Relating Business Modelling and Enterprise Architecture

Lucas Onno Meertens

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English Summary

This thesis proposes a methodology for creating business models, evaluating them, and relating them to enterprise architecture. The methodology consists of several steps, leading from an organization's current situation to a target situation, via business models and enterprise architecture.

The problems with Business-IT Alignment

Currently, increasing amounts of businesses rely on IT systems to do their business. However, success rates of IT implementations projects are low. Difficulties exist in aligning existing IT systems with business objectives. A consensus exists among researchers and practitioners alike that business-IT alignment (BITA) is necessary to improve business performance. Typical symptoms of lack of BITA include:

- People cannot use the systems effectively.
- Changes in systems often do not consider the financial impacts.
- Systems cannot be changed easily and quickly to adapt to new situations.

Difficulties also exist with technological innovations. Most difficulties are not caused by technical issues. Lack of consideration for financial and organisational aspects is a cause for projects not surviving after the pilot phase. A lack of attention is paid to financial aspects of innovations. Projects are often more expensive than planned due to changing requirements. Projects are often more expensive than planned because demands are not well known.

Therefore, we have a problem to build and adapt IT systems to changing business needs. This thesis attempts to combine two partial solutions to this problem, Enterprise Architecture (EA) and Business Modelling (BM).

A partial solution: Enterprise Architecture

Enterprise Architecture comprises a collection of simplified representations of the organisation, from different viewpoints and according to the needs of different stakeholders. A coherent description of enterprise architecture provides insight, enables communication among stakeholders, and guides complicated change processes. ArchiMate provides a language to create such descriptions in a precise and formal way. While Enterprise Architecture helps to manage change, it includes insufficient business strategy, and use of ArchiMate is limited to expert users.

Another partial solution: Business Modelling

In the basis, business models are used to describe businesses and explore possibilities for future development. Business modelling is intuitive to use by managers, consultants,

and entrepreneurs alike. The business model concept is a young and emerging field of research. The state in which this field finds itself is one of “prescientific chaos”: several competing schools of thought exist, and progress is limited because of a lack of cumulative progress. Links to other research domains are vital to establish the business model as a distinct area of investigation. This lack of cohesion in the field clearly diminishes the added value of business models for organizations and makes business modelling an art, rather than a science.

A combined solution: Relating Enterprise Architecture and Business Modelling

Individually, business modelling or enterprise architecture does not seem to solve the problem completely. However, each of their weaknesses seems to be countered by the strengths of the other. On one side, where EA is limited to experts and lack business strategy, BM is intuitive to use and focusses on the business. On the other side, where BM lacks a methodology, is barely formalized, and lacks scientific underpinning, EA has an Architecture Development Method, and is standardized in ArchiMate. Therefore, combining EA and BM appears to be an advance towards solving our problem.

While solving the problem of building and adapting IT systems to business needs, thereby increasing success rates of IT implementation projects is the final goal, this thesis is limited to relating enterprise architecture and business modelling. This thesis proposes a methodology for creating business models, evaluating them, and relating them to enterprise architecture. We do this by developing several steps of the methodology, which supports bringing an organization from its current situation to a target situation. The developed process steps help to formalize business modelling, and at the same time extend enterprise architecture to be more business focussed and easier to use. This would support our hypothesis the combining enterprise architecture and business modelling leads to better EA and BM models, and therefore, more successful business-IT innovations.

A meta-meta-view on business modelling

One of the main gaps in business model research was the lack of a conceptual model. We introduce a meta-modelling perspective on business models. By placing existing business model review literature in the context of meta-layers and structuring it following the components of design theory, we create the meta-meta-business model (Me2BM). This helps to see what we are talking about in the jungle of business models and their different interpretations.

How to create business models?

No widely accepted method existed for design and specification of business models. We propose the Business Modelling Method to create business models. This six-step method, named BMM, is developed, demonstrated, and evaluated in this thesis. The

BMM provides a way to create business models systematically. Innovators can apply the steps to create business cases for their ideas. This helps them to show the viability and get things implemented.

How to evaluate business models?

Having built one or more business models, a need arises for a method to objectively compare alternative business models, and choose the best course of action. We propose the business case method as a way to evaluate business models. The designed business case method to compare business models objectively can be used to compare and choose the best business model successfully. This is what has to happen in the last step of the BMM.

How to relate business models to enterprise architecture?

We show how business models and enterprise architecture can be related. The contribution is threefold: 1. We relate Business Model Canvas building blocks to ArchiMate, 2. We demonstrate the value of that relationship in a cost/benefit-analysis, 3. We provide methodological support, clarifying the role of business models in the Architecture Development Method.

The U*Care project serves as a case study to demonstrate the above three methods chained together. Business models are created, evaluated, and related to enterprise architecture. Combining enterprise architecture and business modelling leads to better EA and BM models, and therefore, more successful business-IT innovations.

In conclusion

Our main research contribution to the fields of enterprise architecture and business modelling lies in providing a way to deal with issues from business-IT alignment, by developing a design science methodology for creating business models, evaluating them, and relating them to enterprise architecture.

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1

Motivation, background, and research design

This thesis proposes a design science methodology for creating business models, evaluating them, and relating them to enterprise architecture. The methodology consists of several steps, leading from an organization's current situation to a target situation, via business models and enterprise architecture. This chapter presents the motivation of the thesis, as well as the main research objectives, research questions, and approach adopted.

This chapter is organized as follows: section 1.1 provides motivation and background to the research; section 1.2 outlines the main problems motivating this thesis; section 1.3 presents the research design, including objectives, questions, and the approach of this research; section 1.4 defines the scope of this work; finally, section 1.5 provides the structure for the remainder of this thesis.

1.1 Motivation and background: What is the problem?

Success rates of IT implementations projects are low. Several studies have reported failure rates between 40% and 84% (Kaplan and Harris-Salamone, 2009). The CHAOS reports of the Standish Group are the most well-known ones of these, especially as the report from 1994 reported the highest failure rates (Johnson, 1994). Only 16.2% of projects completed on time, on budget, and met user requirements, with 31.1% of projects that failed outright. Reports that are more recent show better results, with a fall back in the last report (Eveleens and Verhoef, 2010). While the CHAOS reports are disputed (for example by Eveleens and Verhoef (2010)), they still indicate that the (lack of) success of IT projects is an issue. Low success rates means that money is being wasted.

1.1.1 Difficulties exist in aligning existing IT systems with business objectives.

A general consensus exists among researchers and practitioners alike that business-IT alignment (BITA) is necessary to improve business performance (Wagner and Weitzel, 2006). Aligning business and IT has been at the top of the priority list for IT managers for several years (Luftman and Kempaiah, 2008; Luftman, 2005; Luftman et al., 2009, 2006; Saat et al., 2010). The inability to realize value from IT partly results from a lack of alignment between the business and the IT strategies of a firm (Henderson and Venkatraman, 1993; Wagner and Weitzel, 2006).

People cannot use the systems effectively. Systems do not improve organizational performance or create business value; users and their managers do. If the desired improvement conflicts with what people are motivated to do, a system alone will not solve the problem. In building systems, organizations may optimize one part of a process and end up creating less than optimal performance for the process as a whole (Markus and Keil, 1994). Emergence of acceptance models, such as TAM (Davis et al., 1989) and UTUAT (Venkatesh et al., 2003), shows that systems are often not used, and therefore are not effective.

Changes in systems often do not consider the financial impacts. Especially in complex environments (e.g., healthcare), such projects fail to take into account the business aspects that are required for a technological innovation to become a success in real-life settings. Usually, questions such as "who benefits from the product?", and "who will pay for it?" (Drucker, 1954) are not included in the design of new IT products. Yet, they may have a huge impact on the requirements for the end system. Especially when the answers to the above questions may concern multiple stakeholders, the chance that the product is adopted and implemented is severely limited.

Systems cannot be changed easily and quickly to adapt to new situations. "*The demands of new business initiatives are immediate but building a tailored strategy-enabling IT infrastructure often takes considerable time and expertise. Identifying these needs is not easy. While the components of infrastructure are commodities and are commonly available, the management processes used to implement the best mix of infrastructure capabilities to meet specific business strategy needs are a scarce resource.*" "*Architectures have to cope with both business uncertainty and technological change, making it one of the most difficult tasks for an enterprise.*" "*Each architectural decision that enforces specific technical choices needs to incorporate the business logic underlying the selection so that these standards can evolve as business conditions change*" (Weill et al., 2002).

1.1.2 Difficulties also exist with technological innovations.

According to Avison and Young (2007), "*The health care sector has explored how information and communication technology might improve patient service for the past 50 years (Kaplan, 1987), but there is evidence that many, even most, health care information systems are failures (Heeks et al., 1999).*" Japan implemented many telemedicine projects, as Hasegawa and Murase (2007) researched. Generally, research funds of local and national governments supported them. "*Their initial and running costs are covered by the funds during the term of the project, which is usually less than 3 years. However, after the term of economic support, many projects tend to be discontinued because of the extremely* *low income from national insurance.*" This is an example, where the innovations do not survive after the pilot phase.

Most difficulties are not caused by technical issues. A majority of health information technology projects fail in some sense, according to Kaplan and Harris-Salamone (2009). They recognize that, while technical issues still exist, "*problems are due to sociological, cultural, and financial issues, and hence are more managerial than technical*". For systems to be successful, design methods must include organizational, behavioural, cognitive, and social factors (Kaplan and Harris-Salamone, 2009).

Lack of consideration for financial and organisational aspects is a cause for projects not surviving after the pilot phase, as Broens et al. (2007) indicate. Consideration of financial aspects often does not occur or occurs too late, as many of the projects are subsidised. Only when the subsidy expires, financial aspects come into view (quickly). The project has to attract new sources of income at this point. Either in the form of a new subsidy, or from other (commercial) sources. Especially in this last case, the project has to show how it will make money to pay back the investments. Creating and evaluating a business model for the innovation may be a suitable way to do this.

A lack of attention is paid to financial aspects of innovations. A systematic review of cost effectiveness of telemedicine by Whitten et al. (2002) concludes that "*there is no good evidence that telemedicine is a cost effective means of delivering health care*" (neither did they present evidence that it is not cost effective). While we do not go into any further detail whether or not telemedicine is cost effective, their review also shows that only a low ratio (55 out of 612) of studies present cost benefit data. Even from this small amount, only a few studies did this according to the standards otherwise applied in medicine.

Projects are often more expensive than planned due to changing requirements. While trying to align IT with the business, many CIOs experience a quite fuzzy target (Silvius, 2007). With what 'business' should IT align? According to the 'Strategic Alignment Model' (Henderson and Venkatraman, 1993), a first answer should be "with the business strategy". However, business strategy is unfortunately not often a clear target in practice. An organization must be able to be responsive to developments in its environment. The company strategy is therefore not a destiny that is ever reached. In reality, strategy provides a direction, not a destiny (Silvius, 2007).

Projects are often more expensive than planned because demands are not well known. A typical situation where aligning business to IT is difficult, is understanding workflows. Kaplan and Harris-Salamone (2009) state that the many workflow changes and workarounds provide evidence for this. They claim it occurs due to several reasons. On the one hand, the inability of the people who have to work with the system to articulate their needs and what they do. On the other hand, the lack of understanding of the workflow by IT. Besides that, sufficient incentives to change are missing sometimes. This gap in aligning business to IT has to be crossed for IT to be successful.

1.1.3 Hence, we have a problem to build and adapt IT systems to business needs.

The above two sections show that on the one hand, it is difficult to adapt existing systems to changing environments. On the other hand, it is difficult to design systems for a new environment. Montilva and Barrios (2004) recognize the idea that information system design should consider the enterprise context of these systems, and that it should be enhanced with business modelling elements. The next sections introduce two areas of research, which offer partial solutions to this problem, Enterprise Architecture, and Business Modelling.

