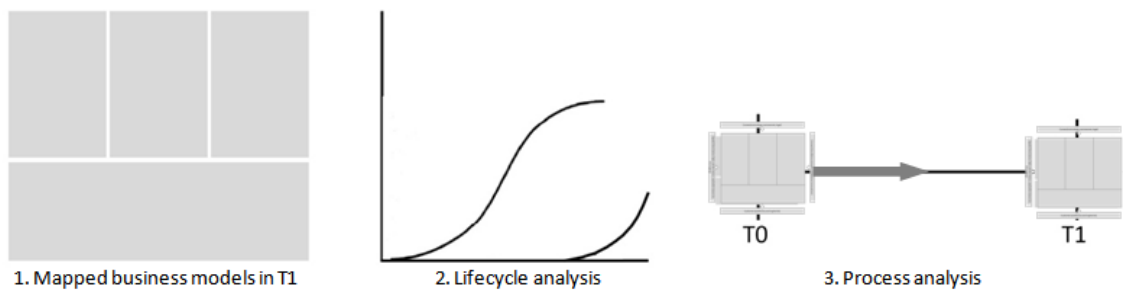


Figure 6.1: Overview of the different parts of the analysis

Part I

6.1 A Static Comparison of Business Models

In chapter 4.1.1, I present two different perspectives taken by different authors on the business model concept. Roughly, one includes the flow of time while the other does not. In this part, a static comparison between the business models presented in chapters 5.1.1.10 and 5.1.2.10 is conducted where the timeframe (T1) is contemporary to when I collected and assembled the empirical data. The analyzed business models are concepts of products which are produced by AkzoNobel Asphalt Applications and they represent different types of technologies used during asphalt production. Furthermore, the Rediset-additives have environmental and social benefits and WMA technology is estimated to successively replace adhesion promoters where possible.

6.1.1 Overview and analysis of differences in the mapped business models

Key Partnerships/ Network positioning	Key Activities	Value Proposition	Customer relationships	Customer Segment
<ul style="list-style-type: none"> • Test institutes • Universities • Suppliers • Distributors 	<ul style="list-style-type: none"> • Support • Supply chain management • Incremental product development • Educational activities • Uphold personal relationships • Attending conferences 	<ul style="list-style-type: none"> • Prolonged durability of the asphalt concrete • Enabling the use of local stone material • Required by regulation • A decrease in maintenance cost 	<ul style="list-style-type: none"> • Distributors and agents • Personal contact with large paying and deciding customers • Municipalities require a more active sales effort • Two way communication • Support • Tailored products 	<ul style="list-style-type: none"> • Paying customers such as construction companies and municipalities • Deciding customers such as Trafikverket and Rådningverket • Stakeholders such as taxpayers and unions • Country segmentation
	<ul style="list-style-type: none"> • Brand • Laboratories • Customer relations • Reliable source of raw material • Production capacity • Distribution network • Knowledge 		<ul style="list-style-type: none"> • Barrels to distributors • Delivery on short notice through distributors • Large paying customers can receive delivery from factory 	
<ul style="list-style-type: none"> • Production • Development costs • Screening • Sales • Expansion into new markets • Raw material • Distribution channels 		<ul style="list-style-type: none"> • Sales based on SEK/kg sold • Individual pricing is applied 		

Customer not necessarily = end user. Above is a representation of adhesion promoter Wetfix (HMA-technology)

Key Partnerships/ Network positioning	Key Activities	Value Proposition	Customer relationships	Customer Segment
<ul style="list-style-type: none"> • Test institutes • Universities • Partnership with key stakeholders • Suppliers • Distributors 	<ul style="list-style-type: none"> • Support • Supply chain management • Research and development • Incremental product development • Educational activities • Uphold personal relationships • Attending conferences 	<ul style="list-style-type: none"> • Prolonged durability of the asphalt concrete • Producing asphalt concrete at lower temperatures • Energy savings • Reduced emissions during paving • Increased operations radius of asphalt production site • Increased paving season 	<ul style="list-style-type: none"> • Distributors and agents • Personal contact with large paying and deciding customers • Municipalities require a more active sales effort • Two way communication • Support 	<ul style="list-style-type: none"> • Paying customers such as construction companies and municipalities • Deciding customers such as Trafikverket and Rådningverket • Stakeholders such as taxpayers, unions and Rådningverket • Sales are focused on customers where good relations exist • Country segmentation
	<ul style="list-style-type: none"> • Brand • Laboratories • Customer relations • Reliable source of raw material • Production capacity • Distribution network • Internal and external knowledge • US laboratory cooperation 	<ul style="list-style-type: none"> • Enabling the use of local stone material • Decreased CO2 emissions during production of asphalt concrete 	<ul style="list-style-type: none"> • Barrels to distributors • Delivery on short notice through distributors • Large paying customers can receive delivery from factory in bulk 	
<ul style="list-style-type: none"> • Production • Research and development • Proving product performance • Sales • Raw material • Distribution channels • New laboratory equipment 		<ul style="list-style-type: none"> • Sales based on SEK/kg sold • Individual pricing is applied 		

Customer not necessarily = end user. Above is a representation of the additive Rediset LQ (WMA-technology)

Figure 6.2: Rough overview of highlighted differences in business model

Figure 6.2 presents an overview of the main differences identified in the business model of Rediset LQ (Right with changes marked) compared to Wetfix-products (Left). The following subchapters are structured according to the business model elements (found in chapter 4.1.3) through which the differences are analyzed.

6.1.1.1 What value is delivered

Osterwalder & Pigneur (2010) define the value proposition as an aggregate of the benefits offered to customers. A sustainable business needs to take a holistic approach, thus also creating value for other stakeholders such as the environment and society (Bocken et al., 2013). Reasoning is seen as an attribute which, according to Sommer (2012), is the core of why an offering is expected to be useful for the customer. Thus, using the framework presented by Sommer (2012), where reasoning consists of three dimensions (use, risk and effort), and adding the holistic dimension (Bocken et al., 2013) sets the scene for an interesting analysis. Firstly however, it is necessary to point out that there are large similarities and differences in the value propositions of Wetfix-products and Rediset LQ. The later product roughly offers that same value proposition as the Wetfix-products and additionally Rediset LQ offers a whole slew more. If compared to the Wetfix-products, which mainly transfer value from one actor to another³⁸ (although the end product can be used by anyone), Rediset LQ delivers explicit value to stakeholders other than the paying or deciding customers as the use of the product reduces relative energy consumption. The reduction of relative energy consumption directly contributes to reducing CO2 emissions, thus contributing to the mitigation of global warming. Additionally, the reduction of emission levels during paving potentially reduce the pressure on welfare services³⁹ since health risks associated with volatile substances are potentially reduced. Consequently, some of the value delivered by Rediset LQ can be seen as “thick” as it, relative to Wetfix, returns some of the capital utilized in production of the product (Haque, 2011). Since the use of Rediset LQ promotes more sustainable consumption of resources such as oil and since the product

³⁸ a characteristic labeled as “thin” value (Haque, 2011)

³⁹ i.e hospital services

delivers positive social and ecological effects, Rediset LQ can be regarded as a sustainability innovation. As such, Rediset LQ could benefit from a business model tailored to the challenges connected to such innovations (Lüdeke-Freund, 2013). However, the idea of Rediset LQ being a sustainability innovation can be questioned if one compares the environmental and so the spectrum of environmental impact presented by Charter and Clark (2007) below:

- **Level 1 (incremental)** - *Incremental or small, progressive improvements to existing products*
- **Level 2 (re-design)** - *Major re-design of existing products*
- **Level 3 (functional or 'product alternatives')** - *New product or service concepts to satisfy the same functional need e.g. teleconferencing as an alternative to travel*
- **Level 4 (systems)** - *Design for a sustainable society*

(Charter and Clark, 2007:10)

The levels are not separated by absolute or quantifiable boundaries but sustainability innovations should aim to achieve the higher levels which are associated with radical reduction of environmental impact. One could speculatively assign Rediset LQ to the second or first level which are associated with eco-innovation. However, in contrast to eco-innovations Rediset LQ includes social benefits, thus motivating a sustainable innovation label on Rediset LQ (Charter and Clark, 2007). For the road owners however, that is to say deciding customers in most cases, there is little added value when investing in Rediset LQ. Why? Because the end product is still asphalt but compared to HMA technology there is an added uncertainty in terms of product performance and an increased price tag to boot. Enabling the "green" label adds value for some road owners which are motivated by political forces and in theory the large road owners would benefit from using WMA technology in general as it would increase the probability of them reaching their CO₂ emission targets. However, the lack of standardized measurements and the difficulty of measuring chemical compound effects on asphalt is a main challenge of appropriating value from Rediset LQ⁴⁰.

In terms of use, which is the core of the value (Osterwalder, 2004), the construction companies producing asphalt and the paving crews reap most of the benefits of Rediset LQ. Increased operation radius, prolonged season, decreased energy consumption and lower emissions of volatile substances are all benefits related to the use of the product. Deciding customers can benefit from prolonged paving seasons however as planned construction and maintenance can proceed with less sensitivity to weather. In terms of risk, Rediset LQ reduces performance risk during production and paving but, the product performance is not always as expected and there is uncertainty regarding WMA in terms of performance measurements. Thus, for road owners, uncertainty actually increases. Finally regarding effort, Wetfix-products are generally well established and the brand name is strong thus search costs are reduced. Seeing Rediset LQ being a new product, it does not reduce search costs relative Wetfix-products nor does it reduce training costs. There are however decreases in the operations costs due to the lowering of energy consumption.

Holistically, Rediset LQ does include additional stakeholders other than the customers and creates value for paying customers but the product seemingly does not deliver enough value on its own to road owners which would compensate them for the higher cost associated with buying the additive. Seeing that a majority of roads where WMA technology could be used are procured by public actors who mainly focus on price (Riksdagen.se, 2014; Upphandlingsbolaget Göteborgs stad, 2014) the

⁴⁰ Further discussed in chapter 6.2.2.2

increased cost associated with purchasing Rediset LQ creates a challenge for AkzoNobel to appropriate value through the product. One can argue that since public organizations represent the taxpayers, the added stakeholder benefits, such as global warming mitigation and a reduced strain on the welfare system, should be incorporated into the final price evaluation during procurement. However, there are questions regarding the real benefits for stakeholders as well. Does the increased paving season and operations radius enabled by WMA technology increase the net energy consumption compared to HMA? Does the need for increased volumes of Rediset additives in order to create similar adhesion promotion effects as the Wetfix-products relatively increase the consumption of fossil products? In order to be successful on the market these questions need to be answered and uncertainty regarding the product performance eliminated. Further, AkzoNobel Asphalt Applications could benefit from experimenting with the business model in order to deliver value to the road owners.

6.1.1.2 How value is delivered

In this element, which consists of customer relations, customer segments and distribution channels, there are mainly differences identified in the customer segment building block. However, some nuances in the customer relations building block are identified which are interesting to develop as well. By some authors, the business model concept receives critique regarding its narrow focus on the customer, thus excluding other stakeholders from the analysis (Sommer, 2012; Wells, 2013). However, according to several interviewees, stakeholders (that is to say actors who influence deciding customers) are taken into consideration for both Wetfix and Rediset LQ. The tax payers, include most of us, are merely considered stakeholders paying for the roads. However, Råddningsverket is seen as an important stakeholder who has influence over what roads need maintenance etc. In the case of Rediset LQ, worker unions are identified as possible representatives of stakeholders who potentially can put pressure on deciding customers to require WMA technology, thus increasing the likelihood of increased sales of Rediset LQ. According to several authors (Bocken et al., 2013; Sommer, 2012; Wells, 2013) considering stakeholders and sharing value with other stakeholders other than customers and share holders is part of being socially sustainable. Thus, the business model of any sustainability innovation needs to appeal these additional groups and include the environment (Bocken et al., 2013; Sommer, 2011). Although there is an agenda behind AkzoNobel Asphalt Applications' active consideration of stakeholders, the consideration of including stakeholders can be seen as an aspiration in moving towards social sustainability. The inclusion of stakeholders can also be seen an argument for Rediset LQ being a product with potential social benefits.

Osterwalder and Pigneur (2010) argue that customer segmentation needs to be done according to common needs, behaviors or other attributes and once a customer segment(s) is decided upon, an organization can design the business model around the understanding of a specific customer segment. In both the Wetfix and the Rediset business model there is a clear customer segmentation based on country, market, size of customer as well as the type of relationship AkzoNobel Asphalt Applications has developed with customers. Focusing on Sweden, customers are both deciding (mainly municipalities and Trafikverket) and paying (i.e. various construction companies) and these are mainly the same for both business models. Due to the asphalt maintenance market being mainly regulated by public actors, these deciding organizations are seen as customers who decide what type of asphalt should be paved at what road. Thus, much information activity and pure lobbying is

invested in convincing these actors to set more favorable requirements when doing public procurement. That is especially true in the case of Rediset LQ. The main identified difference in the customer segment is within the paying customer segment where focus of the Rediset LQ business model is put on so called key customers who AkzoNobel has established a good relationship with and who have resources and capabilities which compliment AkzoNobel's. However, despite the shift of focus regarding paying customers compared to Wetfix-products there are no controlled changes in the business model. What makes matters more complicated is the fact that the customers of Rediset-additives are intended to be exactly the same as for Wetfix-products once Rediset-additives gain momentum on the market. The focus on key customers can be traced to an established trust and brand recognition as mentioned by Osterwalder (2004). Thus, the nuances in customer relationships are relevant to bring into the analysis.