1.2 We have Enterprise Architecture

1.2.1 What is Enterprise Architecture?

Engelsman et al. (2011) describe Enterprise Architecture (EA) as "*a design or a description that makes clear the relationships between products, processes, organisation, information services and technological infrastructure; it is based on a vision and on certain assumptions, principles and preferences; consists of models and underlying principles; provides frameworks and guidelines for the design and realisation of products, processes, organisation, information services, and technological infrastructure.*" It comprises a collection of simplified representations of the organisation, from different viewpoints and according to the needs of different stakeholders (Lankhorst, 2005). A coherent description of EA provides insight, enables communication among stakeholders and guides complicated change processes (Jonkers et al., 2004).

ArchiMate (Iacob et al., 2009), an open standard of The Open Group, provides a language to create such descriptions in a precise and formal way. ArchiMate defines concepts for describing architectures at the business, application, and technology layers, as well as the relationships between these layers.

1.2.2 What can you do with EA?

Enterprise Architecture helps to manage change. "*An important aspect of EA models is that they should be used to represent both the current and target architectures (Kaisler et al., 2005) (Gustas, 2005). Enterprise architecture supports the development of a 'roadmap' that shows how to progress towards the target architecture: an architecture that is aligned to the business strategy and goals. Thus, the definition given above explicitly refers to the role of EAs in managing change. In an environment that is not exposed to change, there is no need for an EA. Conversely, as the impact of change becomes greater, then so does the need for an EA to manage that change.*" (Khoury, 2007)

1.2.3 What you cannot do with EA!

Use of ArchiMate is limited to expert users. "*As the ArchiMate concept present a comparatively large taxonomy, it is clear that a significant effort must be undertaken* *before gaining the skills to develop and understand a range of ArchiMate models. This precludes the use of ArchiMate by non-architectural experts. In addition, as the concepts are numerous, they represent the enterprise at a relatively granular level of detail. While this has advantages for low-level systems planning and development it can act as an obstacle to high-level planning where there is a need to work at a high level of abstraction before moving on to lower level, detailed modelling.*" (Khoury, 2007)

Enterprise Architecture includes insufficient business strategy. In the enterprise architecture field, several techniques and methods exist to assess the gap between an enterprise architecture's current situation and some desired situation in design terms - see for example TOGAF (The Open Group, 2009). Although research has been done concerning the development of EA model-based cost analysis techniques (for example, by Iacob and Jonkers (2007)), these enterprise approaches do not aim to assess what such a gap means in terms of costs and revenues at a business strategy level.

1.3 To understand the business better, we could use business modelling

1.3.1 What is business modelling?

A simple analysis of the two words "business model" already gives an idea of what a business model is about. On the one hand, there is "business": the way a company does business or creates value. On the other hand, there is "model": a representation of something – in this case, of how a company does business. (Osterwalder, 2004)

We extend this common and simplistic interpretation of a business model as "the way a company earns money", into a broader and more general definition of the concept: a simplified representation that accounts for the known and inferred properties of the business or industry as a whole, which may be used to study its characteristics further, for example, to support calculations, predictions, and business transformation (Editors of the American Heritage Dictionaries, 2000). We adopt this definition, as it stresses several important issues for this thesis. Firstly, we work with models in the sense of a simplified representation (several other interpretations of model are possible). Secondly, the models that we use are about business; either a single business, or a network of businesses. Finally, we use the models to study the business in several ways.

1.3.2 What can you do with business modelling?

In the basis, **business models are used to describe businesses and explore possibilities for future development** (Baden-Fuller and Morgan, 2010). However, as the definition above indicates, many characteristics of a business may be modelled to make "the way a company earns money" explicit. For example, the Business Model Canvas (Osterwalder and Pigneur, 2010) includes customers, value proposition, and key resources amongst others. The last part of the definition above, namely the indication of the possible uses of a business model is of particular importance in the context of this thesis.

Business modelling is intuitive to use by managers, consultants, and entrepreneurs alike. The use of business models has been greatly promoted thanks to popular books (Clark et al., 2012; Osterwalder and Pigneur, 2010) and communities focussed around the Business Model Canvas, built on a good business model of its own. Usually, the canvas is printed out on a large surface so groups of people can jointly start sketching and discussing business model elements with Post-it® notes or board markers. It is a hands-on tool that fosters understanding, discussion, creativity, and analysis. (Business Model Innovation Hub, 2013)

1.3.3 What you cannot do with business modelling!

The business model concept is a young and emerging field of research, strongly growing since 2000 (Osterwalder et al., 2005; Zott et al., 2011). The discipline is formed on the connection of three main areas: strategic management, industrial organization and information systems (Pateli and Giaglis, 2004). However, there are still some important issues in the business model research domain. A common language amongst participants is still missing. Links to other research domains are limited (Pateli and Giaglis, 2004). Researchers rarely use each others' work to build on. Consensus on the theoretical underpinnings has not yet been achieved. So far, the business model remains a theoretically underdeveloped concept. More clarity on the theoretical foundation and conceptual consolidation is necessary (Zott et al., 2011).

The state in which this field finds itself is one of "prescientific chaos" (Kuhn, 1970): several competing schools of thought exist, and progress is limited because of a lack of cumulative progress. Because of this, no clear and unique semantics are agreed upon in the research related to business models. The very concept of "business model" is associated with many different definitions (Vermolen, 2010). The components of such a business model differ significantly from one approach to another. Furthermore, to the best of our knowledge, no widely accepted methodological approaches exist in the literature for the design and specification of business models (Vermolen, 2010). This is in contrast with well-established approaches, such as TOGAF (The Open Group, 2009), and Unified Process (Jacobson et al., 1999; Scott, 2002), which have emerged in the other, yet closely related, areas of enterprise architecture and information system design.

Links to other research domains are vital to establish the business model as a distinct area of investigation. By not building on existing work, research advances more slowly than it could and often stays superficial. Lack of consensus on the theoretical underpinnings of the business model concept undermines its applicability in different contexts. This theoretical underdevelopment is also problematic for its usefulness in empirical research and in theory building (Osterwalder et al., 2005).

This lack of cohesion in the field clearly diminishes the added value of business models for organizations and makes business modelling an art, rather than a science. In a nutshell, business modelling:

- Has weak scientific underpinning
- Has a low level of formalization
- Lacks a methodology

1.4 Solving the problem? Combining business modelling and enterprise architecture

In conclusion to the above sections, we have a problem to build and adapt IT systems to business needs. Individually, business modelling or enterprise architecture does not seem to solve the problem completely. However, each of their weaknesses seems to be countered by the strengths of the other. On one side, where EA is limited to experts and lack business strategy, BM is intuitive to use and focusses on the business. On the other side, where BM lacks a methodology, is barely formalized, and lacks scientific underpinning, EA has an Architecture Development Method, and is standardized in ArchiMate. Therefore, combining EA and BM appears to be an advance towards solving our problem.

Although new, the idea of relating enterprise architectures and business model seems to be quite powerful and justified, as it has emerged recently in both the architecture and BM communities simultaneously. Recently, Fritscher and Pigneur (2011) published their view on the relation between business models, enterprise architecture and IT services. While their work also underscores the importance of relating business modelling to enterprise architecture, their paper does not go into technical details regarding concept and relationship mappings. It is a rather global mapping and comparison of the three frameworks.

Several contributions in the area of business modelling are related and relevant in the context of this research. Montilva and Barrios (2004) recognize the idea that information system design should consider the enterprise context of these systems, and that it should be enhanced with business modelling elements. They propose three types of models, two of which we discuss as well, namely that of a business model (the "BMM product model"), and that of a process model that specifies the steps to be taken to produce the business model. However, a significant difference exists between these results and our research, caused by the very definition of the business model concept. Thus, Montilva and Barrios' business model concept is closer to that of an enterprise architecture model than to our understanding of the business model concept, both in terms of content and in level of detail. Montilva and Barrios' business model contains rather detailed specifications of elements such as goals, events, business rules and processes, business objects, and technologies, which are typically captured by enterprise modelling languages, such as ArchiMate (Iacob et al., 2009). Furthermore, the process model that Montilva and Barrios propose only focuses on the design of a business model with the sole purpose of serving as source of requirements for the future IS design.

Barrios and Nurcan (2004) follow the same line of thinking in another paper, which focuses on the relationship between business models and enterprise information systems in a changing environment. Nevertheless, neither of the papers mentioned above addresses the issue of quantifying business models and using them to evaluate the business value of the future system by means of one or more business cases or cost/benefit analysis.

1.5 Research Design: What to do?

While solving the problem of building and adapting IT systems to business needs, thereby increasing success rates of IT implementation projects is the final goal, this thesis is limited to relating enterprise architecture and business modelling. In the previous sections, we have motivated how each of these helps towards the final goal, and why they should be combined. In the remainder of this section, we elaborate on the design of our research.

The design of this research follows the method described by Verschuren and Doorewaard (2007). First, we focus on the objective, which concerns handling the problems described previously. Second, we ask the research questions that we need to answer, to get the information needed to reach the objective. Finally, we select the research strategy, which determines what methods we use and the material required.

1.5.1 Objective: Propose a methodology

> **Research Objective:** Provide a way to deal with issues from business-IT alignment, by developing a design science *methodology* for creating *business models*, evaluating them, and relating them to *enterprise architecture*.

This thesis proposes a methodology for creating business models, evaluating them, and relating them to enterprise architecture. This methodology provides a way to deal with IT projects to avoid many of the issues from business-IT alignment. We do this by developing several steps of the methodology, which supports bringing an organization from its current situation to a target situation. Some of the steps in this process focus explicitly on the relation between business aspects and IS aspects, improving the alignment between the two. The developed process steps handle important issues of the main problem. It should formalize business modelling, and at the same time extend enterprise architecture to be more business focussed and easier to use. This would support our hypothesis the

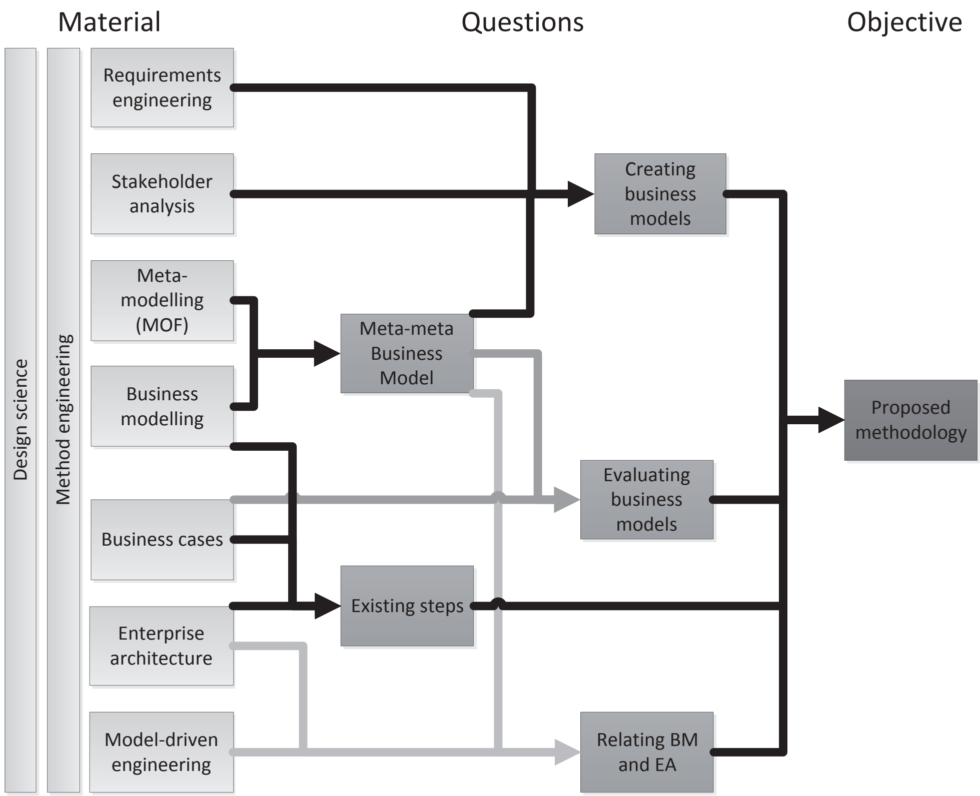

Figure 1: Research model. Proposing a methodology by combining three new and several existing steps.

combining enterprise architecture and business modelling leads to better EA and BM models, and therefore, more successful business-IT innovations.

1.5.2 Question: What do we need to know?

To develop a methodology for creating business models, evaluating them, and relating them to enterprise architecture, we need to gain knowledge on several areas. Reading the research model in Figure 1 from right to left, first shows us the research objective we want to reach. As the proposed methodology will be built from several steps (shown mid-right), we need to understand each of them. To start with, we need to elicit/create a business model as a starting point. Then, we need to create alternative business models and evaluate them. Finally, we need to relate the best alternative business models to enterprise architecture. In addition, several (parts of) steps may already exist. These four points lead to the top-level research questions:

1. How to create a business model?
2. How to evaluate business models?
3. How to relate business models and enterprise architecture?

As can be seen form the above, this research emphasizes questions of “how to”, which shows that we are primarily concerned with providing solutions to practical problems. However, to deal with each of these practical problems, knowledge questions have to be asked (Wieringa, 2009). Looking which existing steps are available is only the start for that. The block to the mid-left of Figure 1 shows the second knowledge question, which’ answer is needed to support the first three top-level questions:

4. Which steps for the above already exist?
5. What concepts are used in business modelling?

As each “how to” question could be answered with “Use method X”, the remaining questions all boil down to either discovering what has been done and is available (knowledge), and filling in the gaps (practical). For finding what has been done already, we look at literature on business modelling, business cases, requirements engineering, stakeholder analysis, model-driven engineering, and enterprise architecture. For filling in the gaps, we look at literature in design science and method engineering. Each of these fields of literature is in the left side of the research model in Figure 1.

1.5.3 Strategy: Which approach to take to answer the question?

The proposed methodology combines the three new steps described above with several existing steps. Research is done on eight areas of literature (left-hand side of Figure 1) to create the three process steps. Together with existing steps, they form an integrated methodology, which aims to bring an organization from its current situation to a target situation. Method engineering is the basis approach we use to create the steps, as well as the final methodology. As the methodology deals with the relatively new research area of business modelling, we attempt to advance this by forming a better foundation from which to work.

In the following subsections, first we explain design science as we see it. The description leads to the design science research methodology by Peffers et al. (2007) (Figure 3), which is the main method we use. Second, we touch upon method engineering. Third, we give our view on how enterprise architecture, business cases, business models, and the system under development relate. Fourth and final, we indicate which methods we use to answer each of the questions.

1.5.3.1 Design Science

As both business modelling and enterprise architecture have a place in information systems (IS) research, it is interesting to see how our research can be positioned in this field. March and Smith (1995) offer a design science framework, with four research outputs and four research activities (of which two are argued to be design science). Gregor (2002, 2006) presents a taxonomy with five types of theory in information systems research. Hevner et al. (2004) provide a conceptual framework and guidelines for understanding, executing, and evaluating IS research. Based on Walls et al. (1992), Gregor and Jones (2007) provide an anatomy of a design theory, including eight components. Peffers et al. (2007) take several of these seminal works and develop a research methodology for it. The subsequent sections describe these in more detail and relate them to each other.

1.5.3.1.1 Design and natural science framework. March and Smith (1995)

Science can be split in two broad categories: knowledge producing, and knowledge using. Knowledge-producing science looks at the world and tries to describe what is happening. This is also known as natural science. Knowledge-using science aims at improving the world and prescribes what should happen. This is also known as design science. Table 1 shows some characteristics of the two categories of science.

Table 1: Natural science versus design science

Natural science	Design science
Descriptive	Prescriptive
Knowledge-producing	Knowledge-using
Theorize and justify	Build and evaluate
Truth	Utility
Example: Physics	Example: Engineering

March and Smith (1995) argue that for IT research to be both effective and relevant, both design science (build and evaluate) and natural science (theorize and justify) activities are necessary. They put these activities next to each other in one dimension of their research framework. The other dimension consists of research outputs: constructs, models, methods, and instantiations. Table 2 shows the framework. At the top are the four research activities, and at the left are the four research outputs. Design science is the left half of the framework (build and evaluate).

Each of the outputs in design science can be built and evaluated. While no order is prescribed, a top-down approach is usual. Starting to build constructs first, and then build the other outputs until instantiations. Then, the instantiations are used to evaluate each of the outputs. This is logical, as constructs define the language used to specify the (conceptual) models or frameworks. Based on the model, methods can be developed to fill in the models. Applying the method to a case results in an instantiation. This instantiation is specified using the constructs, structured by the model, and created by the method. Therefore, the instantiation can serve to evaluate all the outputs.

Table 2: Framework for design science by March and Smith (1995)

	Build	Evaluate	Theorize	Justify
Constructs				
Model				
Method				
Instantiation				

1.5.3.1.2 Design science in information systems research. Hevner et al. (2004)

As opposed to behavioural science, design science in IS extends boundaries by creating new artefacts. Building and evaluating (applying) the artefacts results in knowledge and understanding of a problem (domain) and its solution. Stressing the problem-solving

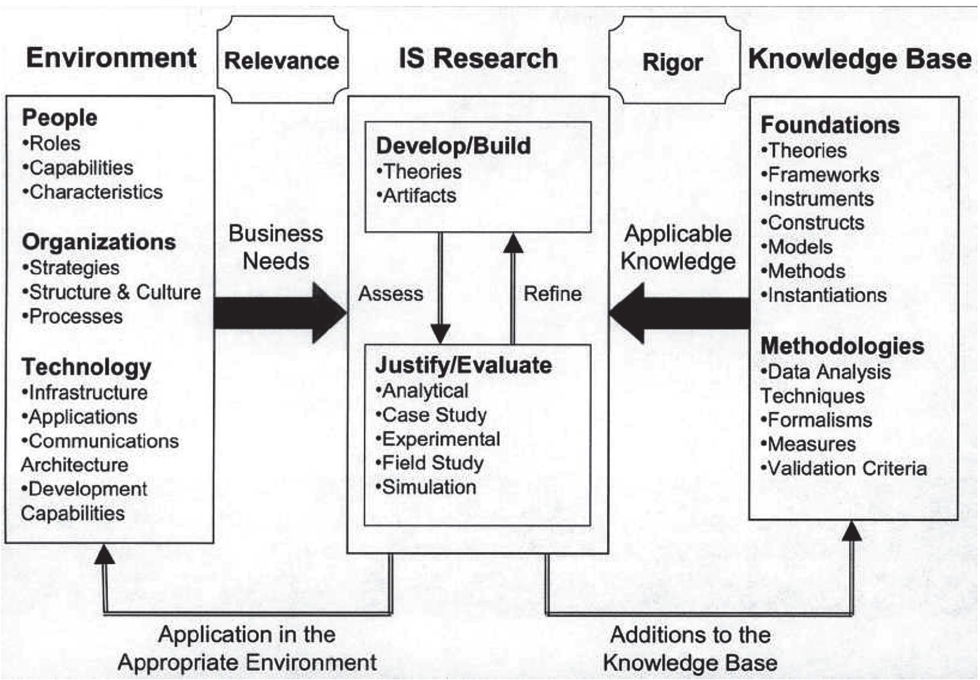

Figure 2: Information Systems Research Framework as proposed by Hevner et al. (2004)

style of design science, Hevner et al. (2004) provide a conceptual framework and guidelines for understanding, executing, and evaluating such IS research.
Figure 2 shows the framework. It indicates how IS research combines its broad knowledge (to the right), with needs from its environment (to the left) to solve problems. Solutions to these problems take the form of artefacts. Artefacts, in this sense, are the research outputs as March and Smith (1995) define them. An artefact can be a (set of) construct(s), a model, a method, or and instantiation. Another connection to the same work is the explicit research activities in IS research/design science: build and evaluate.

Next to the framework, Hevner et al. (2004) provide a set of seven guidelines. The guidelines help to recognize, define, and conduct design science. Table 3 presents the seven guidelines:

Table 3: Design Science Research guidelines by Hevner et al. (2004)

Guideline 1	Design as an artefact	Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.
Guideline 2	Problem relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3	Design evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4	Research contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.
Guideline 5	Research rigour	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.
Guideline 6	Design as a search process	The search for an effective artefact requires using available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7	Communication of research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

1.5.3.1.3 The nature of, and taxonomy for, theories in information systems. Gregor (2002, 2006)

To provide more structure in design theory in IS, Gregor (2002, 2006) comes up with five types of theory and relates them to each other. Table 4 shows and explains the five types. The types are similar to the research activities given by March and Smith (1995). In most cases, the relations are that a lower number theory type is necessary for a higher number theory type. For example, you should analyse a problem before you design a solution.

The work of Gregor relates to the previously described literature. The type V theory is usually seen as design science. The prescriptions, which the theory gives, resemble the research outputs of March and Smith (1995). Similarly, if you follow the guidelines of Hevner et al. (2004), you get a type V theory: you are doing design science.

Table 4: A taxonomy of theory types in IS research by Gregor (2006)

Theory type	Distinguishing attributes
I. Analysis	Says "what is". The theory does not extend beyond analysis and description. No causal relationships among phenomena are specified and no predictions are made.
II. Explanation	Says "what is", "how", "why", "when", "where". The theory provides explanations but does not aim to predict with any precision. There are no testable propositions.
III. Prediction	Says "what is" and "what will be". The theory provides predictions and has testable propositions but does not have well-developed justificatory causal explanations.
IV. Explanation and prediction (EP)	Says "what is", "how", "why", "when", "where" and "what will be". Provides predictions and has both testable propositions and causal explanations.
V. Design and action	Says "how to do something". The theory gives explicit prescriptions (e.g., methods, techniques, principles of form and function) for constructing an artefact.

1.5.3.1.4 The anatomy of a design theory. Gregor and Jones (2007)

Gregor and Jones (2007) argue that a design (science) theory (type V according to Gregor (2002)) generally has eight components (some of which are mandatory and other optional) that ensure the complete design of an IT artefact. They call this the anatomy of a design theory. The IT artefact can be either the process of designing (the design method), or the product (the information system design). Walls et al. (1992) further explain this distinction between process and product in information systems design theories.

A design theory can be tested against these components. A good design theory explicitly explains each of them. The first six are mandatory, the last two are optional. The components resemble the guidelines of Hevner et al. (2004). The components "constructs" and "(expository) instantiation" occurs in the research outputs of March and Smith (1995) too. Their "models" captures the "principles of form and function", while "principles of implementation" are their "method".

Table 5: Design theory components by Gregor and Jones (2007)

	Component
(1)	Purpose and scope
(2)	Constructs
(3)	Principles of form and function
(4)	Artefact mutability
(5)	Testable propositions
(6)	Justificatory knowledge
(7)	Principles of implementation
(8)	Expository instantiation

1.5.3.1.5 A design science research methodology. Peffers et al. (2007)

While the previous sections describe concepts, frameworks, and guidelines for design science, none of them provides a method to conduct it. Peffers et al. (2007) fill this gap with their methodology. The methodology has six phases, which may be iterated. Figure 3 shows a process model of this design science research methodology (DSRM).

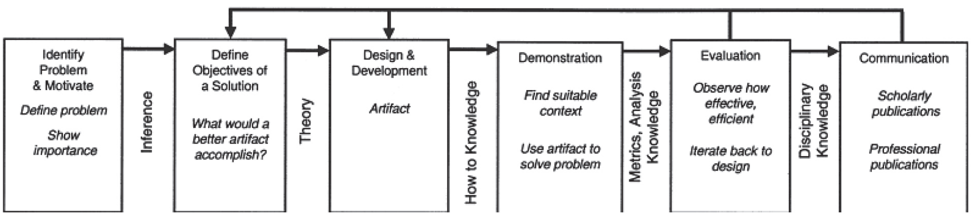

Figure 3: Process model for a design science research methodology (DSRM) by Peffers et al. (2007)

The DSRM has been well founded on existing literature. This shows in that it covers most of the literature in the previous sections. Clearly, this is a type V theory (design and develop) in the taxonomy of Gregor (2006), which includes type I theory in the first and fifth state (identify and evaluate are both forms of analysing). The build and evaluate research activities of March and smith (1995) both have their own phases, respectively design & development and demonstration, and evaluation. The outputs of these phases can be the research outputs defined in the same work. For example, demonstration is usually done by creating an instantiation of the design. The phases resemble both the guidelines of Hevner et al. (2004) and the components of the anatomy (Gregor and Jones, 2007). For example, both guideline 7 and the last phase of the methodology focus on communication, while component 1 (purpose and scope) matches the second phase (objectives of a solution).