Several authors (Osterwalder, 2004; Sommer, 2012) argue that trust is a prerequisite for business transactions. In the case of the Wetfix-products there exists trust for the brand as well as the product and it is required to use some adhesion promoter when producing asphalt in Sweden. However, WMA technology is still in its cradle which creates skepticism, among deciding and paying customers, regarding its function mainly in regard to product performance and durability due to lack of standardized measurement methods and sufficient empirical data. Further, Rediset, in terms of brand name, is fairly unknown. In such situations, where there is an uncertainty in a new product or technology and where it needs to be tested, mutual trust is important and follows a set logic of *"you have previously believed in me so you ought to believe in me now as well."*⁴¹ Thus, using the AkzoNobel brand and creating test data for Rediset LQ is important in order to create trust among potential customers. Once the data is available *"(...) get it out there in articles in trade journals so that an increase in knowledge of its existence fostered, then you could go on company X [potential customers]. You don't approach company x if you want to add a test road if you never had trust capital with them."*⁴² Further, AkzoNobel is using key customers as well as test institutions with known and trusted brand names in order to boost the trustworthiness of the Rediset LQ test data. This then creates a slight shift in customer relations where key customers take an additional role as marketing channels which through their presentation of their test results and use of their brand names increase the credibility of Rediset LQ. Consequently, the key customers become key partners conducting key activities (Osterwalder, 2004) in the Rediset LQ business model. One can question if this shift in activity system is a sign of a strategic shift or a change in the business model. However, considering strategy referring to the choice of business model (Casadesus-Masanell & Ricart, 2009) and the business model being a manifestation of that choice (Chesbrough, 2007; Davidson and Lambert, 2013) thus explaining *"the rationale of how an organization creates, delivers and captures value"* (Osterwalder and Pigneur 2010:14) it is safe to say that the difference in activity systems noted above partly explain how value is delivered.

Finally, customer relationships are in a spectrum between close and distant (Osterwalder, 2004). Regarding the distance to customers there is no real difference identified between the two business models, however large paying customers and deciding customers where trust is important have a personal contact at AkzoNobel Asphalt Applications. It can thus be assumed that trust is fostered by one – to – one human relationship.

⁴¹ Interview 140613

⁴² Interview 140604

6.1.1.3 How value is created

This element includes key partnerships, activities and resources. Looking at the building blocks which constitute this element I have identified differences in all three building blocks of Rediset LQ compared to the Wetfix business model. Starting with partnerships, they are often motivated when bringing new products or technologies to market. In such cases Osterwalder and Pigneur (2010) argue that organizations team up in order to gain economies of scale, reduce uncertainty and risk as well as acquire resources and capabilities not available within the focal organization. In the business model of Rediset LQ partnerships with key customers has gained an increased importance compared to Wetfix-products which can be due to Rediset –additives being new products, potential sustainability innovations as well as representing a new technology. The cooperation is mainly apparent in the gathering of data regarding the emission levels during paving as well as the product performance and ease of handling during asphalt production in production plants as well as during the act of paving roads. Such cooperation reduces development costs for both parties and gives the actors involved access to resources and capabilities which they do not have access to alone. In regard to risk taking the key customer becomes the main risk taker in regards to public relations.

“If the first winter destroys the road or a heavy rain during autumn washes the road into the ditch, It's their [key customer] risk, it is not our risk. Well it is our risk too but we are not the ones who front.”

(Interview, 140521)

However, key customers are actually investing in different WMA technologies simultaneously thus reducing their risk of “being left behind” by hedging on different technologies. This type of hedging suggest an uncertainty regarding what solution to actually commit to which in the long term limits the ability of any solution to take off. In literature, cooperating with key customers is a way of avoiding major errors in technology and design during early phases of industry development (Grant, 2010) and the identified type of uncertainty which is holding customers back is an indicator of a preparadigmatic phase where a dominant design is yet to emerge (Suarez, 2004). Cooperation with key customers gives AkzoNobel access to resources and activities in terms of paving test roads, which would be costly to invest in on their own, as well as boosting the credibility of the product performance through diversified sources of data. The key customers are also getting access to resources and capabilities which enable hedging thus creating a win-win situation.

Regarding the aspect of gaining economies of scale AkzoNobel cooperates with a vast number of suppliers and distributors. I have not identified any differences when comparing Wetfix and Rediset LQ business models however there has been changes compared to previous years in these relations on a corporate level due to the goals for sustainable development set by top management (AkzoNobel, 2014). If and how these differences will affect the business models of Wetfix and/or Rediset LQ or other business models at AkzoNobel in the long term is not clear in this study but could be further investigated by managers at AkzoNobel Asphalt Applications.

In terms of key activities there has been a larger focus on research and development for the Rediset LQ compared to Wetix which is to be expected since Rediset LQ represents a new type of technology thus requiring more knowledge intensity. Such changes in key activities are iterative and differ across time and are closely related to new product development (Utterback & Suarez, 1995). Further, information activities are more intense in the case of Rediset LQ due to the novelty of the product and the need to create credibility and trust for the new product among deciding and paying

customers. An interviewee bluntly explains how lobbying and the spread of information about the product create markets:

“Once they [paying and deciding customers] get an understanding of there being a problem a new market can be created. It [market] is then processed in different ways(...) authorities need to be processed (...) requirements in their procurement norms are written.”

(Interview, 140613)

Finally, there are subtle differences in the key resources needed. Due to the development of the Rediset additives there have been investments in tangible resources such as lab equipment. Additionally, investments in knowledge have been conducted; that is to say both in terms of acquiring staff as well as hiring knowledge from outside experts. Furthermore, while the initial development of Rediset WMX (prequel to the Rediset LQ) was mainly conducted in the AkzoNobel R&D center in New York, cooperation between the labs in Stenungsund and New York has been conducted in order to develop the Rediset LQ. These changes have been iterative and are thus not planned, instead knowledge and equipment is acquired when apparently needed.

6.1.1.4 How revenue is generated

I have identified several differences in the cost drivers of the compared products as can be seen in figure 6.2. While an interviewee stated that there is no difference in ratios regarding costs for raw material, production, organization and finally distribution, there are differences connected to the changes in key activities and resources in the Rediset LQ business model compared to the Wetfix-products one. These include investments in new knowledge, R&D and tangible materials. Although such costs can be seen as sunk costs there are still added costs in terms of continuous testing of the product performance and development of measures to consider. It is however not clear if these differences are significantly higher if viewed over a set time perspective compared to Wetfix-products. Consequently, one could argue that the differences in cost structure between the business models are not significant enough to be classified as a change in the building block.

Due to the main cost driver being raw materials, such as oil, there are reasons for AkzoNobel to start experimenting with other raw material sources. Oil is not a sustainable product and the consumption of oil contributes to climate disruption (IPCC, 2013) thus only decreasing its use by *“doing more with less”* (AkzoNobel, 2014:2) is not sufficient if the company is serious in driving towards sustainable development. As mentioned in the second chapter of this thesis the company is actively exploring new forms of raw material base in cooperation with other chemical companies in chemical cluster in Stenungsund.

Furthermore, there is no experimentation regarding revenue streams at AkzoNobel Asphalt Applications. Whereas six types of value capturing mechanisms are identified by several authors (Osterwalder, 2004; Sommer, 2012), selling is the only type used in the business models of Rediset LQ and Wetfix. Experimenting with revenue models can drive sales and simultaneously be sustainable and foster resource efficiency (Sommer, 2012). Thus, there is a potential for future development in this area of the business models.

6.1.1.5 What can be synthesized from the static business model analysis?

Following Markides (2006:20) business model innovation definition of *“discovery of a fundamentally different business model in an existing business”* would indicate that the differences in the elements

and building blocks of the business models highlighted by the analysis above imply business model innovation. However, one can question what *fundamentally different* means as well as question the static comparison made above which does not regard possible differences in product lifecycle maturity (Kaplan, 2014) nor is the flow of time added which is a fundamental element when viewing business model innovation as a process (Schief and Van Putten, 2012). Nevertheless, the differences identified do motivate a deeper exploration of the Rediset LQ business model. A deeper analysis is helpful in order to establish whether or not a business model innovation process has occurred as well as understand how it has occurred thus answering RQ1.

Part II

6.2 An Attempt to Explain the Differences

The static comparison in chapter 6.1.1 highlights the differences in business model between the Wetfix products and Rediset LQ through a frozen snapshot in time (T1). However, the compared business models are still abstract concepts depicting different products, which in turn represent different technologies that possibly are in different lifecycle phases. According to several authors (Birchenhall and Windrum, 1994; Kaplan, 2014) a product/service/technology develops over four set phases over time (introduction, growth, maturity and decline). Additionally, these phases are connected to different types of adopters (Rogers, 2003) where the majority adopters are responsible for growth and maturity of the lifecycle. A dominant design is able to meet a whole set of user needs, thus lowering the entry barrier for the majority adopters and consequently facilitates the diffusion of an innovation (Teece, 1986). Furthermore, determining and owning the dominant design significantly influences an organization's ability to appropriate value from an innovation (Lüdeke-Freund, 2013). The different lifecycle phases and the different adopters have different characteristics, however a brief analysis should be enough to set the stage.

6.2.1 A brief analysis from an innovation lifecycles perspective

Looking at the Wetfix products, they represent HMA technology which is a standard way, a dominant design if you will, of producing asphalt. Adhesion promoters such as Wefix are required in Sweden through regulation, thus all actors who produce asphalt are required to add some adhesion promoter (be it a chemical, hydrated limestone or cement) to the asphalt mix. Consequently, the lifecycle of adhesion promoters ought to be in a mature stage as majority adopters and laggards are required to use such products. Other indicators of Wetfix-products being in a mature, or potentially declining, market in Sweden is the focus on cost competition (Bessant and Tidd, 2013) and the fact that testing methods are well developed and comply to set authority standard. Thus, barriers are already lowered for major adopters (Asthana, 1995; Teece, 1986).

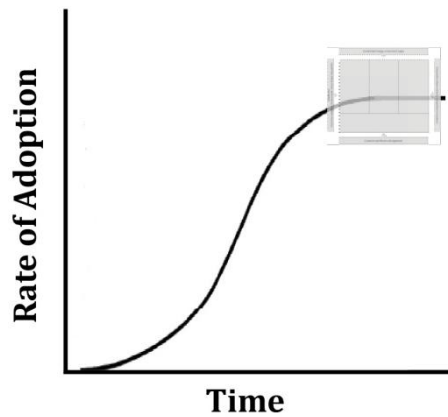


Figure 6.3: The T1 Wetfix-products business model in the mature phase of the S-curve

As for the Rediset additives, they represent a different technology which seems to be at an early phase in its Innovation lifecycle. In the preparadigmatic phase of such a lifecycle adoption rate is slow due to uncertainty regarding product performance and the initial high price (Asthana, 1995; Bessant and Tidd, 2013). Uncertainty, in terms of product performance, is present in the case of the Rediset additives due to the lack of standardized measurements⁴³ and the difficulty of measuring chemical compound effects on asphalt. Additionally, the product performance is not always as expected thus, uncertainty regarding product performance is a barrier for major adopters such as Trafikverket since a majority usually waits until the product/technology is perceived as reliable and trusted (Asthana, 1995). In terms of price, Rediset additives are still more costly compared to Wetfix products and as majority adopters, such as Trafikverket, procure based on price (Riksdagen.se, 2014; Upphandlingsbolaget Göteborgs stad, 2014) further market diffusion is hindered.

An additional signal of Rediset LQ being in an introduction phase of the lifecycle is how AkzoNobel Asphalt Applications market the product. According to Asthana (1995), the primary aim of a marketing strategy during the early phases of the lifecycle is to educate the market, create market awareness and prove the product performance. The actions taken by AkzoNobel Asphalt Applications, such as working together with key customers and research institutes to prove product performance, continuously developing measurement techniques, and lobbying as well as spreading information through seminars and conferences, are clearly matching the actions mentioned by Asthana (1995). Furthermore, the “hedging” behavior of key customers indicates that a dominant design has yet to emerge, which implies a preparadigmatic phase (Teece, 1986). However, there are innovators (such as the key customers) and potential early adopters (such as municipalities who want a "green" profile, and construction companies who pave in tunnels and in multistory car parks) who test and in some cases use the product at the time of data collection (T1). Such actors could indicate that the adoption rate is moving forward. Small niche markets, as the ones mentioned, are usually the starting point of radical innovations but such markets are also seen as unattractive for large organizations since the volumes are small. Nevertheless, AkzoNobel Asphalt Applications are present in these markets potentially indicating a fast second strategy where a dominant design has not yet emerged but the potential market is attractive enough to invest into (Schaltegger and Wagner, 2008).

⁴³ Further developed in 6.2.2.2

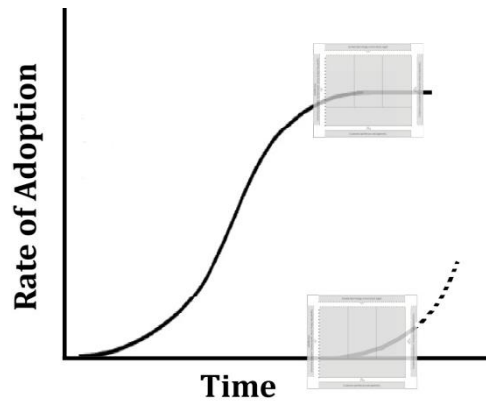


Figure 6.4: The T1 Wetfix-products and Rediset LQ business models in different lifecycles

In summary, the static business models of Rediset LQ and the Wetfix-products are captured in T1, that is to say they give a static overview of the contemporary state of the business models during the time of data gathering. These static concepts are however in different innovation lifecycles, thus the differences identified in the business models and the challenges of appropriating value from Rediset LQ could be due to the characteristics of the innovation lifecycle in which Rediset LQ resides.