1.5.3.2 Method engineering research

Next to design science, much of this research is creating methods for business modelling and enterprise architecture. We base the creation on methodology engineering as coined by Kumar and Welke (1992) and further developed by Brinkkemper (1996). More recently, Henderson-Sellers and Ralyté (2010) captured the state-of-the-art on (situational) methodology engineering.

Methodologies serve as a guarantor to achieve a specific outcome. The methodology engineering viewpoint has two aspects: representational and procedural (Kumar and Welke, 1992). The representational aspect explains what artefacts are looked at. The artefacts are the input and deliverables of phases in the method. The procedural aspect shows how these are created and used. This includes the activities in each phase, tools or techniques, and the sequence of phases.

1.5.3.3 Model: How does it all relate?

Both business case and enterprise architecture are instances of a business model. They have more details than the business model on their own specific areas. The relation between an enterprise architecture and a business case is a two-way dependency. Choices in either model influence the other model. Between the current situation and the target situation, the relation is the difference (delta) between the two. From enterprise architecture downwards, each model is a further specification of (part of) the above model. At the bottom level is the system. Figure 4 captures this view.

With these relations defined, it is interesting to define BITA in this model. Good BITA would be that when the business model changes, the enterprise architecture needs minimal change. The delta between the current business model and the target business model may be large, while the delta between the current en target enterprise architectures is small to zero. The assumption is that a delta in the BM improves the benefits, while a delta in the EA increases costs. So if the BM changes, while the EA is flexible enough to remain the same, the benefits increase and the costs remain the same. This results in a positive business case. From the IT perspective, the positive business case can be reached if a change in the enterprise architecture, or lower level model, reduces costs with no further impact on the higher levels. In complex cases in reality, the two types of changes occur together. This is one of the main pitfalls in implementing IT. It is not just automation of the existing business, but often requires (or at least enables) changing the business (processes) too.

1.5.3.4 Choosing methods: How to answer each question?

Looking from the top, the design science research methodology (DSRM) by Peffers et al. (2007) covers the objective of developing a design science methodology for creating business models, evaluating them, and relating them to enterprise architecture. The first

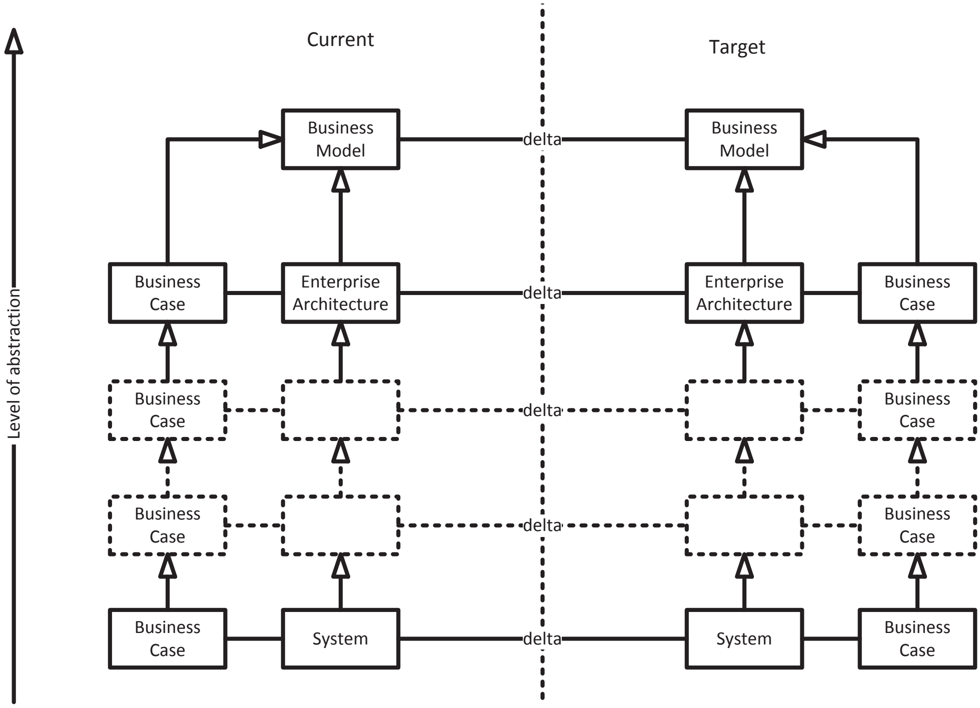

Figure 4: A high-level view of how business models, business cases, and enterprise architecture relate to each other

phases of this process have been described already. At the start of this chapter, we have identified the problem, and motivated that it should be dealt with. Following that, we defined the objective. Answering the top-level questions leads to a new artefact, which we have to demonstrate and evaluate. Each of the first three top-level questions can be answered by following that same process (DSRM) for its own area. Their answers all take the form "Use method X". The answers (methods) of these questions can be glued together, using method engineering, to create the artefact in stage three of the highest level DSRM.

To answer the knowledge questions arising from each of the practical problems, we search the literature. For both the fields of business modelling and business cases, we conduct a thorough and structured literature review. For that, we use the method of Webster and Watson (2002) as a guide, together with the five-stage grounded theory method for rigorously reviewing literature by Wolfswinkel et al. (2013). For the field of enterprise architecture, we mainly look into ArchiMate. For the fields of requirements engineering, stakeholder analysis, and model-driven engineering, we reuse the knowledge acquired during course work on the subjects. The fields of method engineering and design science have been treated in previous sections already.

For question 4 (What concepts are used in business modelling?), we take the information gained from the literature review on business modelling, and combine it with our knowledge of design science and meta-modelling. Together, this leads to a conceptual model of business modelling, which indicates what components are used in business modelling.

For the demonstration and evaluation stages of the DSRM, we use case studies. For the highest level DSRM, we use the full U*Care project case (U*Care Project, 2013). For demonstrating the answer to the first question, we focus on only one department and innovation of this case to demonstrate the method to create business models. For the second question, we use a case study of the company DEA Logic, which provides products and services for Dutch housing associations. This demonstrates one way to evaluate business models, the business case method. For the third question (how to relate business models and enterprise architecture), we apply the newly-developed method to the ArchiSurance case, which is an example case often used in the enterprise architecture community (Lankhorst and The ArchiMate team, 2004).

The final stage of the DSRM is communicating the findings. Most parts of the chapters have been published individually in academic outlets previously. This thesis collects them and attempts to polish them, so a red line can be followed, which the next section outlines.

1.6 Structure of the thesis

The structure of this thesis follows both the design science research methodology by Peffers et al. (2007) (Figure 3) and the research model in Figure 1. Starting with this chapter itself, we provided a problem identification and motivation. Next to that, the objective of this research was defined, which is to develop a methodology for creating business models, evaluating them, and relating them to enterprise architecture. The above sections show what we have to do to achieve the objective. The remaining chapters aim to do these things.

Chapter 2 focusses on what has (not) been done before in the areas of business modelling and business cases. It does this by conducting a systematic review of the literature in both of the areas. Besides showing what has been done, it also reveals some gaps that need to be filled, before we can reach our objective.

Chapter 3 fills one of the main gaps in business model research. It creates a conceptual model of business modelling by introducing a meta-modelling perspective on business models. By placing existing business model review literature in the context of meta-layers and structuring it following the components of design theory, we create the meta-meta-business model (Me2BM). This helps to see what we are talking about in the jungle of business models and their different interpretations.

Chapter 4 answers the question “how to create business models” with “Use the Business Modelling Method”. This six-step method, named BMM, is developed, demonstrated, and evaluated in this chapter. The BMM provides a way to create business models systematically. Innovators can apply the steps to create business cases for their ideas. This helps them to show the viability and get things implemented.

Chapter 5 provides one way of evaluating business models, the business case method. The designed business case method to objectively compare business models can be used to compare and choose the best business model successfully. This connects it to the BMM, as it is what happens in the last step of the BMM.

Chapter 6 shows how business models and enterprise architecture can be related. The contribution is threefold: 1. We relate Business Model Canvas building blocks to ArchiMate, 2. We demonstrate the value of that relationship in a cost/benefit-analysis, 3. We provide methodological support, clarifying the role of business models in the Architecture Development Method.

Chapter 7 demonstrates and evaluates the methods from the previous three chapters. The U*Care project serves as a case study to demonstrate the three methods chained together. Business models are created, evaluated, and related to enterprise architecture. Combining enterprise architecture and business modelling leads to better EA and BM models, and therefore, more successful business-IT innovations.

Finally, chapter 8 concludes the thesis with a summary and discussion. It revisits the objective and research questions to list all the answers assess whether the objective is reached. The final chapter lists the contributions of the thesis, both to practice and to research. We look back at the research to see what we did not do: the limitations and opportunities for future research. At the very end of this thesis, we come with some final thoughts on what (else) we have learned.

2

Background: What has (not) been done?

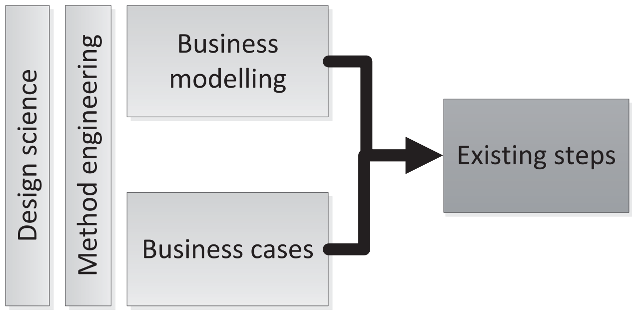

Figure 5: Answering research question 4: Existing steps

This chapter provides a background on business modelling and business cases, based on systematic review of previous literature.

2.1 Business modelling: A literature review

In this chapter, the business model concept is investigated. First the search approach, structure, and criteria are discussed, followed by a short literature overview. In the second part, the early revolution of business models is discussed, followed by the use of business models in the third section. Next, business model components are identified, and finally evaluation methods for business models are discussed in the fourth section.

2.1.1 Business models literature review method: justification of the approach, structure, sources and criteria, and a short literature overview

The scientific knowledge about business models is retrieved from scientific papers and books. A quick search on Scopus on the keywords: "*business models*" *OR "e-business models"*, returns over 8000 relative recent results, with only 200 papers published before the year 2000. To conduct a thorough and structured literature review, we use the method of Webster and Watson (2002)as a guide, together with the five-stage grounded theory method for rigorously reviewing literature by Wolfswinkel et al. (2013).

To start, we formulate question, which need to be answered by the found literature. Then we perform a forward search (Webster and Watson, 2002). Starting with discussing the search engine, further also the search and selection criteria are clarified. Next, the selection process of the results from the forward search is visualized, and a short literature overview is presented. Finally, a backward search is performed on the selected articles.

2.1.1.1 Questions on business modelling

Based on the problem definition, the research goals and the research question, we formulate the following questions. Answering these questions with insights from the academic literature, the information and background on business models needed as input is retrieved.

1. How have business models evolved over time, and what is it now?
2. What is the use of business models?
3. Which components can be distinguished?
4. How are business models evaluated?

2.1.1.2 Source, selection criteria, and keywords

For the search process, we use SciVerse Scopus. This search engine provides many search specification options and searches quickly through the world's largest database of title, abstract, and author information of leading scientific journals. Google Scholar is used to search for full text versions of the selected articles.

To narrow down the number of search results, we use the following criteria:

1. Papers published before 2008 should have 15 or more citations
2. Papers published between 2008 and 2010 should have 8 or more citations
3. Papers published between 2010 and 2012 should have 1 or more citations
4. Papers must be published between 1998 and 2012
5. Papers must have at least 20 references
6. Search is limited to subject areas 'business management and accounting' and 'computer science'.

The number of citations of a paper gives a good indication for the quality, utility, and the impact value on the research area (Seglen, 1997). The number of citations also serves as an indicator to assess the quality of a journal in journal ranking studies. We have two arguments for the second search restriction. The first argument is that publications older than (in this case) 14 years have an increased probability of being outdated. The significant papers that are excluded by this restriction have a high probability of being cited in newer included articles. The second argument is based on research of Osterwalder et al. (2005). The number of hits on the term "*Business Model"* in scholarly reviewed journals is counted for the separate years from 1990 until 2003. The results show an exponential growth of hits starting in 1998 (Figure 8) (Osterwalder et al., 2005). The third point states that papers should have at least 20 references. This ensures that the research is well founded and based on previous research of others. The final criterion limits the number of results to articles published in journals of two specific fields, in which the biggest part of fundamental research towards business models is done. A search without this restriction results in five times more hits. Most of those results are about making a specific business model for a medicine or other investment or entrepreneurial ideas.

The query uses the keyword '**usiness mode**'. The asterisk sign (*'*'*) helps to include all results for which the rest of the word could be anything. So the search term "*mode*",* includes both '*model* ' and '*models*'. Figure 6 shows the search query as entered in Scopus.com on March 20, 2012. The search resulted in 4926 results. After application of the citation restriction, 406 results remained.

```
TITLE-ABS-KEY(
      ("*usiness mode*")
AND PUBYEAR > 1997
AND ( LIMIT-TO(SUBJAREA,"COMP" ) OR
            LIMIT-TO(SUBJAREA,"BUSI" ) OR
            LIMIT-TO(SUBJAREA,"MULT" ) )
```

Figure 6: Search query

Figure 7 shows the selection process of the relevant articles. After three iterations, the most useful articles are retrieved in full text. In the first phase, we select articles based on potential relevance of the title. In the second phase, we select articles based on the abstract. Finally, we filter out the articles to which no access is granted to retrieve the full text. The total search process yields 28 papers.

2.1.1.3 Short literature overview

This section shows the content that the retrieved articles cover, and discusses whether the performed literature search is sufficient to answer the questions.

Table 6 provides an overview that gives insight in which articles give (partial) answers to the questions. We do not present all retrieved articles because some articles do not directly address or answer any of the research questions, but can be of use for indirect relevant knowledge.

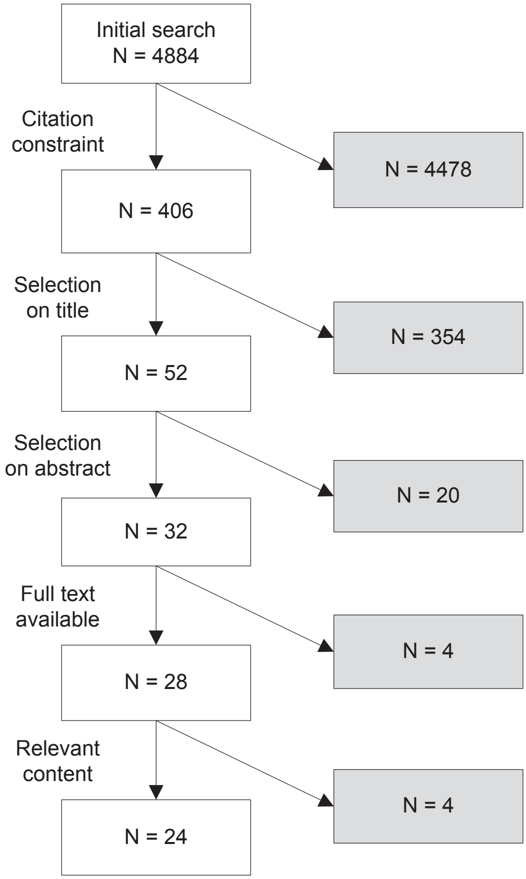

Figure 7: Literature selection process

To check whether most of the relevant literature about a subject is found, Levy and Ellis (2006) give a common rule of thumb: "the search is near completion when one discovers that new articles only introduce familiar arguments, methodologies, findings, authors, and studies". Webster and Watson (2002) give a comparable argument: "You can gauge that your review is nearing completion when you are not finding new concepts in your article set". The outcome of performed literature review towards business models, with the goal to answer the questions, satisfies the two guidelines and, therefore, is enough to provide answers with sufficient background and knowledge based on the studied literature. Especially, when taking into account that the important 'backwards search' is not included in this section but is done without further notification in the more in-depth theoretical framework.

2.1.2 Early evolution of business models

The term 'business model' (BM) is often used, especially in the entrepreneurial and management field, but also in other areas. A quick search on the search engine Scopus.

Table 6: Business model literature overview

		BM evolution	Goal of BM and usage	BM components and/or building blocks	BM evaluation
1	(Baden-Fuller and Morgan, 2010)	p. 158			
2	(Casadesus-Masanell and Ricart, 2010)	p. 201	p. 1b		
3	(Chesbrough, 2010)		p. 355a		
4	(Demil and Lecocq, 2010)			p. 231	
5	(Doz and Kosonen, 2010)	p. 1&2			p. 1-9
6	(Gambardella and McGahan, 2010)	p.2			
7	(Chesbrough, 2007)	p. 1&2			p.4
8	(George and Bock, 2011)	p.5	p. 7		
9	(Vidal Tost, 2010)			p. 58 & 62	p.58
10	(Magretta, 2002)		p. 3		
11	(Shafer et al., 2005)	p. 2-5	p. 3	p. 6	
12	(Morris et al., 2005)	p. 1-4		p.2	
13	(Pateli and Giaglis, 2004)	p. 6	p. 8		p. 11
14	(Hedman and Kalling, 2003)		p. 2-6	p.8	
15	(Sosna et al., 2010)		p. 1		p. 3
16	(Teece, 2010)		p. 1-2	p. 3	p. 10
17	(Markides, 2006)				p. 1
18	(Gordijn et al., 2001)		p. 1-2	p. 2	
19	(Morris et al., 2005)	p.1-3	p.1-2	p.5	
20	(Pateli and Giaglis, 2004)	p.1-4	p. 1-4	p. 5	p. 9
21	(Amit and Zott, 2001)			p. 2	
22	(Bremser and Chung, 2005)				p.1
23	(Zott and Amit, 2010)			p.7	p.8
24	(Zott et al., 2011)	p. 1-5	p. 2	p. 11	

com tells us that over 8000 articles are published until 2012. Just over 2000 articles are published in the business area. In Figure 8, a graph shows the number of articles found in all research fields, and in the business area. The numbers strongly increase after 1996. This clarifies that business models and research towards this term is relatively new. Looking closer at the search results, it becomes clear that the combination of these two words is used for multiple purposes with significant different meanings. One of the first published articles in the search results uses the term to discuss how a business can be modelled for simulation purposes (Duersch, 1975). Some of the selected articles mention the same - in their eyes problematic - phenomena of using the same term for different purposes (George and Bock, 2011; Morris et al., 2005; Shafer et al., 2005) and the other way around (different terms for the same purpose) (Morris et al., 2005). This is mostly due to the fact that the term comes from different perspectives like e-business, strategy, technology, and information systems (Zott and Amit, 2010). From every viewpoint, peering through different lenses, each author was seeing different things and came up with a new definition. Around 1997, the ideas about business models were split into roughly two groups already. The biggest group was from the Business/IT perspective which focused on how value is created and transferred between IT activities and business (Morris et al., 2005). The other from the strategic perspective, which focused on "*the totality of how a company selects its customers, defines and differentiates its offerings, defines the tasks it will perform itself and those it will outsource, configures its resources, goes to market, creates utility for customers and captures profits.*" (Slywotzky, 1996). The *internet* boom caused business models to be invoked almost routinely, which caused a stream criticism on the concept due to its immaturity and the diversity of the business models. "A company didn't need a strategy, or a special competence, or even any customers – all it needed was a Web-based business model that promised wild profits in some distant, ill-defined future. Many people –investors, entrepreneurs, and executives alike- bought the fantasy and got burned. The concept of the business model fell out of fashion nearly as quickly as the .com appendage itself " (Magretta, 2002). A better understanding of the concept was necessary.

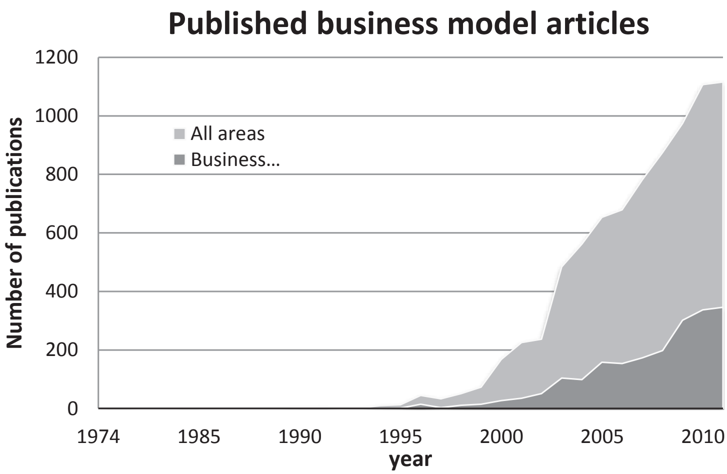

Figure 8: Published business model articles from 1974 until 2012 retrieved from Scopus.com

Research towards a better understanding of the concept grew, and in 2005 Shafer et al. (2005) published an article with the goal to clarify much of the confusion about what business models are and how they can be used properly. In their literature search, they found 12 definitions and 42 different business model components. Some of the components appeared in only one definition, others were used by more. The components that were cited twice or more were categorized using an affinity diagram, which helps to identify patterns and establish related groups in qualitative datasets. This process resulted in four main categories: strategic choices, create value, value network, and capture value. Each category consisted of multiple entities like costs, financial aspects, and profit for the value-capturing category. Based on this, they presented a new definition which defined a business model as "*a representation of a firm's underlying core logic and strategic choices for creating and capturing value within a value network*". The definition suggests that business models helps articulate and make explicit key assumptions about cause-and-effect relationships and the internal consistency of strategic choices. Because for-profit companies must make money to survive, their viability is tied both to the value they create and to the way they capture value and resultantly generate profit. The creation and capturing of value does not occur in a vacuum. Hamel (2002) argues that both occur in a 'value network'. This can include suppliers, partners, distribution channels, and other roles that extend the companies resources (Shafer et al., 2005).

At the same time, Osterwalder et al. (2005) published an article with a comparable goal. Instead of a literature review to obtain the different definitions, they asked participants of the IS community for their definitions of what they understand to be a business model. From 62 respondents, 54 definitions were received. Osterwalder et al. (2005) distinguished 44 of the definitions into two categories: value/customer-oriented business model (55%), and activity/role-oriented business model (45%). The main difference between the two categories, as he defines them, is that from a company perspective, the former approach is more outward looking, while the latter is more inward focused. One of the most interesting parts in that work is where they distinguishes between three different hierarchical levels for research towards and articles about business models (Figure 9). The levels are not mutually exclusive, but must be distinguished conceptually to achieve a common understanding. The overarching first level consists of definitions of what a business model is and what belongs in it and meta-models that conceptualize them. At this level, a business model describes

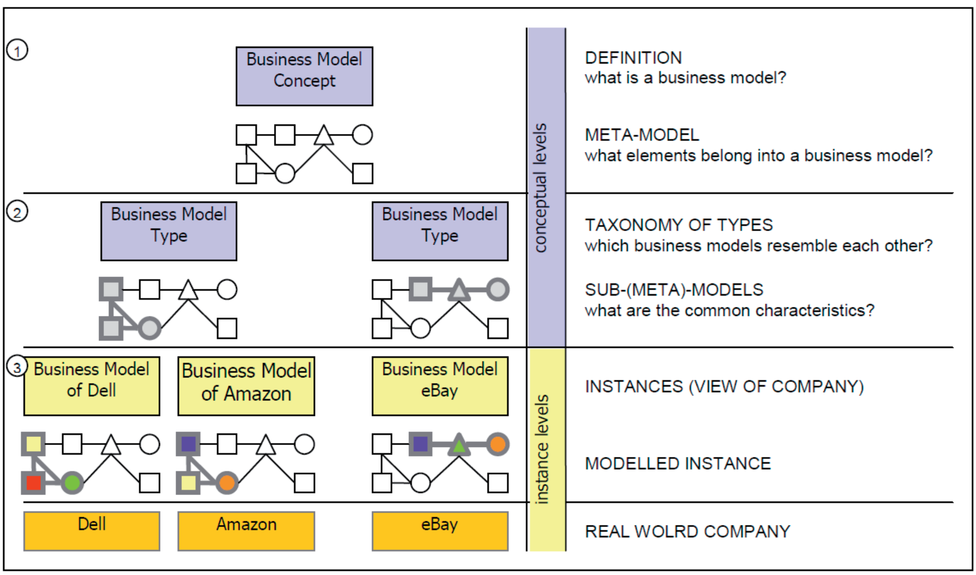

Figure 9: Business Model Concept Hierarchy (Osterwalder et al., 2005)

what a business does for a living, so to say. The second level represents several types or meta-model types of business models that are not generic but contain common characteristics. The final level consists either of concrete real world business models or of conceptualization, representations, and descriptions of real world business models. This is also used to analyse companies (Osterwalder et al., 2005).