However, the flow of time is still somewhat neglected in the analysis of the mapped business models but a fundamental element when viewing business model innovation as a process (Schief and Van Putten, 2012). As business model innovation in this thesis is defined as: any observable change over time in a business model building block or element exposed to a market, the flow of time needs to be added to the analysis in order to fully explore RQ1. That being said, the static business model of Rediset LQ in the context of innovation lifecycles do help explain the challenges in appropriating value from Rediset LQ. Thus, prior to setting the stage for a business model innovation process analysis, it is worthwhile to analyze the barriers further in order to partly answer RQ3.

6.2.2 Exploring some of the challenges of appropriating value from Rediset LQ

In chapter 4.3.4 challenges of appropriating value from sustainability innovations are presented and some of those challenges are noticeable in a T1 context. Hence, an additional exploration is motivated and can be followed below. Table 6.1 gives an overview of the challenges mapped in theory and their empirical connection where some to the challenges are explored in the static T1 context while other are explored in a process context.

Challenges in theory related to...	Explanation in theory	Connection in empirical data
Appropriability regime	The ability to capture value from innovation is determined by the type of knowledge (i.e tacit), innovation (i.e process) and protection (i.e patent)	The appropriability regime in the chemical industry is generally seen as high. The knowledge needed in order to develop new chemicals as well as the processes are hard to replicate and relatively easy to protect.
Dominant design	Competition of different technology design standards in preparadigmatic phase. Once a dominant design emerges through a transitional phase competition shifts towards process innovation.	Rediset LQ is in the preparadigmatic phase. There are different WMA technologies on the market. AkzoNobel competes with Rediset LQ by proving its functional performance. Development has been conducted in close collaboration with key customers.

Complementary assets	Generic assets such as after-sales, marketing, support and competitive manufacturing are necessary for a successful commercialization. Third party cooperation is important.	AkzoNobel offers support in some markets however after-sales or competitive manufacturing has not been confirmed. There is third party cooperation in terms of distribution and marketing.
Measurement	There is a lack of trusted methods which are able to prove the claimed sustainability of an innovation.	Existing challenges confirmed in several dimensions.
Double externality	<i>"The double externality problem means that part of the value of an innovation cannot be appropriated due to innovation spillovers, while at the same time external costs are borne by the innovator"</i> (Hockerts & Wüstenhagen 2010 found in Lüdeke-Freund , 2013:13).	Although "leakage" cannot be confirmed there exists a price disadvantage for Rediset LQ compared to Wetfx-products due to it internalizing external costs. There could be a price advantage if the value created in terms of decreased CO2 emissions and a better working environment among pavers could be fully appropriated through subsidies or a market fit business model.
Discursive ambiguity	The definition of sustainability innovation and sustainable development is contextual in terms of time, space and culture.	Empirical data in terms of how sustainable development is defined at AkzoNobel and awareness among interviewees regarding context sensitivity suggests a confirmation of theory. Some legislative challenges are also identified where current public procurement and regulations act as barriers to, but having the potential to facilitate, a market development.
Anticipatory risk	The effects of an innovation in terms of economic, environmental and social dimensions can merely insufficiently be anticipated.	In the case of Rediset LQ the discovery of additional value propositions through trial-and-error key customer testing is an example of the anticipatory risk. These effects have been beneficial however possible long term effects are still unknown.
Radical innovation	Sustainability innovation is often assumed to be of radical or systemic character thus replacing technological regimes and unstable dominant designs.	The trend of technology within the industry it is moving towards lower temperatures and WMA technologies can potentially replace HMA adhesion promoters such as concrete and hydrated limestone.
System-level change	System-level changes are often required to transform technological regimes and current dominant designs.	System-level steps cannot be confirmed however AkzoNobel is including several actors in the testing of Rediset LQ thus indicating an increase of transformative potential.
Mental models	The common understanding among individuals of what their business is and how they create value is a barrier to novelty and innovation.	There are several mental models making it hard for AkzoNobel to appropriate value from Rediset LQ.

Table 6.1: Comparing some of the theoretical and empirical challenges of capturing value from sustainability

6.2.2.1 Challenges related to complementary assets

According to Lüdeke-Freund (2013) one of the three dimensions which are universally valid and can be seen as challenges for appropriating value from any innovation are complementary assets. Complementary assets, such as after-sales, marketing, support and competitive manufacturing, increase the likelihood of a successful commercialization (Suarez, 2004; Teece, 1986). In the case of Rediset LQ, there are some complementary products such as technical support and marketing efforts (account managers and distributors) but in other aspects complementary assets have not been confirmed in the empirical data. Nevertheless, sharing such costs with third party actors is a way of strengthening ones position to capture value from innovation (Grant, 2010).

6.2.2.2 Challenges related to dominant design and appropriability regime

The other two dimensions which are seen as universally valid as challenges for appropriating value from any innovation are: *the dominant design* and the *appropriability regime* (Lüdeke-Freund, 2013). The preparadigmatic phase in which Rediset LQ seems to reside will, after a time of trial-and-error, develop into a paradigmatic phase where a dominant design emerges (Bessant and Tidd, 2013; Teece, 1986). In the search for a dominant design experimentation and insights gathered from failed experiments are necessary (McGrath, 2010). Similarly, the prototyping and experimentation are central elements in the business model innovation process since they allow organizations to try out a new model while mitigating its inherent risks as well as learning how to adjust the business model to better fit market needs (Gassmann et al., 2012). Consequently, there is opportunity for AkzoNobel to actively experiment with the business model of Rediset LQ, using trial-and-error and double looped learning (Moingeon et al., 2010; Sosna et al., 2010). Furthermore, WMA technology will seemingly substitute HMA technology which means that AkzoNobel needs to “jump” the S-curve. In such situations, managing the current and profitable way of creating and capturing value while simultaneously developing a new way of doing so (Kaplan, 2014) is a part of implementing novel business models (Moingeon et al., 2010).

Suarez (2004) identifies four firm-level factors which help determine the dominant design, namely: *technological superiority, a large install base, credibility and strategic maneuverability*. In order to do a proper analysis of these factors a comparison with peers is necessary (Suarez, 2004) however, such empirical data is not available. Suarez (2004) also identifies four environmental factors which help determine the dominant design, namely: *a strong appropriability regime, favorable regulations, network effects and the characteristics of the technological field*. The appropriability regime determines the likelihood of capturing value from an innovation based on factors such as legal protection and innovation type. A tight appropriability regime is characterized by strong legal protection and an access to relevant knowledge which is limited by the nature of the innovation (Teece, 1986). Creating producing or replicating chemical compounds and processes requires significant resources in terms of laboratory, human knowledge and production plants thus potentially making it hard for new entrants but still allowing incumbents to reverse engineer chemical compounds. However, purely copying chemical compounds is not allowed since there are relatively strong patent protections available (Google.com/patents, 2009) which make it likely that Rediset LQ is within a tight appropriability regime. If then Rediset LQ is brought to market through a business model with a proper market fit it would further strengthen the appropriability regime of the product since business model innovations are hard to imitate (Amit and Zott, 2010; Chesbrough, 2010). Furthermore, being in a tight appropriability regime is somewhat of an assurance that translating the

innovation into market value during a period of time (Teece,1986). As for network effects and the characteristics of the technological field there is not enough data to make an analysis.

Regarding regulations, there are ones in Sweden which oblige social actors who produce and pave asphalt to use adhesion promoters and are thus mainly favorable for HMA technology. At the time of T1, there are no favorable regulations in Sweden promoting WMA technology. Moreover, the REACH regulations are by many interviewees seen as stifling innovation as they make it even harder for new entrants as well as making novel chemical compound development very expensive as new compounds need to be registered by paying a fee. Nevertheless, large deciding customers such as Trafikverket are under pressure to reduce CO2 emissions with 1700 tones by the end of 2014 (Interview 140605) and they have employees whose job is to decrease CO2 emissions of asphalt paving thus creating an internal pressure within Trafikverket as well. Consequently, there are incentives for large deciding customers to create more favorable procurement deals for WMA technology however favorable procurement deals are still lacking. In contrast, Norway has a trial bonus system for foaming WMA which is expected to boost the WMA market there. What legislative efforts could be made in Sweden to help boost the WMA market? An aggregation of the empirical data suggests that the following points could probably help boost the appeal of WMA technology:

- *Public procurement focusing on WMA technology*
- *Regulations reducing the amount of CO2 emissions allowed for producing a set amount of asphalt*
- *More stringent regulations regarding volatile substance emissions levels during paving*

6.2.2.2 Challenges related to measurement and double externality

Why are large deciding customers such as Trafikverket hesitant of procuring Rediset LQ? If we accept the idea of Redise LQ being in a preparadigmatic phase, using the innovation lifecycle framework and innovation diffusion theory might help us to partly understand why AkzoNobel Asphalt Applications have difficulty in appropriating value from Rediset LQ.

As mentioned above, diffusion in the preparadigmatic phase is slow due to uncertainty regarding product performance and the initial high price (Asthana, 1995; Bessant and Tidd, 2013). The uncertainty of product performance in the case of the Rediset additives is due to the lack of standardized measurements and the difficulty of measuring chemical compound effects on asphalt. The test methods for Rediset product performance and chemical compound effects, which are devised through trial-and-error processes at Asphalt Applications, are not standardized and synchronized with other actors in the industry, thus making it hard to create credibility for the tests. Instead of synchronizing with competing actors and Swedish governmental agencies, AkzoNobel seemingly develops methods on their own and rely on trusted institutions and key customers. However, the lack of standardization of test methods is not exclusive to Rediset as there seems to be a lack of standardized test methods for WMA technology in general. One possible explanation would be mental models that are related to measurement of product performance and evaluate test results. According to several interviewees some of the standardized tests for HMA are not sufficient for testing WMA however, new test methods are not accepted due to a “we have always used this method” mindset. From the perspective of deciding customers, reliable measurements are key when ordering WMA technologies. Why? There are high costs associated with road failure or construction delay, thus the risk of trying new solutions is very high. Difficulties measuring the effects of different

compound concentrations in the asphalt and connecting that to road performance creates a reliance on statistical performance. Although statistical performance for general WMA technology on Swedish roads is available it does not seem to be sufficient to mitigate the perceived risk. This type of risk aversion within public organizations is further a barrier for procuring innovations with environmental and social benefits (Barbier, 2011). The large impact deciding customers have on what is procured for the Swedish roads make them representative of major adopters mentioned in innovation diffusion theory. From an innovation diffusion perspective, the majority adopters are risk adverse and shy away from new technology. They become confident enough to buy the product/service/technology once it is perceived as reliable and trusted actors approve of its functionality (Asthana, 1995; Rogers, 2003; Teece, 1986). Additionally, the acceptance of the majority adopters often signals the emergence of a dominant design (Rogers, 2003; Teece, 1986). According to several sources (Riksdagen.se, 2012; msr.se; 2014), the risk aversion among public actors can be connected to the precautionary principle which flavors public procurement in Sweden. As the precautionary principle creates incentives for procuring the cheapest alternative as well as refraining from procuring chemicals which are perceived as risky in terms of public health or the environment (msr.se, 2014; recautionaryprinciple.eu, 2014) proving product performance and creating cheaper alternatives is important for successful diffusion.

According to Hockerts and Wüstenhagen (2010 found in Lüdeke-Freund, 2013) sustainability innovations can be subject to cost disadvantages since they potentially internalize negative societal/environmental costs without the value created for society/environment being appropriated. In the case of Rediset LQ the product is more expensive compared to HMA alternatives. Through its use however, Rediset LQ reduces the necessary temperature for which asphalt can be produced thus reducing fuel costs among the asphalt producers and consequently reducing CO2 emissions (benefiting the environment) since heating of asphalt in most asphalt production plants is done by burning fossil based fuel. Furthermore, the use of the Rediset LQ reduce hazardous emissions during paving (benefiting individuals but in the longer run also society due to a small potential increase of public health). These societal and environmental benefits are not appropriated due to nonexistent supporting regulation (Hockerts & Wüstenhagen, 2010) and potentially due to the lack of active experimentation with the Rediset LQ business model (Teece, 1986; Lüdeke-Freund, 2013). In contrast, Kiron et al. (2013) argue that customers are willing to pay premium for products which are perceived as more sustainable. However, deciding customers do not seem to be interested in paying premium for the sustainability benefits of the product. Several interviewees argue that if CO2 emissions were subject to higher costs representing the potential damage they cause society, Rediset LQ would not have a cost disadvantage. Other interviewees state that if customers would include the benefits, in terms of increased operations radius, prolonged paving season etc. in their cost-benefit calculations, the cost of Rediset LQ would be lower compared to Wetfix-products. The societal benefits could also be appropriated, however in such cases AkzoNobel would need to prove just how much society saves through the use of Rediset LQ. That is to say, how much fewer individuals will need medical attention due to less exposure to volatile particle emissions? Again the challenge of measurements becomes relevant. In order to overcome the challenges which are related to double externality, creating a market fit through business model innovation is one aspect (Lüdeke-Freund, 2013; Chesbrough, 2007) however for the regulatory challenge Lüdeke-Freund (2013) proposes lobbying for public policies and raising awareness among customers. The awareness issues are very much related to the measurement challenge and providing data showing the benefits of Rediset LQ.

Regarding lobbying AkzoNobel is trying to lobby for more favorable requirements in the public procurement processes. This is again done by trying to prove the benefits of the product.