With this model, the literature about business models can be separated much better for the model makes it officially clear that authors can be talking about the same concept 'business model' and addressing a specific level, which has a significantly different meaning then one of the other two levels.

In the years between 2005 and 2011, research focused less on the definition and components of business models and more on the position of business models in relation to strategy (Casadesus-Masanell and Ricart, 2010; Teece, 2010), business model innovation (Chesbrough, 2010; Doz and Kosonen, 2010; Vidal Tost, 2010), and different sub-meta-models (level 2) (McGrath, 2010). The following sections discuss each of these topics separately.

2.1.3 Business models: what it is, what it is used for, and what it is not

Now that it is clearer where business models come from, it is time to define what a business model is and what it is not. This is discussed in three parts. First, section 2.1.3.1 discusses the most used and acknowledged definitions. Second, section 2.1.3.2 follows by explaining what business models are used for currently. Finally, section 2.1.3.3 concludes by discussing the scope of business models to define the line where business models stop, and strategy and business plans start.

2.1.3.1 Business models: what it is

As shown in the previous section, over the years a lot of definitions have been formed and used to explain the concept of business models (George and Bock, 2011; Morris et al., 2005; Shafer et al., 2005). In 2005, Osterwalder et al. (2005) asked 62 respondents to give a definition of business models. They receive 54 definitions. Therefore, this explains some of the confusion about the concept in literature as well as in practice. Even in a recent publication of George and Bock (2011), this problem is acknowledged and addressed as a lack of coherence. Much effort has been put into literature review to develop consensus that tends to yield all-encompassing definitions that include established organizational constructs such as value creation and strategy. In other words, the research done, leads to divergent definitions instead of a convergent definition (George and Bock, 2011). The wide variety of roles that business models can or ought to fulfil is a reason for this. George and Bock give an overview of these perspectives based on their literature review. Perhaps the biggest problem with this is that in most publications it is unclear from which perspective the research is performed and all authors write about it as for it is the only right perspective and definition. In

Table 7. George and Bock give an overview of the different business model themes with their own representative definition.

Table 7: Thematic Summary of Business Model Literature (George and Bock, 2011)

Theme	Sample publications	Summary	Representative definition
Design	Slywotzky, 1999; Timmers, 1998	Agent-driven or emergent configuration of firm characteristics	"A business model is an architecture for product, service, and information flows, including a description of the various business actors and their roles" (Timmers, 1998).
RBV	Mangematin et al., 2003; Winter & Szulanski, 2001	Organizational structure codeterminant and coevolving with firm's asset stock or core activity set.	"Each business model has its own development logic which is coherent with the needed resources—customer and supplier relations, a set of competencies within the firm, a mode of financing its business, and a certain structure of shareholding" (Mangematin et al., 2003).
Narrative	Magretta, 2002	Subjective, descriptive, emergent story or logic of key drivers of organizational outcomes.	"[Business models] are, at heart, stories—stories that explain how enterprises work" (Magretta, 2002).
Innovation	Chesbrough & Rosenbloom, 2002	Processual configuration linked to evolution or application of firm technology	"The business model provides a coherent framework that takes technological characteristics and potentials as inputs and converts them through customers and markets into economic outputs" (Chesbrough and Rosenbloom, 2002).
Transactive	Amit & Zott, 2001; Zott & Amit, 2007, 2008	Configuration of boundary-spanning transactions	"A business model depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities" (Amit and Zott, 2001).
Opportunity	Afuah, 2003; Downing, 2005; Markides, 2008	Enactment and implementation tied to an opportunity landscape	"[The business model] is a set of expectations about how the business will be successful in its environment" (Downing, 2005).

Because the focus of this research is to develop a structural approach to make a business case of an organizations (potential) business model, the used definition of a business model is derived from scientific publications discussing often used and approved business modelling approaches. Osterwalder et al. (2005) propose the descriptive definition below. To identify the most common used building blocks among business models in literature, they compared the models mentioned most often, and studied the used components. From that synthesis emerged nine building blocks which were mentioned by at least two authors. Based on this, they proposed the following definition:

Business model definition:
A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams. (Osterwalder et al., 2005)

In this definition, the nine building blocks are represented. Osterwalder (2004) grouped the nine blocks into four categories, product, customer interface, infrastructure management, and financial aspects. A description of the separate blocks is given in Table 8. Section 2.1.4 discusses the emergence and selection of business model components in more detail.

Table 8: building blocks description (Osterwalder et al., 2005)

Pillar	Business Model Building Block	Description
Product	Value proposition	Gives an overall view of a company's bundle of products and services.
Customer interface	Target customer	Describes the segments of customers a company wants to offer value to.
	Distribution channel	Describes the various means of the company to get in touch with its customers
	Relationship	Explains the kind of links a company establishes between itself and its different customer segments.
Infrastructure management	Value Configuration	Describes the arrangement of activities and resources.
	Core competency	Outlines the competencies necessary to execute the company's business model.
	Partner network	Portrays the network of cooperative agreements with other companies necessary to efficiently offer and commercialize value.
Financial aspects	Cost structure	Sums up the monetary consequences of the means employed in the business model.
	Revenue model	Describes the way a company makes money through a variety of revenue flows.

2.1.3.2 Business models: what they are used for

According to Magretta (2002), a good business model answers Peter Drucker's age old (1954) questions: Who is the customer? And what does the customer value? Next to that, she also argues that a business model must answer the fundamental questions that every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?

So, business models are used to structure, organize, synchronize, and formalize all the thoughts and ideas within a company that explain what they do, how they make money with it, and to whom this value is delivered. In 2000, Accenture did a study in which 70 executives from 40 companies were interviewed regarding their company's core logic for creating and capturing value (Linder and Cantrell, 2000). Which is the basis of a business model according to Shafer et al. (2005). One of the results of the study was that 62% of the interviewees had a difficult time describing succinctly how their own company made money. This study was performed during the emergent of the business model concept.

Chesbrough (2010) suggests that a business model fulfils the following functions:

- Articulates the value proposition (i.e., the value created for users by an offering based on technology);
- Identifies a market segment and specify the revenue generation mechanism (i.e., users to whom technology is useful and for what purpose);
- Defines the structure of the value chain required to create and distribute the offering and complementary assets needed to support position in the chain;
- Details the revenue mechanism(s) by which the firm will be paid for the offering;
- Estimates the cost structure and profit potential (given value proposition and value chain structure);
- Describes the position of the firm within the value network linking suppliers and customers (incl. Identifying potential complementors and competitors);
- Formulates the competitive strategy by which the innovating firm will gain and hold advantage over rivals.

In addition, Osterwalder (2004) searched for the use of usages of business models. After a literature search, he came up with five categories:

- Understanding and sharing
- Analysing
- Managing
- Prospects
- Patenting of business models

The five points will be explained in more detail now.

2.1.3.2.1 Understanding and sharing

Business models help to understand and share the business logic. They argue that because people use different mental models, they do not automatically understand a business model in the same way. Therefore, a generic and shared concept for describing business models is necessary. Further, formalizing business models and expressing them in a more tangible way, clearly helps managers to communicate and share their understanding of a business among other stakeholders.

2.1.3.2.2 Analysing

Based on the reasoning that things are only comparable if they are understood in the same way, a structured business model approach is needed to enable companies to compare their business model to those of their competitors. By comparing, business model become a new unit of analysis for they can improve measuring, observing and comparing the business logic of a company.

2.1.3.2.3 Manage

In addition, management of the business logic of the firm is improved because businesses models help ameliorate the design, planning, changing, and implementation of business models. Organizations are able to adjust quicker to market changes and business models improve the alignment of strategy, business, organization, and technology. In an agile environment, it is much easier to go from one point to another when one can exactly understand, say and show what and how elements will change.

2.1.3.2.4 Prospect

Business models describe possible futures for a company. Osterwalder et al. (2005) argue that the business model concept can help foster innovation and increase readiness for the future through business model portfolios and simulation.

2.1.3.2.5 Patenting of business models

The final point they make is that business model may even play an important role in the legal domain of patents. They explain this argument by an example where an online retailer has a competitive advantage by making use of a special patented ordering system and attacked a competitor that started using the same ordering system technology for patent infringement. However, they also say that it remains to be seen in what direction patenting business models and business processes moves (Osterwalder et al., 2005).

Both the definition by Osterwalder (2004) and the use of business models as described by Magretta (2002), Shafer et al. (2005) and Chesbrough (2010), can be summarized by stating that business models should be used as a tool to analyse, define, and describe the rationale of how an organization creates, delivers and captures value.

2.1.3.3 What a business model is not

After discussing what a business model is and what it is (or could be) used for, it is also important to distinguish what it is not. The two most discussed things in literature about what it is not are discussed in this section. The first one is strategy, and the second one business plans. Two concepts, which seem to have a lot to do with business models, but should not be mistaken for business models.

2.1.3.3.1 Business plans

Business plans have been widely studied in the literature on entrepreneurship. They have been considered an internal management tool or an instrument for finding partners (Doganova and Eyquem-Renault, 2009). Business planning helps firm founders to anticipate on problems and information needs, turn broad goals into concrete milestones and correct quickly deviation from objectives(Delmar and Shane, 2003). On the other hand it can be argued that once written, business plans are never used by entrepreneurs for internal management purposes (Honig and Karlsson, 2004). Furthermore, Carter et al. (1996) argue that business planning spoils resources and time that could be more profitable to the venture if employed for more necessary marketing activities.

Therefore, a business plan is about a set of business goals, the reason why they should be attained, and the plan how those goals can be reached. Osterwalder and Pigneur (2010) argue that the purpose of a business plan is to describe and communicate a for-profit or non-profit project and how it can be implemented, either inside or outside and organization. The motivation behind the plan may be to “sell” a project, either to potential investors or to internal organizational stakeholders. It may also serve as an implementation guide.

So what than is the difference? As stated in the previous section, a business model can be summarized and described as the rationale of how an organization creates, delivers, and captures value. A business plan describes the reason and the plan to obtain certain business goals. A business model could be (not necessarily) a part of a business plan.

Osterwalder and Pigneur (2010) state the difference as follows: “*Once you’ve arrived at a final business model design, you will start translating this into an implementation design. This includes defining all related projects, specifying milestones, organizing any legal structures, preparing a detailed budget and project roadmap, and so forth. The implementation phase is often outlined in a business plan and itemized in a project management document.*”

2.1.3.3.2 Strategy

In literature, everybody seems to agree that business models and strategy are two different things. Related, but different. The difference however is sometimes hard to make clear. Using publications from Casadesus-Masanell and Ricart (2010), Magretta (2002) and Shafer et al. (2005), the difference between the two concepts will be emphasized in the next paragraphs.