Furthermore, a lack of trusted test methods are especially relevant for appropriating value from sustainable innovations as the claimed social and environmental benefits need to be proven (Lüdeke-Freund, 2013). Regarding Rediset, the measurement challenge is apparent in the case of the supposed environmental benefits, in terms of the reduction of CO₂ emission as well as the social benefits achieved during paving. The main questions are how are the reductions measured? Are they really reductions if one brings in the increase in transport which increased operations radius of asphalt production plants using Rediset LQ implies? What if one brings in the increased paving season which potentially results in more asphalt being paved thus more material consumption and CO₂ emissions? What if one looks at the lifetime of the products and not only the stage of asphalt production, does Rediset LQ still deliver reduced CO₂ emissions in relation to peers or HMA? All these questions need to be answered. At least AkzoNobel and other actors need to come clean with how they measure sustainability benefits and jointly develop a standardized way of measuring, thus making their products comparable (Lüdeke-Freund, 2013, Interview 140605). Additionally, the social sustainability value proposition regarding decreasing levels of volatile substance emissions during paving can be calculated and proven in technical terms. However, such measures do not seem to be enough to convince customers or change mental mindsets. Although emissions are reduced visibly and the reduction of dangerous particles has been confirmed scientifically, the subjective experience of an individual is important as *"it does not matter if there are less dangerous particles if the smell is worse"*⁴⁴. To challenge the perceived difference among individuals is a difficult task and the uncertainty in terms of measurement becomes a barrier for convincing customers of the necessity and functionality of the product. Such challenges can, according to Lüdeke-Freund (2013), be mitigated through transparency regarding measurement methods.

6.2.2.3 A brief summary of some challenges related to appropriating value from Rediset LQ

In summary, considering sustainability innovations needing the support of public policy, more specifically public procurement in this case (Uyarra et al., 2014), as well as novel business models in order to succeed in the market place (Lüdeke-Freund, 2013). The picture painted above regarding the deciding customers' risk aversion and inertia, price disadvantages of sustainability innovations as well as the measurement challenges facing Asphalt Applications seems to be the main challenges for the appropriation of value from Rediset LQ. The challenges related to product performance uncertainty and risk aversion are not necessarily exclusive to sustainability innovations but the measurement challenges regarding the social and environmental benefits of an innovation as well as the price disadvantage due to the internalization of external costs are. Table 6.2 below summarises the finding mentioned above.

⁴⁴ Interview 140613

Challenge	Potential solution(s)
<i>Appropriability regime</i>	<ul style="list-style-type: none"> • Rediset LQ is within a tight appropriability regime thus probability of capturing market value is high • Use business model innovation to further straighten the appropriability regime
<i>Dominant design</i> <ul style="list-style-type: none"> • WMA technology is within a preparadigmatic phase • Large deciding customers have incentives to order WMA technology 	<ul style="list-style-type: none"> • Identify dominant design through trial-and-error product development and business model experimentation • Lobby for more legislative efforts facilitating WMA technology market build up in Sweden.
<i>Complementary assets</i> <ul style="list-style-type: none"> • Sufficient empirical data is not available 	-
<i>Measurement</i> <ul style="list-style-type: none"> • Lack of standardized test methods for WMA technologies • Questions regarding measurement of CO2 emissions • Insufficient real road statistical data • Uncertainty of product performance in certain contexts due to insufficient cause/effect component concentration and asphalt properties test methods • Subjective perception of social value 	<ul style="list-style-type: none"> • Develop standardized inter industrial performance test methods for WMA • Create more real road statistical data • Develop standardized and comparable lifecycle CO2 emission measurements
<i>Double externality</i> <ul style="list-style-type: none"> • High product cost possibly due to internalization of external costs 	<ul style="list-style-type: none"> • Lobby for supporting public policy allowing appropriation of environmental and social benefits created by the product • Show paying customers how to calculate the full benefits of using the product • Experiment with business model

Table 6.2: Overview summary of some of the Rediset LQ market challenges

6.2.3 Setting the scene for a process analysis

In order to understand the differences from a business model innovation perspective the flow of time needs to be added and preferably a static business model captured some years ago (T0) be used as a point of reference from which the sustainability innovation Rediset LQ business model develops. According to several authors (Doz and Kosonen, 2010; Schief and Van Putten, 2012) a successful business models tend to be stable over time as they tend to become somewhat crystallized and hard to change due to proven efficiency and reliability. Using the innovation lifecycle framework the crystallization can be explained through the effects of the emergence of a dominant design which shifts innovation activities to incremental process innovations in order to reduce cost (Bessant and

Tidd, 2013; Teece, 1986) Consequently creating a preference to stay close to what is familiar, building on existing resources and capabilities as well as rely on a continuation of past successes (McGrath 2010; Grant, 2010; Schnider and Spieth, 2010). Path dependency of this sort might constrain AkzoNobel Asphalt Applications in finding new ways for creating and capturing value creation and is somewhat confirmed through the empirical data where one can derive that there has been no significant changes in the building blocks or elements of the Wetfix product business model since 2004.

The work preceding Rediset LQ was initiated in 2005 and was built on essentially the same capabilities and resources available for incremental Wetfix development. Consequently, I am going to make a break-neck assumption in order to answer RQ1. In the subsequent analysis, I am assuming that the Wetfix products business model has been stable, basically static, over time thus setting the T1 Wetfix products business model mapped in chapter 5.1.1 equal to a T0 reference point from which the Rediset LQ business model has developed (see figure 6.5). This assumption can be criticized from a Demil and Lecocq (2010) perspective who argue that a business model is in a permanent state of disequilibrium. Additionally, one can argue that such an assumption opposes the philosophical starting point of this thesis where business model innovation is seen as a social construct which is created, recreated and reinforced by the actions of social actors. However, the simultaneous existence of several business models is confirmed by Moingeon et al. (2010) and the crystallization of business models can be seen as being reinforced through a process of social behavior and relationships which reinforce an existing social order (Barbier, 2011). Additionally, the compared business models reside in different innovation lifecycles and thus they are subject to different forces of change (Bessant and Tidd, 2013; Teece, 1986). It should also be noted that a period of technological change is indicated as Wetfix and Rediset represent different technologies where HMA is seemingly in a mature stage and Rediset, being in a preparadigmatic phase, is estimated to substitute Wetfix products where possible. Periods of technical change involve business model innovation (Giesen et al., 2009; Wells, 2013) as well as “jumping” to a new S – curve which involves managing the existing business while simultaneously investing in a new business (Kaplan, 2014). In contrast, products in mature innovation lifecycles focus on cost advantages where the business model is somewhat crystallized and hard to change due to proven efficiency and reliability (Bessant and Tidd, 2013; Doz and Kosonen, 2010; Schief and Van Putten, 2012). Thus, I argue that the mapped Wetfix business model, as a social construct, has been reinforced and crystallized through a process of social behavior and relationships which reinforce the existing order. I further argue that the disequilibrium mentioned by Demil and Lecocq (2010) has not affected the business model of Wetfix products per say but has resulted in the emergence and development of the Rediset LQ business model from the Wetfix products business model.

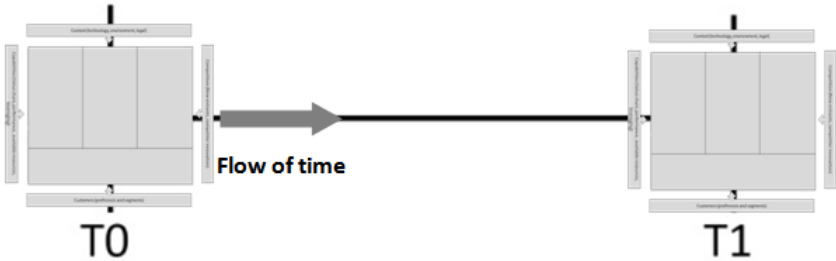


Figure 6.5: Frame of process analysis where Wetfix business model at T1 = Rediset LQ business model at T0

6.3 Business Model Innovation

Having argued that the business models compared in T1 are different, that they reside in different innovation lifecycles and that the difference between the businesses models can potentially be due to business model innovation assuming the Wetfix products business model being largely static. I will now focus on understanding if and how the process of business model innovation has occurred as well as map any sustainability driving forces affecting any part of the process and further map and develop some challenges of appropriating value from the sustainability innovation Rediset LQ.

6.3.1 Sustainable development drivers of WMA-technology R&D at Asphalt Applications

One focal point of this thesis is the relation between sustainable development and business model innovation. In chapter 1.2 I present the line of thought where sustainable development is seen as a driver of innovation and innovation in turn being a driver of sustainable development. In order to answer RQ1 and RQ2 sustainable development as a business driver needs to be addressed, thus in contrast to other contextual forces, sustainable development as a contextual force will be given extra attention below. However, as the notion of sustainable development needs to be anchored in a given social context (Wells, 2013) where local actors agree upon what the notion involves in their context a deeper exploration in how AkzoNobel views sustainable development is motivated.

6.3.1.2 Internal context

In *Our common future* (WCED, 1987) the concept of sustainable development is broken down into the three dimensions of economic, social and economic sustainability. In the empirical data it is evident that AkzoNobel has a definition of sustainable development grounded in mentioned literature thus also adhering to the three dimensions mentioned. It is however worth noting that the dimensions found in *Our common future* (Sustainable-environment.org, 2014; WCED, 1987) are formulated as very general guidelines that are supposed to be accessible for all levels of society (Dresner, 2008) be it a nation state or a 10 employee business. Thus, it is not surprising that the company's interpretation of the dimensions of sustainable development somewhat differ from the definitions developed in the *Our common future* (WCED, 1987).

"(...) there is no point in being the most environmental company going bankrupt"

(Interview, 140527)

AkzoNobel, just as many other successful corporations, acts and operates on shareholder value maximization logic where its primary obligation is to maximize shareholder profits (Fligstein, 2001). As a consequence the economic dimension, that is to say economic growth, outweighs the other dimensions in importance. Within such logic, AkzoNobel is subdued to a growth imperative (Gordon and Rosenthal, 2003) which is why the economic dimension is the foundation for every investment. The growth imperative is also the reason to why there needs to be a business case for sustainability (Lüdeke-Freund, 2013), that is to say business opportunities which allow for business success while simultaneously contributing to a sustainable development, if other dimensions are to be taken into consideration (Schaltegger and Wagner, 2006; found in Lüdeke-Freund, 2013). In order to able organization to gain revenue through the internalization of external costs legal measures are needed (Hockerts and Wüstenhagen 2010 found in Lüdeke-Freund, 2013). Enabling organizations to capture

value from the internalization of negative societal/environmental costs would further mitigate the double externality challenge which is connected to capturing value from sustainability innovations.

“(...) most impact equals most focus (...)”

(Interview, 140522)

The environmental dimension of sustainable development means a focus on creating technology which conserves or enhances the common resource base (Sustainable-environment.org, 2014; WCED, 1987). On a corporate level and thus also in the case of Asphalt Applications, the environmental dimension can be summarized in *“doing more with less”* (AkzoNobel 2014:2). The underlying assumption regarding what type of impact the company creates through its operations as well as the company ability to measure these environmental impacts create a bias for what common resource base the environmental dimension at AkzoNobel encompasses. Thus, there is an extensive focus put on the reduction of CO₂ emissions and energy consumption across the value chain which overshadows other environmental impact areas. In the case of Rediset LQ, the product can be seen as a gradual change towards conserving the common resource base of oil if compared to Wetfix-products. However, asphalt generally affects the environment negatively throughout its lifecycle (NVF, 2000) and using Rediset additives still requires consumption of oil. Additionally, producing Rediset LQ still creates CO₂ emissions and one wonders if the CO₂ savings from the production of asphalt are lost through increased operations radius, prolonged paving season and production of Rediset LQ. Thus, it is debatable whether it qualifies as a sustainability innovation or not. Unfortunately, data from a lifecycle analysis is not available but these issues put focus on the importance of actors within an industry defining and measuring the dimensions of sustainable development in an agreed upon way. Consequently, reducing barriers for sustainability innovations as the sustainability aspect of such innovations need to be embedded and agreed upon within the temporal and social context (Lüdeke-Freund, 2013). Such actions also coincide with the principle of localization and engagement which is one of the principles of a sustainable business model (Wells, 2013)

Savitz et al. (2013) claim that a sustainable business improves the lives of those it interacts with, where stakeholders are any group or individual who affects or is affected by an organizations activities (Sommer, 2012). At corporate level AkzoNobel, the social equity dimension is lowest in hierarchy and suffers from a general limited access to data and consequently measurability. Nevertheless the social dimension is noticeable within the context of Rediset-LQ due to measurability of the reduction of volatile substance emissions during paving.

A comparison between the theoretical and empirical dimensions is displayed in table 6.3.

Dimensions in theory	Confirmed dimensions in empirical data	Description of empirical data
Economic growth	Economic profit	Economically viable investments outweigh other dimensions.
Environment	Environment	CO2 emissions and energy consumption
Social equity	Social equity	Including stakeholders and are committed to employee wellness.
-	Time	Seeing sustainable development as a direction not an absolute state.

Table 6.3: Comparing the theoretical and empirical dimensions of sustainable development.

6.3.1.2 External context

On a macro level there has been several business case drivers of sustainable development affecting corporate AkzoNobel and thus possibly Asphalt Applications. The different drivers found in literature (table 4.4) are matched with empirical equivalents (table 5.2) in table 6.4 below.