2.1.3.3.3 Business models, strategy and tactics

Casadesus-Masanell and Ricart (2010) contribute to the literature by presenting an integrative framework to distinguish and relate the three concepts. The following definitions were given:

- Business model refers to the logic of the firm, the way it operates, and how it creates value for its stakeholders.
- Strategy refers to the choice of business model through which the firm will compete in the marketplace.
- Tactics refers to the residual choices open to a firm by virtue of the business model it chooses to employ.

Figure 10 gives a representation of their two-stage framework. In their formulation, strategy and business models are related, but not the same. A business model is a direct result of strategy but is not, itself, strategy. Furthermore, they argue that a strategy is a contingent plan of action as to what business model to use. The firm's available actions for strategy are choices (of policies, assets, or governance structures) that constitute the raw material of business models. Thus, strategy entails designing business models to allow the organization to reach its goals (Casadesus-Masanell and Ricart, 2010).

Magretta (2002) gives an additional important difference between strategy and business models. She explains that though many people use the terms interchangeably today, the difference is that strategy explains the competitive advantage of the company. Thus, why and how a company will do better than their rivals.

Shafer et al.(2005) argue that business models reflect the choices and their operational implications, made in the strategy process.

Nonetheless, with the different explanations and argumentations, the difference between the two concepts remains fuzzy. It is clear that there is a difference and that the terms are connected and interrelated. The difference becomes most clear when the two definitions are compared. A strategy is the plan of action of how a company obtains specific goals in a period. It has to be kept in mind however, that the strategy field is fragmented. There is no such thing as one theory of strategy (Hedman and Kalling, 2003). A business model is a representation and description which explains the

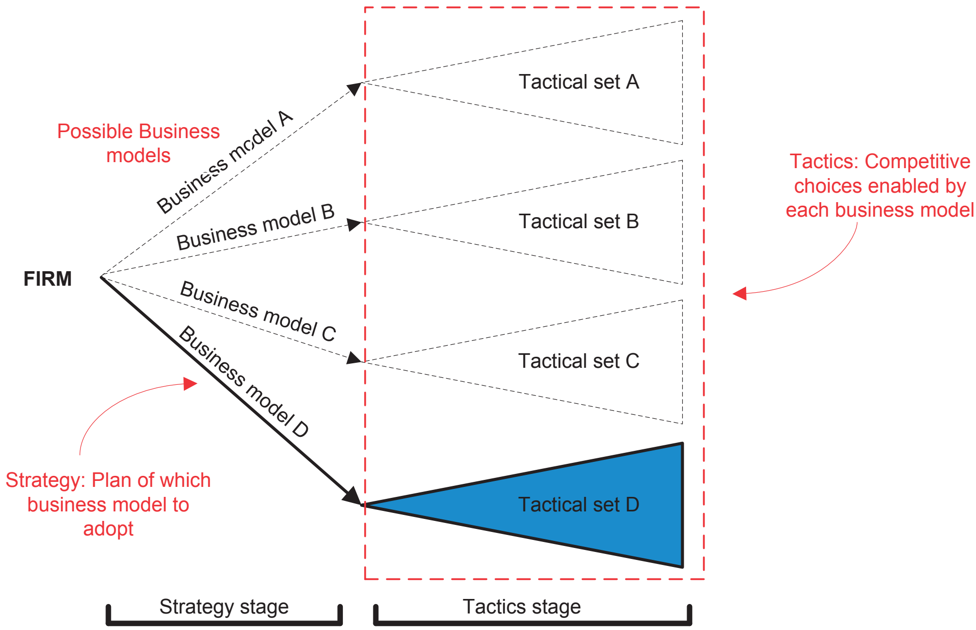

Figure 10: Strategy, business model and tactics two stage framework (Casadesus-Masanell and Ricart, 2010)

rationale of how an organization creates, delivers and captures value (Osterwalder et al., 2005). Tactics are the actions that lead to the execution of the strategy.

2.1.4 Business model components

Like the definition of business models, the literature about the components is ambiguous as well. However, multiple authors have tried to bring some structure, which we discuss in this section. After a period of a strongly increasing amount of research towards business models in 2002 – 2004 (see Figure 8) three different sets of authors (Morris et al., 2005; Osterwalder et al., 2005; Shafer et al., 2005) published articles trying to define a complete unambiguous set of constructs that form a business model. Despite their different approach and point of view, the basis of their results shows many similarities.

In the literature review by Shafer et al. (2005) a total of 12 definitions were found, containing 42 different components. With the use of an affinity diagram, the components that were cited twice or more were categorized. This resulted in a diagram with 20 business model components divided in four main categories: strategic choices, create value, value network, and capture value (Figure 11).

Motivated by the lack of consensus over the key components of business models that, Morris et al. (2005) also came up with a perspective on business model components based on a literature review. They found 24 different items that were mentioned as possible components, with 15 receiving multiple mentions. Based on those conceptual and theoretical roots, they developed a standard framework for characterizing a business model. They argued that to be useful, such framework must be reasonably simple, logical, measureable, comprehensive, and operationally meaningful. Their model addresses six key questions (Table 9) derived from their literature review and based on commonalities among the various perspectives. The first four key questions concern the most consistently emphasized components: the value proposition, the customer, the internal processes and competencies, and how the firm makes money. The fifth key question reflects the need to translate core competencies and the value proposition into a sustainable marketplace position. Finally, they argue, a useable framework should apply to all types of ventures, reflecting the design considerations necessary to accommodate differing levels of growth, time horizons, resource strategies, and exit vehicles. Therefore, the sixth decision area captures the growth and time objectives of the company.

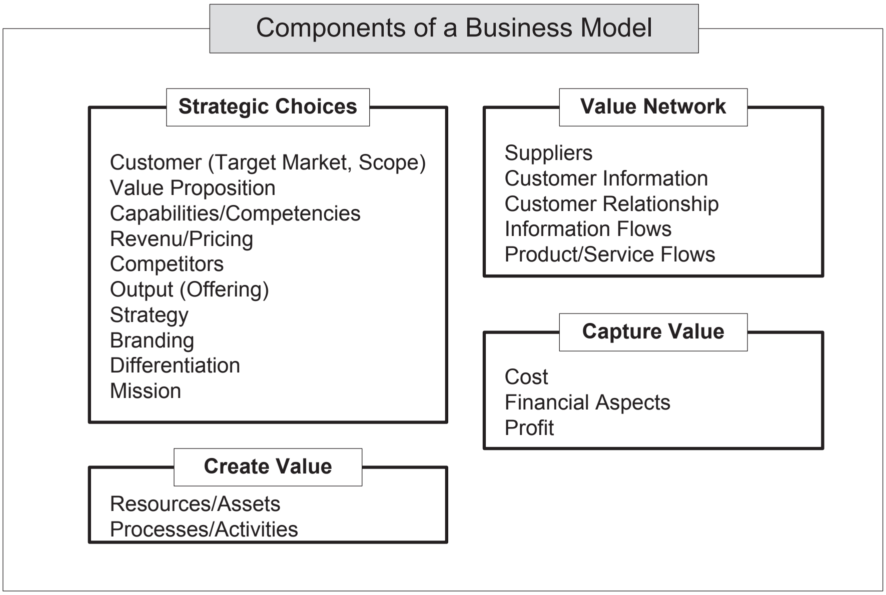

Figure 11: Components of business model affinity diagram (Shafer et al., 2005)

Table 9: Six questions that underlie a business model (Morris et al., 2005)

Component	Question	Description
1	How do we create value?	*Factors related to the offering*
2	Whom do we create value for?	*Market factors*
3	What is our source of competence?	*Internal capability factors*
4	How do we competitively position ourselves?	*Competitive strategy factors*
5	How do we make money?	*Economic factors*
6	What are our time, scope, and size ambitions?	*Personal/investor factors*

In 2004, Osterwalder and Pigneur also published their ideas concerning the business model ontology. Their ontology has been inspired by different enterprise ontology projects described in academic literature (Osterwalder and Pigneur, 2004). They argue that the studied ontologies mainly concentrate on processes and organizational representation, where the focus of their work is on the logic and concepts of value creation, at a higher level of abstraction, which is the business model. Their ontology is broken down into four pillars, the what, who, how, and how much. These correspond with the building blocks: product innovation, customer relationship, infrastructure management, and financial aspects. These building blocks are subdivided into 20 blocks. However, within a short period of time the number of blocks were reduced to the 9 blocks which are still used in their Business Model Canvas (Osterwalder and Pigneur, 2010). Table 8 shows the nine blocks and their descriptions.

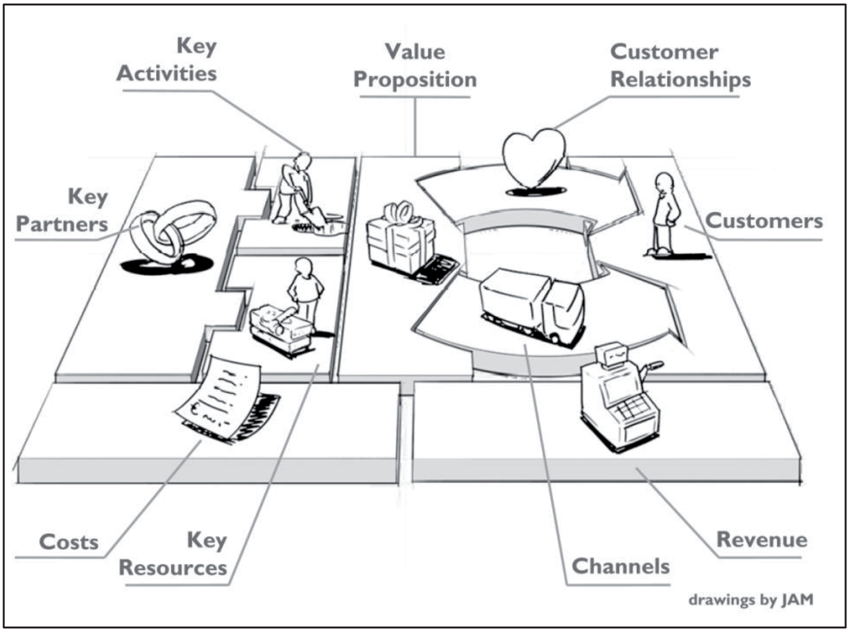

Figure 12: Business model Canvas (Osterwalder and Pigneur, 2010)

Hedman and Kalling (2003) present a comparable ontology model. Their results are the outcome of a widely spread literature study towards (e-)business model components from a strategic perspective. The model includes seven causally related components: (1) customers, (2) competitors, (3) offering, (4) activities and organization, (5) resources, (6) supply of factor and production inputs, and (7) a longitudinal dimension (Hedman and Kalling, 2003). The representation of the model (Figure 13) is not as polished as the Business Model Canvas in Figure 12, but the composition of components is interesting. Within the model, the separation is made between outside influences on the organization and causal components inside the organization. Also, the causality between, for example, the suppliers and the resources, or the available resources and the possible organizational activities, are effects of the strategic perspective on the business model ontology.

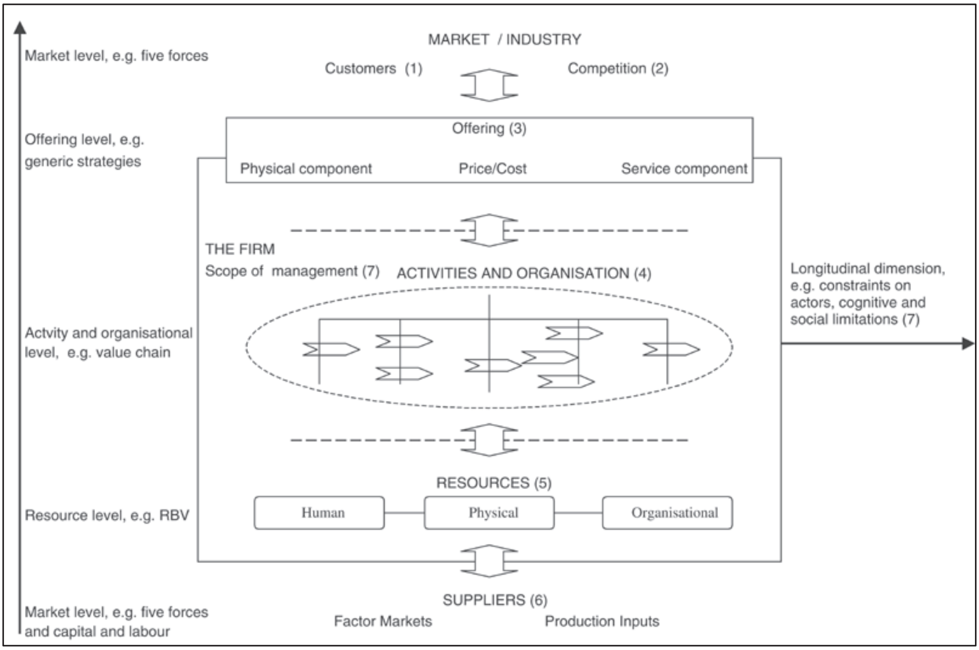

Figure 13: Components of a business model (Hedman and Kalling, 2003)

At the same time, with diverse approaches, perspectives, and backgrounds, the authors above independently produce their own business model ontologies that contain similar components. Table 10 gives an overview. Taking the shared items of the ontologies, a business model is not a value proposition, a revenue model, or a network of relationships by itself; it is a combination of all these elements.