Theoretical drivers	Potential sustainable development effects	Empirical equivalent
Cost reduction	Energy savings, material flow reduction	Cost reduction & Customer requests
Risk reduction	Reduction of political, societal and technological risks	Risk mitigation & Context
Sales and profit margins	Increased sales through new products and services, new markets and customers	New business opportunities
Reputation and brand value	Social awareness, innovativeness,	Improve brand value and generates trust
Employer attractiveness	Attract and retain talented employees	Attract knowledge & Employee engagement
Foster innovation	Provokes new product, process and business model innovation	New business opportunities
Keepin up with competition	Competition gaining a competitive advantage through sustainable development	Plant & Product competition
N/A		Attract investment capital

Table 6.4: Macro driving forces of sustainable development

Not all of the drivers found in literature or in the empirical data have had traceable impact on the development of the WMA product at Asphalt Applications however. There are mainly three drivers which have driven the initiation and the development of the Rediset additives: *Cost drivers, potential increase in sales margins and keeping up with competition.*

Resource scarcity implies an increase in prices for resources such as oil (Heinberg, 2007) and cost reduction through resource efficiency is a main driver for sustainable development (Nidumolu et al., 2009; Schaltegger et al., 2012). Oil prices have long been on a rise⁴⁵ and oil is a core component in asphalt production, both in terms input in the production process in the form of bitumen and in terms of energy for heating the asphalt to sufficient temperatures (Asfaltskolan.se, 2014). Thus, it is

⁴⁵ See Appendix V

understandable that asphalt producers prefer products which help them reduce costs through resource efficiency in terms of lowering the asphalt production temperature, consequently reducing the need for fuel oil.

In regards to a potential increase in sales margins, Kiron et al. (2013) argue that customers are willing to pay premium for products which are perceived as more sustainable. This claim cannot be confirmed in the case of Rediset LQ however the potential in gaining competitive advantage and, in the long run, taking market shares from HMA adhesion promoters such as hydrated lime stone (a main HMA technology competitor to AkzoNobel in the US adhesion promotion market) and cement (relevant in the Swedish market as HMA production in some geographical areas is mainly using cement as adhesion promoter) was another driver. Hydrated limestone and concrete cannot be used as adhesion promoters in warm temperature asphalt production. Furthermore, many of the factors mentioned in literature such as cost reduction through resource efficiency (Nidumolu et al., 2009; Schaltegger et al., 2012), employee attractiveness (Schaltegger et al. (2011) and risk reduction (Nidumolu et al., 2009; Schaltegger et al., 2012) aggregate into competitive advantage in different ways (Grant, 2010). Due to the trends in the industry competing companies were developing and releasing WMA products on the market and there was an understanding at AkzoNobel that WMA technology could potentially replace HMA. Thus, keeping up with competition was another driving force for the development of Rediset additives. Competing products also had an impact on the development of the Rediset additives since liquid competing products were a key source of knowledge in the development of a liquid form of the additive.

6.3.1.3 Summary of the contextual sustainability drivers

In summary, the notion of sustainable development needs to be anchored in a local context and factors such as common measurements and definitions potentially affect the ability of an organisation to appropriate value from a sustainability innovation. Consequently, AkzoNobel Asphalt Applications need to align their definition of sustainable development across the industry (including competitors and deciding as well as paying customers) through common measurements and a common definition of the notion. Furthermore, Nidumolu et al. (2009) argue that sustainable development is a driver for innovation which will force organisations to rethink their products and business models. Through the analysis above it can be inferred that at least three drivers for sustainable development have had a significant influence on the initiation and development of Rediset LQ. Have these drivers and factors affected the business model innovation process of Rediset LQ in any way? In order to answer that question we need to explore how the process has been conducted.

6.3.3 An evolutionary perspective on the identified differences in business model elements

As mentioned previously, the flow of time is a fundamental element when viewing business model innovation as a process (Schief and Van Putten, 2012). Building on the assumption motivated in chapter 6.2.3 (see figure 6.5) the following chapter is an analysis of the development of the Rediset additives thus starting at T0 and moving onwards until reaching T1. T0 is set to 2005 as this is the time when the R&D preceding the development of Rediset LQ was initiated. Many of the doors opened regarding challenges of appropriating value from Rediset LQ as well as the connection between sustainable development and business model innovation will be developed and concluded throughout this chapter. Furthermore, this chapter incorporates different pieces of the theoretical framework and builds on most of the empirical data as well as the analysis presented in the chapters

above. However, the bulk of data is derived from chapter 5.3.2. External factors (Sosna et al., 2010) and/or product/process innovation (Gassmann et al., 2012) cause incremental changes which can lead to business model innovation. Consequently, by using the business model elements as a framework for the analysis of the product development of Rediset LQ and incorporating contextual factors (see figure 6.6) as well as the challenges of appropriating value from Rediset LQ in the relevant elements the process of business model innovation can be analyzed.

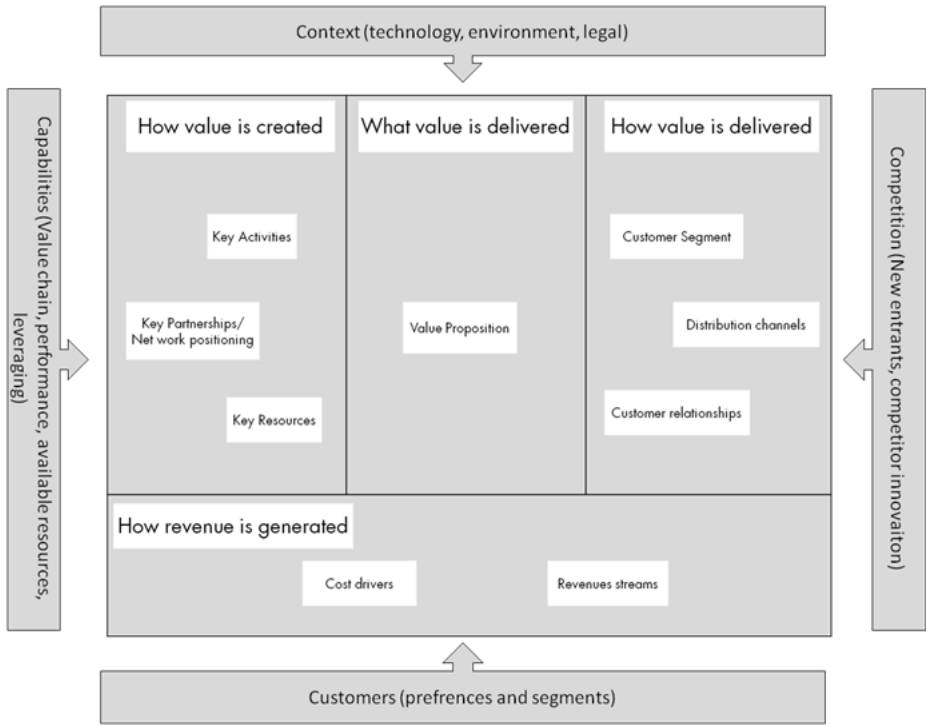


Figure 6.6: Business model element and the contextual factors framework

6.3.3.1 The pre-T0 situation

Davidson and Lambert (2012) argue that environmental factors force organisations to adapt and Wells (2013) further argues that business model innovation is not conducted in a vacuum, implying the importance of contextual factors. In order to understand what factors triggered the development of Rediset LQ the knowledge perspectives presented figure 6.6 will be used as they facilitate an understanding of the business environment (Implement, 2012). According to Implement (2012) contextual trends which are reflected in people’s opinions and in regulation potentially impact business models (Implement, 2012). Prior to T0 there was an industry wide trend in trying to reduce temperatures when producing and paving asphalt and according to several interviewees the trend was caused by the ongoing public debate about climate change as well as increases in oil prices and scientific theories regarding the possibility to reduce the production temperature of asphalt. Another knowledge perspective highlights the importance of competition which gives an organization hints about new and potentially disruptive innovations as well as an understanding of customer wants and needs which are currently not satisfied (Implement, 2012). One driving force for the US AkzoNobel Asphalt Applications R&D center, which was the R&D center that initiated the development of Rediset LQ, was that lowered production temperatures would make limestone inappropriate as an adhesion promoter. Thus giving Asphalt Applications a potential competitive advantage in the US market since a large part of the adhesion promotion market was held by limestone producers. The

societal and technological trends being touched upon, the legislative trend still remains as a contextual factor potentially affecting the T0 business model (Davidson and Lambert, 2012; Giesen et al., 2009; Implement, 2012). There are no specific regulatory factors identified in the empirical data which, in the pre-T0 timeframe, had impact on the initial development of Rediset.

In summary, in the pre-T0 timeframe in which the development of Rediset-additives was initiated was characterized by societal discussions regarding sustainable development and a general industry exploration of WMA technologies. As a result of these external forces all of the building blocks (key partnerships, key activities and key resources) within the “How value is created”- element have been affected in different degrees. Further, the differences identified in T1 have evolved over time from T0 (McGrath, 2010; Sosna et al., 2010) and are interrelated within and across business model elements (Gassmann et al., 2013; Schneider and Speith, 2013). A closer look at each element across time might give a clearer picture of the process of change.

6.3.3.2 Changes in “How value is created”

At T0, R&D was emphasized as a key activity in order to develop a solution which could reduce temperatures in asphalt production. Initially, the R&D people at the Asphalt Applications R&D center in New York used previously developed chemicals and experimented with them in order to find a WMA solution. Using existing resources in such way and relying on a continuation of past successes is a sign of path-dependency and also an argument for the Rediset business model at T0 being equal to the Wetfix products business model at T1 (McGrath 2010; Grant, 2010; Schnider and Spieth, 2010) However, while in development the R&D team in New York realized that they needed additional knowledge which consequently resulted in the hiring of a consultant which thus, being a human resource (Grant, 2010), changed the composition of the key resources. Further, due to the fact that the US R&D center only had the resources to test the effects of the additive on the bitumen and not bitumen in combination with aggregate, tests were conducted in collaboration with universities and different institutes. According to several authors such partnerships allow organizations to access external resources and capabilities (Grant, 2010; Sommer, 2012). The R&D center in Stenungsund was also brought in eventually (in around 2007-08) and performance tests were additionally conducted there in order to utilize the human and tangible resources available at the site as well as confirm previous test results. It should be mentioned as well that further investments in tangible resources were conducted at the Stenungsund R&D center in order to create asphalt testing capabilities utilizing available human resources and complementing the R&D center in New York.

Once the product function was desirable and enough test results were available to prove the product function the Rediset WMX was brought to selected customers in Sweden thus further evolving the key partnership block of the business model. According to Bessant and Tidd (2013) the preparadigmatic phase is characterized by close relations to users who give technical input according to their needs. Customer preferences are also a factor potentially causing change in a business model (Implement, 2012). The cooperation with key customers resulted in positive feedback regarding the product performance however since the Rediset WMX was a solid product it was difficult to insert into the bitumen compound. Further, due to the injection systems at the asphalt plants being built for liquid injections, using the solid WMX product meant that a full tank of 20 tones of bitumen suddenly was committed to WMA which at the time lacked demand from deciding customers. Additionally, the price of producing WMX was high compared to using just an HMA adhesion promoter due to expensive raw materials. Furthermore, larger quantities of the product were

required in order to get a desired effect on the temperature coupled with a strong adhesion promotion which further increased costs for paying customers. From a sustainable development perspective a key driver was cost reduction in terms of cost of buying fuel for heating up the asphalt during production but the cost of using the WMX potentially eliminated the cost benefits of reduced fuel consumption. The feedback from the key partners regarding WMX took Asphalt Applications back to the drawing board in an attempt to develop a liquid based additive which could give asphalt producers more flexibility in choosing how much WMA to produce as well as lowering the cost of production.

The development of a liquid product was initiated somewhere around 2009-10 at both R&D centers in Sweden and the US. Knowledge exchange was frequent thus building on the existing knowledge as well as initiating novel key activities in terms of cross-Atlantic cooperation. At the same point in time there were competing liquid WMA products, which lowered production temperature of asphalt, available on the market and, while being in a tight appropriability regime, AkzoNobel could study these products in order to gain insights. Thus, building and developing key human resources through knowledge development which allowed the R&D centers to develop two different liquid versions through trial-and-error development. Analyzing competition gives an organization an understanding of new innovations which potentially could disrupt its business (Implement, 2012). Furthermore, keeping up with competing products with environmental benefits (such as lowered asphalt production temperature) is a sustainability driver. The US R&D center product had better test results thus the product was further developed for the European market due to the regulatory environment set by REACH regulations. Consequently, further R&D activities were needed and the difference between T0 and the new business model became even more significant. Once the trials on the new version of the product, LQ1102CE, were ready it was brought to market through trials with key customers. Again, key customers were selected on the basis of resources and technical capability (Grant, 2010; Sommer, 2012) but also on the basis of trust.

Prior to moving into the analysis of how the “how value is delivered”- element and thus setting focus on the customer aspects it is worth highlighting the development of product test methods. During the entire development of the Rediset products, new product test methods have been developed through trial-and-error experimentation and learning seemingly through the process of questioning the acquired prevailing way of doing tests. This indicates a double loop learning process which is an important capability when conducting business model innovation (Sosna et al., 2010). Further, rules, metrics and norms are part of the key activities of an organization (Johnson et al., 2008). As such they are an integrated part of an organizations’ capability (Grant, 2010) and thus influence how an organization adapts to environmental change (Sosna et al., 2010). That is to say, key activities and key resource are closely interconnected (Grant, 2010) and are part of the mental models of an organization. Rigid mental models can impede innovation (Chesbrough, 2010; Sustainability, 2014) and in order to mitigate such barriers double looped learning through trial and error experimentation is necessary (Moingeon et al., 2010; Sosna et al., 2010). In terms of key activities and key resources it seems AkzoNobel utilized double looped learning. This is visible in terms of investing in tangible resources such as testing equipment and the trial-and-error experimentation of test methods which resulted in new test methods. Consequently, it can be assumed that such capabilities exist. However, there are mental models within AkzoNobel Asphalt Applications which are not challenged. Although there have been changes in the test methods these changes have been a result of the product

development of Rediset. There has been no active experimentation or questioning of the way business is done.

“Unfortunately we have taken Rediset and tried to (...) to push it out through the system we know. Same people, same channels, the same thought, and in the end the same argument.” (Interview, 140613)

Moingeon et al. (2010) argue that in order to break these mental barriers a different form of knowledge acquisition needs to take place. The trials conducted and the errors found need to be used to question traditional frames of reference in terms of how value is created as well as how it is delivered. That is to say, through the lens of a business model.

6.3.1.2 Changes in “How value is delivered”

During the course of Rediset LQ development the customer relations and segments have shifted focus compared to T0 where relationships with key customers have developed into partnerships, initially built on trust, marking a visible building block change. Additionally, the key customers have had a significant impact on the development of Rediset as their preferences were an important factor for the development of the liquid Rediset LQ. As key customers tested the different product versions several other benefits emerged. As previously mentioned, one main driving force to initiate development of WMA solutions at AkzoNobel Asphalt Applications was the potential in decreasing temperature during asphalt production and consequently also CO2 emissions. As the trial-and-error testing together with key customers proceeded, unintended benefits such as decreased emission levels during paving and an increased operations radius of an asphalt production plant were detected. An increased operations radius implies an increased product performance compared to Wetfix products and decreased emission levels during paving add social value to the Rediset value proposition. The anticipated social and environmental benefits of sustainability innovations do not always coincide with the actual effects thus there is always an anticipatory risk (Lüdeke-Freund, 2013). In the case of Rediset, the unanticipated effects have been beneficial while potential long term effects are still unknown.

Partnering up with key customers has also been part of an attempt of AkzoNobel Asphalt Applications to break industry mental models. Mental models are powerful barriers of innovation (Chesbrough, 2010; Sustainability, 2014), these are manifested in a common understanding among individuals regarding what business they are in, what it includes and how value is created. Within the asphalt industry these mental models manifest in a general skepticism against "sustainable" products since the industry has a history of using mainly “unsustainable” products. Further, sustainable development in general is viewed with skepticism within the industry due to the general belief that anything sustainable is inherently worse than unsustainable peers in terms of product performance. Additionally, paving crew workers have been hesitant to chemical solutions due to their historical experience of fumes creating headaches etc. Other ways in which AkzoNobel Asphalt Applications have attempted to change these mental models is through educating customers through scientific papers and raising awareness regarding the benefits of the product at fairs and seminars. Further, the company is, at T1, planning to cooperate with unions which potentially could shift mental models among paving crew workers. According to several authors (Lüdeke-Freund, 2013; Wells, 2013) how the notions of sustainable development and sustainability innovation are defined depends on the contemporary context in which an organization operates. Cultural values as well as when and where it operates are factors which affect those notions. Empirical data show that presenting Rediset LQ as

a sustainable alternative is not all easy since such claims create questions regarding the “unsustainability” of other AkzoNobel product. In Sweden much of the public debate regarding sustainable development focuses on reduction of CO2 emissions. Thus, there are paying customers who specifically ask for more sustainable products where sustainability often is associated with reduced CO2 emissions. Recently an emphasis has also been put at workers health during paving. This ambiguity creates a need for AkzoNobel to communicate differently with different customers. The company is aware of this challenge and acts accordingly, a clear example can be found in the communication done in Sweden compared to Russia. In Sweden the value found in lowering CO2 emissions during production and volatile substance emissions during paving is used as an argument for Rediset LQ while the Russians are more interested in the increased operational radius of the asphalt production plants allowed by the product. The adaptability of the communication is confirmed in theory where Lüdeke-Freund (2013) argue that challenge related to discursive ambiguity presents opportunities through communication. Further, AkzoNobel is clear about how they define sustainable development and how Rediset LQ adds to sustainable development through its reduction of CO2 emissions during production and reduction volatile substance emissions during paving. Nevertheless, the mental model challenges as well as the measurement challenges proving the claimed environmental and social benefits persist.

Furthermore, the customer centric perspective includes an understanding of how customers would prefer delivery of the value proposition as well as finding new customer segments (Giesen et al., 2009; Implement, 2012; Osterwalder, 2004). Several authors (McGrath, 2010; Moingeon et al., 2010; Sosna et al., 2010) suggest this to be done through iterative trial-and-error experimentation, questioning the ways in which things are done to better serve customer needs and potentially find unexpected outcomes. In the *customer relationships* and the *distribution channels* building blocks there is no difference identified in the T1 state nor does any empirical data suggesting that there has been experimentation with those building blocks, thus indicating that a trial-and-error process has not been conducted which consequently indicates a missed opportunity in understanding customer preferences. Nevertheless, key customers have had significant influence of the development of Rediset LQ and consequently on the differences identified in business models at T1. The differences in the “How value is delivered”-element can be explained by an evolutionary change process as described by several authors (Dunford et al., 2010; Montign et al., 2010; Sosna et al., 2010)

6.3.1.1 Changes in “What value is delivered”

The value proposition of a business model is based on the capabilities of an organization and/or its partners (Osterwalder, 2004; Chesbrough, 2006), consequently it is affected by changes in the “How value is created”- element. The changes in the element do not explain all the new value propositions included in the Rediset LQ. According to (Implement, 2012) the customer, as a contextual factor, affects a business model further the value proposition of a business model needs to target the need of a specific customer (Osterwalder, 2004; Chesbrough, 2006). Giesen et al. (2009) argue that a business model innovator needs to understand customer preferences as well as identifying new customer segments and consequently adapt the business model to the customer needs (Sosna et al., 2010). As shown in the process analysis of the “How value is delivered” –element the relation to the key customers have had impact on the development of Rediset LQ in terms of going from solid to liquid product. Additionally, the analysis also shows that new value propositions have been unearthed through trial-and-error testing with key customers.

The general customer centric focus of the business model is however criticized by several authors (Bocken et al., 2013; Sommer, 2012; Wells, 2013). The authors argue that the focus needs to be widened to include benefits and costs to other stakeholders than just the customers of a firm. Others argue that once a business understands and responds to each stakeholder and their needs, the process of business model innovation begins (Sustainability, 2014). In T0 and T1, the Rediset LQ business model stakeholders, such as taxpayers and Rådningsverket, are taken into consideration when evaluating the benefits of using the products. The additional stakeholders identified in the customer segment of the Rediset LQ business model have been included through the detection of the social value proposition in terms of reduced fumes during paving.

Regarding challenges of appropriating value from sustainability innovations Lüdeke-Freund (2013) argues that sustainability innovations often are assumed to replace unstable dominant designs, thus being radical in a sense. The main value proposition of Rediset LQ and other WMA technologies (lower the temperature of asphalt production) can outcompete HMA technologies in the asphalt production process as the lower temperatures make the asphalt mix rigid thus creating cracks if one is using concrete or hydrated limestone as adhesion promoters. To further boost the potential of radical innovations Lüdeke-Freund (2013) argues that organizations should co-evolve the product together with small actors through incremental steps. Empirical data suggests that the partnering with key customers could be a sign of such boosting. Additional data and a deeper exploration of radical innovation could potentially give insights for future research.

6.3.1.4 Changes in “How revenue is generated”

According to several authors (Gassmann et al., 2013; Schneider and Speith, 2013) the interrelatedness of business model elements should also caused significant changes in the cost structure. During the development of from T0, there have been additional costs mainly in terms of R&D costs and some investments in facilities which have caused changes in the key resources building block. Although such costs can be seen as sunk costs there are still added costs in terms of continuous testing of the product performance and development of measures to consider all throughout the time flow between T0 and T1. It is however not clear if these changes have changed the core cost structure of the Rediset LQ business model. As for revenue streams, there has not been any change or experimentation within this building block. According to Lüdeke-Freund (2013) experimenting with revenue models is a common way of facilitating market success of sustainability innovations thus there is opportunity for further trial-and-error experimentations.

6.3.1.5 Summary of the process of business model innovation analysis

Business model innovation is in this thesis defined as any observable change over time in a business model building block or element exposed to a market. Assuming that business models can coexist (Moingeon et al., 2010) and that the Wetfix-products business model at T1 are equal to the T0 starting point of Rediset LQ development I can conclude that the development of Rediset LQ has initiated a business model innovation process. The process is an evolutionary and trial-and-error process constantly affected by external and internal. These finding coincide with several authors who claim that product innovation can lead to business model innovation (Gassmann et al., 2012) through an evolutionary (Abernathy & Utterback, 1975; Moingeon et al., 2010; Sosna et al., 2010) trial-and-error process (McGrath, 2010; Montignon et al., 2010; Sosna et al., 2010) as a response to external and internal forces (Davidson and Lambert, 2013; Giesen et al., 2013; Implement, 2012).

6.3.4 Further challenges of appropriating value from Rediset LQ

6.3.4.1 Challenges related to system-level change

System-level changes are often required to transform technological regimes and current dominant designs. Inclusion of multiple actors and artifacts increase the transformative potential of a system (Johnson and Suskewicz, 2009). Indicators of a system-level change have not been confirmed in the empirical data however AkzoNobel has including several actors in the development of Rediset LQ. There is opportunity in developing within this area, Lüdeke-Freund (2013) points out that experimentation with revenue models is a way of experimenting with system factors. Further such experimentation could bring about revenue model innovation which, according to Giesen et al. (2009) is a type of “game-changing” business model innovation.

6.3.4.2 Summary of the challenges explored in the process analysis

In summary, additional challenges of appropriating value from Rediset LQ has been due to mental models, both within AkzoNobel Asphalt Applications and in the external context among paving crews and paying customers. The internal mental models can be challenges through double looped learning (Montignon et al., 2010; Sosna et al., 2010) from a business model perspective and AkzoNobel Asphalt Applications seemingly have the capabilities to do so. The mental models in the external environment, that is to say paying customers and paving crews, can be due to the discursive ambiguity regarding what sustainability and sustainability innovation is in the context of asphalt. Several authors (Lüdeke-Freund, 2013; U, 2014; Wells, 2013) suggest that the notions of sustainable development and sustainability innovation need to be anchored in the specific context. Consequently, further inclusion and education as well as a definition of sustainable development and measurable parameters which all within the context agree upon are needed. In table 6.5 an overview of the challenges explored in the process perspective is available and potential solutions are presented.

Challenge	Potential solution(s)
<i>Discursive ambiguity</i> <ul style="list-style-type: none"> • Context is important for how the sustainability value of Rediset is perceived • The contrast between Rediset LQ and previous products create communication difficulties 	<ul style="list-style-type: none"> • Different contexts require different emphasis in the communication
<i>Radical innovation</i> <ul style="list-style-type: none"> • WMA technologies can potentially outcompete some HMA alternatives 	<ul style="list-style-type: none"> • Co-evolution in incremental steps with smaller actors (Lüdeke-Freund, 2013)
System-level change <ul style="list-style-type: none"> • Sufficient empirical data is not available 	-
<i>Mental models</i> <ul style="list-style-type: none"> • There exists internal and external mental models 	<ul style="list-style-type: none"> • External models are being battled through inclusion and information • Internal models can be broken by questioning how business is currently conducted and using business model trial-and-error experimentation with double looped learning.

Table 6.5: Overview summary of some of the Rediset LQ market challenges

6.4 Connecting the Parts

In the line of thought found in chapter 1.2 the mutually reinforcing relationship between sustainable development and innovation is explored as sustainability driving forces impel organizations to rethink and innovate products (Nidumolu et al., 2009). Product innovations impelled by sustainability driving forces potentially include environmental and social benefit, so called sustainability innovations, which in turn are assumed to form more sustainable ways of production and consumption and contribute to new knowledge development. Thus, reinforcing sustainable development through a virtuous cycle of technological diffusion, (Charter and Clark, 2007; Hekkert and Negro, 2008). However, organizations bringing sustainability innovations to market are faced by several challenges in appropriating value from them. The challenges in turn impede the potential of sustainability innovations to create transformative effects towards more sustainable development through virtuous cycles. Solving such challenges is regarded as a business model task (Lüdeke-Freund, 2013) where a business model is regarded to have significant impact on the captured economic value available in technological innovation (Chesbrough, 2010; Wells, 2008) and ultimately on how technological artifacts are used. Affecting usage influences stakeholders' perceptions of the technological artifacts thus, a business model influences how these artifacts are marketed and diffused (Boons et al., 2013; Lüdeke-Freund, 2013). Consequently, business models act as mediators between product sustainability innovations, their diffusion and the amount of value that is appropriated from such products, and further sustainable development (Boons et al., 2013; Chesbrough, 2010; Lüdeke-Freund, 2013). Furthermore, a business model can be regarded as a

subject of innovation and as such it is also affected by the sustainability driving forces (Nidumolu et al., 2009).

The purpose of this thesis has been to understand the process of business model innovation and to outline the sustainability driving forces affecting the process of change within the business model of the sustainability innovation Rediset LQ as well as to outline the challenges which face an organization that attempt to appropriate value from such an innovation. Such understanding would further facilitate an understanding of how further transformational effects towards a more sustainable development within the asphalt industry can be achieved. The mapped static business models, which form the basis of the analysis, represent different technologies in different innovation lifecycles. Given the technology trend (figure 2.2) within the industry, where WMA solutions are increasingly being developed, and adding the view of several interviewees who claim that WMA will replace HMA technology in a foreseeable future, it is reasonable to assume that Asphalt Applications are in a time of technological change (in T1) where an S-curve “jump” to WMA is becoming increasingly relevant. While organizations find it difficult to “jump” due to technological and market uncertainty (Kaplan, 2014) Giesen et al. (2009) argue that it is during such times that business model innovation is needed. Furthermore, experimentation and insights gathered from failed experiments are necessary during times of technological change when search for a dominant design is conducted (McGrath, 2010). Consequently, AkzoNobel have the opportunity to accelerate diffusion of Rediset LQ through experimentation with its business model.

However, the picture painted though the analysis in chapter 6.3 proposes that the development of the Rediset additives has initiated an evolutionary, trial-and-error business innovation process, thus implying that the development of a product with potential environmental and social benefits inherently has impelled AkzoNobel Asphalt Applications to rethink the way they do business. However, the process of reimagining the business model is impeded by internal mental models and a lack of questioning the core logic of how business is done. Furthermore, the potential of Rediset LQ to create transformative effects towards more sustainable development through virtuous cycles is impeded due to several challenges related to the lack of public procurement, price disadvantages of sustainability innovations as well as the measurement challenges facing Asphalt Applications in terms of product performance as well as the measurement of environmental and social benefits. Other challenges include discursive ambiguity regarding what sustainable development and sustainability innovation is in the socio-economic context as well as external mental model such as a general skepticism against new measurement techniques or products with environmental benefits.

Finally, throughout this thesis I have identified three driving forces which are related to the notion of sustainable development (cost drivers, potential increase in sales margins and keeping up with competition) which have influenced the development of Rediset LQ. The development of Rediset LQ has in turn initiated and driven an evolutionary trial-and-error process at Asphalt Applications where observable changes over time in business model building blocks as well as elements have been identified. Consequently, the sustainability drivers identified have affected and initiated an evolutionary trial-and-error business model innovation process at AkzoNobel Asphalt Applications which coincides with the evolutionary perspective on business model innovation (Moingeon et al., 2010; Sosna et al., 2010) as well as with the idea of sustainable development impelling organizations to rethink products and business models (Nidumolu et al., 2009).

7 Wrap Up

In this final chapter I shortly answer the research questions and draw some short conclusions from the analysis in chapter 6. Furthermore, the chapter includes a discussion regarding some of the different chapters of this thesis as well as potential paths for future research.

7.1 Conclusion

The purpose of this thesis has been to understand the process of business model innovation and to outline the sustainability driving forces affecting the process of change within the business model of the sustainability innovation Rediset LQ as well as to outline the challenges which face an organization that attempt to appropriate value from such an innovation. The first steps were to understand general external driving forces affecting AkzoNobel Asphalt Applications and map the business models of the two products representing different technologies. Once the business models were outlined, the differences between them were analyzed through the lens of innovation lifecycles thus identifying them being in different lifecycle phases. In an attempting to answer RQ1, the development of the product with potential environmental and social benefits was mapped and analyzed. RQ2 was answered using the identified external driving forces which related to sustainable development and combining them with the mapping of the product development process. Finally, several challenges of appropriating value from Rediset LQ were identified throughout the empirical data gathering. These were analyzed and connected to the line of thought in 1.2 thus answering RQ3.

RQ1: How is business model innovation conducted within AkzoNobel Asphalt Applications?

The product development of Rediset LQ has been an incremental trial-and-error process through which advantages and disadvantages have been unfolded and adapted to over time. Assuming that the T1 Wetfix products business model is equal to the T0 Rediset one, the Rediset development process further triggered an incremental and evolutionary change process through which different building blocks and elements of the business model changed. The business model innovation process has been unstructured, that is to say there has been no active management of it as some emerging and unintended changes in a business model are difficult to manage. Further, the process has been affected by external forces as well as by internal trial-and-error experiments where both double and single looped learning has been utilized. However, there has been no fundamental questioning of how business is conducted in terms of how revenue is generated or how value is delivered.

In order to understand what driving forces related to sustainable development were potentially affecting the business model innovation process thus following the line of thought in 1.2 the second research question was:

RQ2: Are there driving forces related to the notion of sustainable development which have potentially affected the business model innovation process at AkzoNobel Asphalt Applications?

There are three driving forces related to sustainable development identified in this thesis which have had an impact on the development of the Rediset additives and consequently on the business model innovation process.

1. Cost reduction

Cost reduction in this case implies resource efficiency which is manifested through the paying customer demand of products lowering fuel consumption due to the increased price of oil. As

resources such as oil grow scarce an increase in price can be expected and organizations that use oil based products and are subject to a growth imperative are thus inclined to reduce costs through. As oil is a core component in asphalt production, both in terms input in the production process in the form of bitumen and in terms of energy for heating the asphalt to sufficient temperatures, asphalt producers demand products which help them reduce their oil consumption. Using WMA additives is one way of reducing production costs of asphalt as the technology allows asphalt producers to lower the asphalt production temperature thus reducing the need for fuel oil. Cost reduction has consequently affected the initiation of Rediset development as well as its further development from solid to liquid products.

2. Potential increases in sales margin

Cement and hydrated limestone cannot be used as adhesion promoters in WMA temperatures thus potential increase in sales margins, through a potential competitive advantage versus HMA adhesion promoters such as cement and hydrated limestone, have been another sustainable development related driver. The WMA technologies reduce asphalt production temperature which, considering fuel oil is used to heat up the asphalt mix during production, leads to decreased CO2 emissions. That is why this driving force is seen as sustainable development related.

3. Keeping up with competition

Adhering to an industry trend in finding ways of reducing asphalt production temperature is another sustainable development related driving force and it is seemingly closely related to the resource efficiency and customer demand aspect of the cost reduction driving force.

Finally, in order for a sustainability innovation to contribute to more sustainable patterns of consumption and production such an innovation needs to be successfully diffused. Thus, the third question of this thesis relates the challenges of appropriating value from sustainability innovations which are linked to the barriers preventing diffusion.

RQ3: Why is a specific sustainability innovation not taking off in the Swedish marketplace?

I have during the writing of this thesis identified several challenges which partly explain why the specific sustainability innovation, Rediset LQ in this case, is having trouble taking off in the market place. The four main challenges identified are:

1. The challenge related to dominant design

A static snapshot of the business models of Rediset LQ and the Wetfix-products captured in T1 represent different technologies which reside in different innovation lifecycles. Consequently, the challenges of appropriating value from Rediset LQ could be due to the characteristics of the preparadigmatic phase in which Rediset LQ resides and not necessarily be connected to it being a sustainability innovation. Nevertheless, in order to create trust for the product performance of Redieset LQ among the majority adopters, trial-and-error experimentation and double looped learning are keys. The experimentation could be done in product development but also in the business model. Using a business model framework and rethinking the core logic of how business is done could generate enough performance data to facilitate diffusion among majority adopter. Business model experimentation could be conducted by exploring novel customer segments, potentially found among innovators and early adopters. Novel ways of how to generate revenue as

well as novel areas of use, such as indoor paving, are other examples of how AkzoNobel can experiment using a the business model concept and thus increase the probability of Rediset additives becoming a WMA dominant design. However, business model innovation is half of what is needed to facilitate the adoption rate of sustainability innovations. Public policy such as public procurement is another key factor which helps facilitate market creation for sustainability innovations. Following points could probably help boost the appeal of WMA technology in general:

- *Public procurement focusing on WMA technology*
- *Regulations reducing the amount of CO2 emissions allowed for producing a set amount of asphalt*
- *More stringent regulations regarding volatile substance emissions levels during paving*

2. The challenge of measurement

The Rediset LQ is in a preparadigmatic phase where uncertainty regarding product performance, due to a lack of general standards, is causing uncertainty in the marketplace among both deciding and paying customers. Jointly developing comparable standards, in terms of test methods and measurements, with other industry actors while aggregating statistical WMA test data could reduce uncertainty among paying and deciding customers. Furthermore, the relative social and environmental benefits included in the use of Rediset LQ lack general standards and performance indicators. Consequently, leading to doubts among customers regarding the environmental and social performance. The measurement issues also lead to price disadvantages since the environmental and social benefits are not properly calculated in the Rediset LQ cost calculations among customers. Jointly defining the concept of sustainable development and sustainability innovation with other industry actors as well as developing joint performance measurements could facilitate the adoption rate of innovations with such benefits. Furthermore, joint development of practices that take into account the externalities which WMA-products internalize, such as costs of CO2-emissions, could help mitigate the cost disadvantage of Rediset LQ in relation to the Wetfix-products. Such measurements could facilitate the adoption rate of Rediset LQ and other WMA solutions among price sensitive majority adopters.

3. The challenge of mental models

From an AkzoNobel Asphalt Applications perspective, there are internal and external environment mental models of how things should be done in the industry acting as challenges for measurement, product and business model innovation. The internal environment mental models at AkzoNobel Asphalt Applications are related to the lack experimentation and double loped learning regarding the core logic of how business is done. Such challenges can be mitigated by actively managing business model innovation through trial-and-error experimentation and double looped learning. The external environment mental models are related to how paying customers and paving crews view products with environmental and/or social benefits as well as how customers view measurement methods. Such mental models can be due to the discursive ambiguity regarding what sustainability and sustainability innovation is in the context of asphalt. Several authors (Lüdeke-Freund, 2013; U, 2014; Wells, 2013) suggest that the notions of sustainable development and sustainability innovation need to be anchored in the specific context. Consequently, further inclusion and education as well as a

definition of sustainable development and measurable parameters which all within the context agree upon could facilitate changes in the external environment mental models.

7.2 Discussion

7.2.1 Regarding method

The ontological and epistemological approach taken in this thesis acknowledges the difficulties of uncovering a single objective truth within the main topics chosen. Thus, the philosophical starting point of this thesis and the subsequent choices, regarding research design and methodology as well as approaching theory, have been helpful in the quest of gaining a deeper understanding of the thesis main topics. However, there is an inherent tension between regarding the business model as a social construct and thus choosing a research design and methodology fitting that perspective while simultaneously regarding natural phenomenon such as climate disruption as a force existing independent of social actors. I have however shown and argued that the notion of sustainable development can be context sensitive when operationalize and it is this context sensitivity which makes the notion adaptable as well as difficult to grasp or accept in some cases. Similarly, business model and business model innovation are abstract concepts which lack definitions that have gained a scientific acceptability and involve the acceptance of agreed upon standards from which further scientific discoveries can be achieved. Nevertheless, I should admit that building a thesis on a foundation of concepts which lack a robust scientific acceptability of what they incorporate has been a mindboggling challenge which has forced me to rethink my initial view on the business model and the notion of sustainable development. Initially I had a strong conviction that sustainable development was an end state and reaching that end state was a necessity. In order to get business on board the sustainability train, new universally valid business models were needed and in order to be a part of that change I needed to understand how business model innovation was conducted. In other words I was looking for THE answer, an objective truth. Throughout the research process however, I realized that there is no such thing in case of AkzoNobel Asphalt Applications. Although generalizability of the results of this thesis are low due to its design, I believe that a more abstract and generalizable finding has emerged. To be precise, sustainable development can be regarded as a direction where each social actor (be it an individual, an organization or an institution) needs to define what that direction means within their own context. The contextual factors such as climate disruption, population growth, growing inequality, resource scarcity etc. need to be adhered but there is no single way of measuring sustainable development in all thinkable contexts. That is why the dimensions found in WCED (1987) and the principles of sustainable development proposed by Wells (2013) could act as guidelines for such a direction.

7.2.2 Regarding theory

The theory chapter started off revolving around *sustainable development*, *business model* and *business model innovation*. However as empirical data was collected, the need to understand and analyze other aspects found in the data required additional theory. The theoretical framework is additionally rather wide and which came at the cost of depth. Some of the chapters are somewhat swiping and not really represented in chapter 6, however the swiping parts of the theory was still regarded as necessary in order to understand the wider picture.

7.2.3 Regarding analysis

This chapter was probably the hardest to complete and its content was changed several times during the writing process of this thesis. This trial-and-error way of writing was mainly due to the lack of appropriate frameworks on business model innovation which seemed relevant in the context of Rediset LQ and the difficulty of merging the actual findings with the initial research question on business model innovation. As a result of the lack of proper theoretical frameworks, the analysis chapter is somewhat messy and does not follow the set logic of the theory chapter. In order to finalize the analysis chapter several chapters found separate in the theory chapter needed to be merged and some parts of the theory were left out. The difficulties merging the findings into a coherent whole could reflect a need to rephrase RQ1 however doing so would have had several implications on the coherence of the semi-structured interview questions as well as large parts of the theory chapter and the initial analysis. Further, the written analysis was not consistently done in conjunction with the gathering of data and reading of theory. Much of the written analysis was done after the collection of data but as the written analysis emerged it became apparent that more data was needed in order to explain the process of business model change as well as the challenges of appropriating value from Rediset LQ. Thus, new data was collected which again forced me to go deeper into theory.

Discussing the content, two main issues deserve a somewhat deeper discussion. The first one is the idea of Rediset LQ being a sustainability innovation, the second being the assumption of the Wetfix T1 business model being equal to the Rediset LQ T0 business model. Starting with the idea of Rediset LQ being a sustainable innovation, the product can be seen as a gradual change towards conserving the common resource base of oil if compared to Wetfix-products. However, looking at the levels of environmental impact presented by (Charter and Clark, 2007) the benefits of Rediset LQ mainly qualify for the lower levels. Considering the aim of sustainability innovations being to achieve higher levels of innovation, thus significantly reducing environmental impact, one can discuss how successful the additive is at achieving further sustainable development. Viewing sustainable development as a direction instead of a goal however, allows for relative measures of what sustainable development is in different context and during different times. Viewed from such a perspective, the environmental and social dimensions included and discovered during the development of Rediset LQ motivate the idea of regarding Rediset LQ as being a sustainability innovation. The lifecycle benefits (LCA) of Rediset LQ are unconfirmed in this study but compared to the Wetfix adhesion promoters the inclusion of stakeholders and the multidimensional benefits seem significant.

Regarding the assumption of the Wetfix T1 business model being equal to the Rediset LQ T0 business model, much regarding the *why* has been argued for in chapter 6.2.3. However, the assumption could be hasted and ideally deeper empirical data regarding the development of a specific product would have been beneficial for strengthening or discarding the assumption.

7.3 Future Research

An interesting finding in this thesis is the connection between S-curves and business model innovation. It seems that the business model concept can be connected to the innovation lifecycle theory and successfully “jumping” to a new S-curve within a sustaining technology value network seems to involve business model innovation. A deeper exploration of the relation between business

model innovation and innovation lifecycles, both in terms of incremental and disruptive innovation situations would be interesting.

Another interesting focal point for a future study would be to understand how a process of business model innovation is actively managed on a product level as a contrast to the evolutionary perspective depicted in this thesis. If the product level is understood, maybe the understandings could be empirically applied on an organizational level as well. Furthermore, it should be noted that AkzoNobel is changing their corporate business model in order to become more sustainable (AkzoNobel, 2014) thus, a longitudinal study of this change would be of interest since it could allow other organizations to adapt a similar process into their contexts.

Finally, in the context of sustainable development sharing value seems to be a key. Thus, one could question the idea of tight appropriability regimes being desirable. A deeper and critical exploration into the relationship between the diffusion of sustainability innovations and types of appropriability regimes could be interesting.

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List of figures

- 2.1: *Delimited organization chart for AkzoNobel focusing on Asphalt Applications*. Created after analysing data from Interview 140505; interview 140522 and AkzoNobel.com, 2014f
- 2.2: *Defining WMA and HMA*. Created after analysing data from Interview 140604 and eapa.org, 2014c
- 2.3: *Area of possible use of a WMA-product*. Created after analysing data from Interviews 140521 and Interview 140605
- 4.1: Overview of research questions and theoretical chapters.
- 4.2: Porter's value chain found in Grant, 2010
- 4.3: *How the elements and building blocks fit together*. My remake of Oserwalder and Pigneur (2010) and Implement (2012) business model canvas
- 4.4: *Innovation priorities of under- versus over performers from Pohle and Chapman, 2006*
- 4.5: *Knowledge perspectives and canvas from Implement (2012)*
- 4.6: Innovation lifecycle and diffusion rate
<http://highered.mheducation.com/sites/dl/free/0256133603/17274/16010.jpg> accessed: 2014-11-01 16:34)
- 4.7: Current and emerging technology s-curve
http://media.tumblr.com/tumblr_lI0d34R8LB1qbih58.jpg [accessed 2014-11-01 16:46]
- 4.8: A current product business model S-curve in relation to an emerging product business model S-curve
- 4.9: Key dimensions of appropriability regime found in Teece (1986)
- 4.10: Innovation in the different phases found in Teece (1986)
- 5.1: Structure of the empirical findings from a dynamic point of view.
- 5.2: General Wetfix business model
- 5.3: General Rediset LQ business model
- 6.1: Overview of the different parts of the analysis
- 6.2: Rough overview of highlighted differences in business model
- 6.3: The T1 Wetfix-products business model in the mature phase of the S-curve
- 6.4: The T1 Wetfix-products business model in the mature phase of the S-curve
- 6.5: Frame of process analysis where Wetfix business model at T1 = Rediset LQ business model at T0
- A1: Oil prices.

Appendixes

Appendix I - Question guide for semi-structured interviews

Note: In most cases the questions were asked in Swedish further each *business model mapping* related question was asked twice. Once focusing on Rediset (warm mix) and once focusing on Wetfix (hot mix). Further the mapping questions were not used in the business model innovation interviews and vice versa. Additionally “your notion of sustainable development” was changed into warm mix or Rediset LQ. Thus the focal point have shifted towards a potential sustainable innovation.

A I. 1 Business model mapping

- What is the value proposition offered?
 - What do you think that the customer is paying for?
- Who is the customer?
 - What are the different segments?
 - Are there other stakeholders who benefit from the value proposition?
- How do you deliver the value proposition? (includes sales, communication and distribution channels)
 - After sales?
- How is the relation to the customer organized?
 - How do you gain new customers?
- How is revenue generated (selling, leasing, auction, service etc)
 - Do you have different pricing mechanisms?
- What resources (human, tangible, intangible) are necessary for Wetfix / Rediset?
- What key activities are necessary for Rediset / Wetfix?? (R&D, sales, production, testing etc?)
- Please elaborate on the partnerships necessary for making Rediset / Wetfix successful on the market.
- Are there other costs related to Rediset /Wetfix other than the ones related to your answers above?

A I. 2 Business model innovation

- How do you define sustainable development?
 - Why?
 - How is it operationalized?
- Has your notion of sustainable development affected your relations to suppliers?
 - How?
 - Driving forces? (Internal/external)
 - Barriers?
 - Success factors?
- Has your notion of sustainable development affected your customer segments?
 - How?
 - Driving forces? (Internal/external)
 - Barriers?

- Success factos?
- Has your notion of sustainable development affected your relations to suppliers?
 - How?
 - Driving forces? (Internal/external)
 - Barriers?
 - Success factos?
- Has your notion of sustainable development affected the value proposition?
 - How?
 - Driving forces? (Internal/external)
 - Barriers?
 - Success factos?
- Has your notion of sustainable development affected your customer relations?
 - How?
 - Drivingforces? (Internal/external)
 - Barriers?
 - Successfactos?
- Has your notion of sustainable development affected your revenue model?
 - How?
 - Driving forces? (Internal/external)
 - Barriers?
 - Success factos?
- Has your notion of sustainable development affected your partnerships? (current/created new?)
 - How?
 - Drivingforces? (Internal/external)
 - Barriers?
 - Successfactos?
- Has your notion of sustainable development affected your resources? (human/tangible/intangible)
 - How?
 - Driving forces? (Internal/external)
 - Barriers?
 - Success factos?
- Has your notion of sustainable development affected your internal processes?
 - How?
 - Driving forces? (Internal/external)
 - Barriers?
 - Success factos?
- Did these changes happen in a certain order?
 - Any experimentation?
 - How did it happen?

A I. 3 Development of the Rediset-family

Prior to the interview and after describing the thesis, the interviewees were told that I was interested in understanding the process of the development of Rediset and how the process eventually created the changes in the business models of Wetfix and Rediset which I have identified.

- Tell me about the development of Rediset, how did it get started?
- What effect did...
 - customers

- competing products,
 - the context in terms of law, technology and societal norms,
 - your knowledge and resources
- have on the development of the product?
- What was it that made the companies in the industry to in the early 2000ths look at how to make asphalt more environmental friendly?
- What generation is Rediset LQ?
- Is Rediset an eco premium solution?
- Please explain the connection between the New York and the Stenungsund lab.
- Is there any development of Rediset in Sweden now?

Appendix II – Different elements of the business model found in contemporary literature

Bessant and Tidd (2013)	Schaltegger et al. (2011)	Moingeon et al., (2010)	Gassmann et al. (2012)
Value proposition – Specifies how value is created and for whom. Different types of innovation contribute differently to the value creation.	Value proposition - Represents the value, in terms of product or service, an organization offers to a target customer for which he/she is willing to pay.	Value proposition – Includes the product and/or service offered thus explaining the attractiveness of the offer brings to a customer. The customer is also included but refers not only to the buyer but also to other actors benefiting from the offer.	What – Describes what is offered to the target customer, that is to say " <i>what the customer values</i> ". Often referred to as the value proposition which can be defined as a " <i>holistic view of a company's bundle of products and services that are of value to the customer</i> " (Gassmann et al., 2012:2).
Position in the network – Through a ventures position within a network of stakeholders, such as suppliers and customers, risks, rewards and responsibilities are distributed.	Infrastructure – Includes the network of partners necessary to create value and maintain good relationships with customers.	Value architecture - includes all the activities an organization deploys in order to deliver the value proposition to the customers. The element describes the internal value chain as well as the organizations position in a value network including relations to suppliers, distributors etc.	How – This element includes the processes and activities needed to build and distribute the value proposition. The involved resources and capabilities and how they are managed within a focal firm's internal value chain are also part of this dimension and need to be considered in the design of a new business model.
Capabilities and processes – Answers how an innovation or venture delivers value. Delivering value requires a combination of resources, knowledge and capabilities.	Customer – In order to satisfy customer needs and generate long term revenue an organization needs to create and maintain relationships with target customers. This element of the business model represents these relationship building and maintaining activities.		Who – Every business serves a certain customer group thus the business model needs to answer the question "who is the customer?"
Revenue generation – The value created need to be captured which is explained through this element.	Financial aspect – Cuts across previous dimensions an contains cost and revenue structures	The profit equation - combines the result of the value proposition and architecture and specifies the origin of the profitability where the value proposition affect customers' willingness to pay as well as the size of the market share, while the value architecture dictates the cost structure and capital employed. Further, the profit equation is distinguished from revenue model, as it is aimed at return on capital employed while the revenue model focuses on the revenues captured.	Value – The final dimension relates to the revenue model and explains how value is captured and why the business model is financially viable. This dimension thus includes cost structure and mechanisms for revenue creation.

Table A1: Business model elements found in literature

Appendix III – Oil Prices

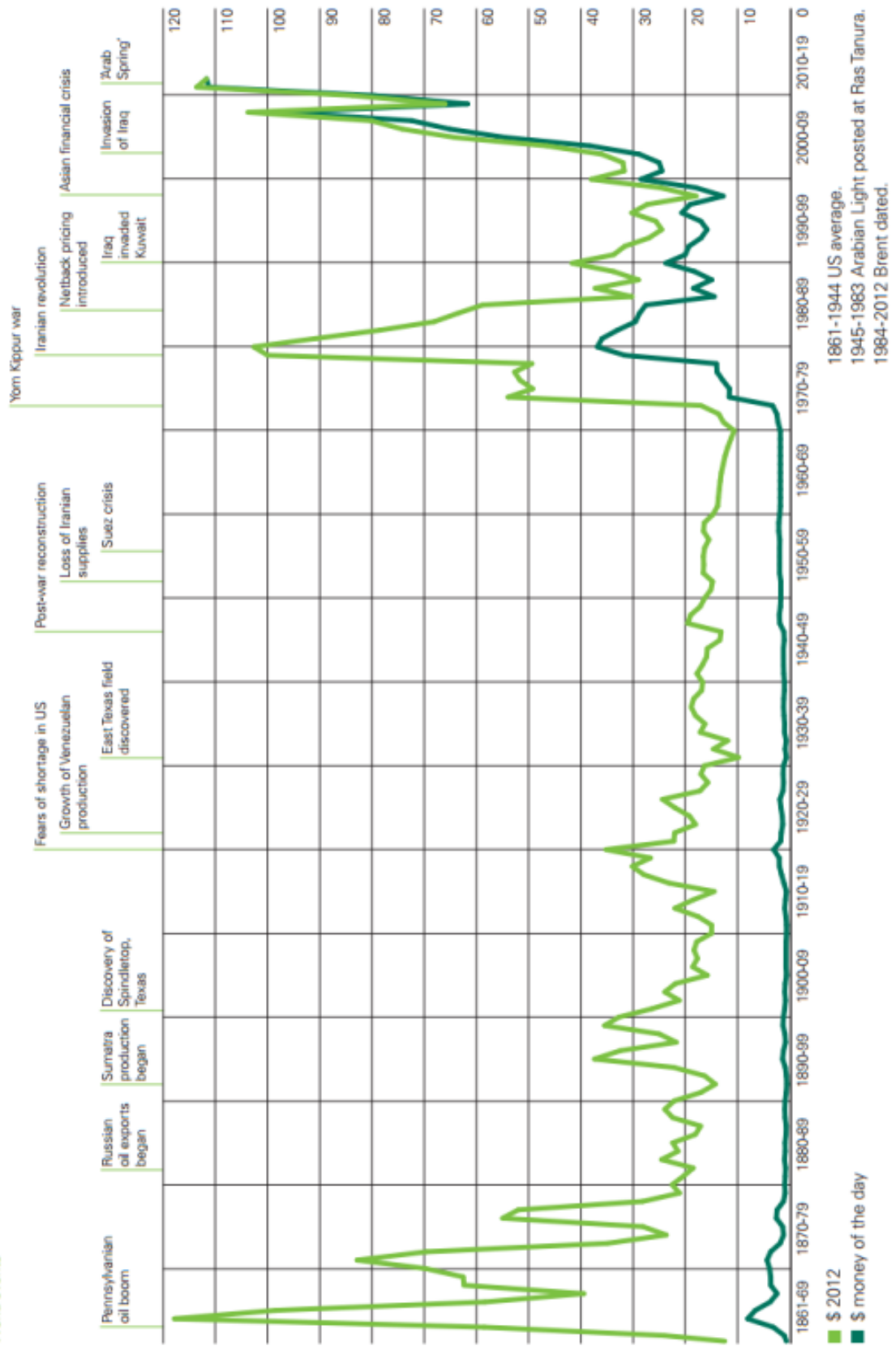


Figure A1: Oil prices. Source: bp.com/statisticalreview (2013)