When the models are ranked against each other, Morris' model gets the last place. The key questions can surely help companies to analyse and design their business models, but the questions are multi interpretable causing a wide variety of incomparable business models without the possible security of covering the important components.

Shafer's model comes on the third place after Morris' model. The model covers almost all possible components, because all components that were referred to twice or more times were admitted in the model. This causes over completeness on the one hand, and lack of structure on the other.

With BMC and the model of Hedman and Kalling (2003) left, the ranking becomes harder. Both models have their own objective and subjective advantages and disadvantages. The more subjective positive aspect about Osterwalder's ontology, is that the model turned out to be used with success around the world in practice (Osterwalder and Pigneur, 2010). However, the model lacks the longitudinal dimension and strategic perspective that are represented in the model of Hedman and Kalling (2003). This raises the important question if the longitudinal time attribute and the strategic perspective belong in a business model.

Table 10: Shared business model ontology components

	(Shafer et al., 2005)	(Morris et al., 2005)	(Osterwalder et al., 2005)	(Hedman and Kalling, 2003)
All shared components	Customers	Customers	Customers	Customers
	Value proposition	Value proposition	Value proposition	Offering
	Capabilities/ competences	Capabilities/ competences	Key activities	Activities
	Resources	Resources	Resources	Resources
	Cost	Cost	Costs	Cost
	Revenue	Revenue	Revenue	Price
	Suppliers	Suppliers	Key partners	Suppliers
Partly shared components	Customer relationship		Customer relationship	Service (?)
	Competitors			Competition
		Time		Longitudinal dimension
	Strategy	Strategy		
Unique components	Mission Information flows	Scope Size	Channels	

2.1.5 Business model evaluation

Business models may be evaluated in several ways. In this section, we discuss the need for business model evaluation and innovation first. Then, we treat some methods to do this. Finally, we focus on one of these methods, the SWOT analysis. All of this based on the literature review.

2.1.5.1 The need for business model evaluation and innovation

Business models matter, for a better business model often beats a better idea or technology (Chesbrough, 2007). In that light, it is shown that many companies fail, not because they do something wrong or mediocre, but because they keep doing what used to be the right thing for too long, and fall victim to the rigidity of their business model (Doz and Kosonen, 2010). In the face of discontinuities and disruptions, convergence and intense global competition, companies now need to transform their business models more rapidly, more frequently and more far-reaching than in the past. Shortening product lives mean that even great technologies no longer can be relied upon to earn a satisfactory profit before they become commoditized. Today, innovation must include business models, rather than just technology and R&D (Chesbrough, 2007).

The domain of evaluation models concerns itself with identifying criteria for either assessing the feasibility, viability, and profitability of new business models, or evaluating them against alternative or best practice cases (Pateli and Giaglis, 2004). In the extensive literature research by Pateli and Giaglis, four primary evaluation purposes have been identified: benchmarking with competitors in business model terms; assessment of alternative business models for possible implementation; risk identification for a firm pursuing business model innovation; and evaluation of an innovative business model in terms of feasibility and profitability.

According to Osterwalder and Pigneur (2010), an organization should assess its business model regularly, so that the health of the company's market position is maintained. Furthermore, this check-up may become the basis for incremental business model improvements, or it might trigger a serious intervention in the form of a business model innovation initiative.

According to the remarks on the need for business model evaluation of these different authors, it can be stated that due to rapidly changing markets and shortening product life cycles, it is important for organizations to regularly assess their business model to maintain their competitive advantage.

2.1.5.2 Business model evaluation and innovation methods

Transforming the business model of a successful company is never easy. Practical, actionable steps and well defined methods can make successful business model transformation more likely (Doz and Kosonen, 2010). Next to the lack of good evaluation methods in practice and literature, the responsibility for initiating business model evaluation and innovation is poorly defined in many organizations (Chesbrough, 2007).

Based on the studied literature, only a small group of articles addresses the issue of evaluation and a few evaluation methods discussed in those articles are found useful. The evaluation model sub-domain is among the less mature areas of business model research. The majority of criteria proposed draws from general theory and is mostly driven by financial indicators that are very difficult, if possible at all, to measure in all cases. Examples of this are: *measures of profitability, profitability prediction,* and *firm access to key information and conflicts* (Pateli and Giaglis, 2004). The next part discusses two methods. However, it is questionable if the first, by Doz and Kosonen (2010), can be called a model for they describe it themselves as a set of practical, actionable steps that a CEO and a corporate leadership team can take, to foster a more purposive – and more strategic – evolution and adaptation of business models, which makes successful business model transformation more likely. The second comes from the non-academic book by Osterwalder and Pigneur (2010).

To develop a prescription for business model renewal, Doz and Kosonen (2010) build on the strategic agility framework. They developed that from an earlier empirical research on a dozen companies in the information technology industry, which were reconceiving their business models. That work conceptualized strategic agility as the 'thoughtful and purposive interplay' on the part of top management between three meta-capabilities:

- Strategic sensitivity: the sharpness of perception of, and the intensity of awareness and attention to, strategic developments;
- Leadership unity: the ability of the top team to make bold, fast decisions, without being bogged down in top-level 'win-lose' politics;
- Resource fluidity: the internal capability to reconfigure capabilities and redeploy resources rapidly.

Based on these three dimensions, they developed five recommended leadership actions for each dimension, which Table 11 shows. Each of these sets can contribute to a firm's ability to renew its business models successfully.

Table 11: The leadership Action Agenda (Doz and Kosonen, 2010)

Dimensions	Leadership actions
Strategic Sensitivity	Anticipating: *sharpening foresight* Experimenting: *gaining insights* Distancing: *gaining perspective* Abstracting: *gaining generality* Reframing: *imagining new business models*
Leadership Unity	Dialoguing: *surfacing and sharing assumptions, understanding contexts* Revealing: *making personal motives explicit* Integrating: *building interdependencies* Aligning: *rallying around a common interest* Caring: *providing empathy and compassion for empowerment*
Resource Fluidity	Decoupling: *gaining flexibility* Modularizing: *disassembling and reassembling business systems* Dissociating: *separating resource use from ownership* Switching: *using multiple models* Grafting: *acquiring to transform oneself*

Strategic agility is most obviously a keystone to having the ability to transform and renew business models. The strategic sensitivity actions can make the company both more precise and accurate in the perceptions its executives have both of its (external) ecosystem and of its (internal) activity system. They also contribute to make executives more aware and alert about their environment. The leadership unity actions contribute to the team's ability to reach collective commitments and elicit true engagement toward them, among its members and from other members of the organization. The resource fluidity actions contribute to the success rate of implementing the agreed changes in the organization's business model (Doz and Kosonen, 2010).

In contrast with the more abstract prescription of the leadership action method, Osterwalder assesses each building block (see Figure 12) with SWOT analysis. One of the advantages of SWOT as a tool to analyse and evaluate a business model is that it is familiar to many businesspeople. In Osterwalder's opinion too, the regularly assessment of a company's business model is an important management activity that allows an organization to evaluate the health of its market position and adapt accordingly (Osterwalder and Pigneur, 2010). In the following section, the SWOT analysis, as Osterwalder and Pigneur apply it, is further discussed.

2.1.5.3 SWOT assessment

The SWOT analysis is an attractive tool because of its simplicity. On the other hand, sometimes a certain SWOT-fatigue is recognized among managers due to the little direction provided by the method, concerning which aspects of an organization to analyse. This may result in a lack of useful outcomes. Osterwalder and Pigneur argue that the SWOT analysis in combination with the structure of the Canvas business model, enables a focused assessment and evaluation of an organizations business model and its building blocks (Osterwalder and Pigneur, 2010).

The tool in itself is rather simple and exists of three questionnaire-like forms. The first form covers the strengths and weaknesses of the current business model. The result gives a good perspective on the current situation of the organization. In the form, statements, such as *'Our value propositions are well aligned with customer needs'*, can be in ranked from +5 (strength) via 1 (no strength, no weakness) till -5 (weakness). Figure 14 gives an example of this assessment form.

The second and third form are very similar to the first, but in these forms either the opportunities are evaluated or the threats. Again, this is done with several questions per building blocks that can be ranked from 1 till 5. An example of the opportunities and threats form is given in Figure 15 and Figure 16.

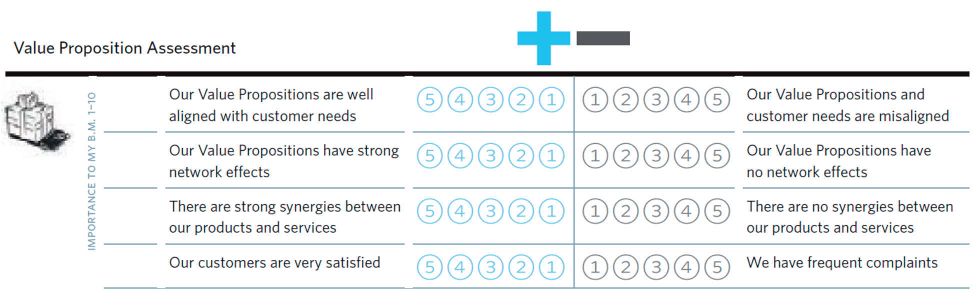

Figure 14: Strengths and weakness assessment of the value proposition (Osterwalder and Pigneur, 2010)

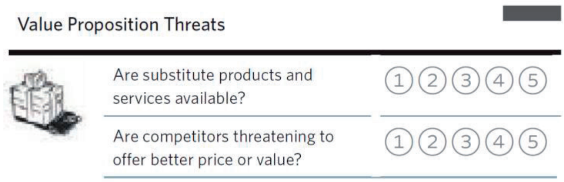

Figure 15: Threats assessment of value proposition (Osterwalder and Pigneur, 2010)

As said before, the evaluation model sub-domain is among the less mature areas of business model research. There are no empirical research results that evaluate and test the quality of the evaluation methods. Therefore, it is hard to say whether the methods are any good in practice. What can be said though is that business model evaluation is found to be important by several authors.

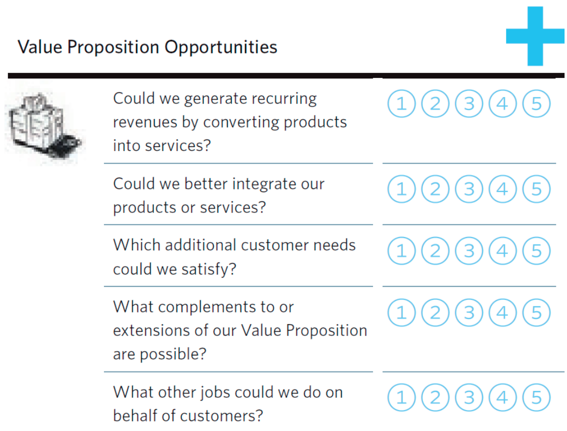

Figure 16: Opportunities assessment of value proposition (Osterwalder and Pigneur, 2010)

2.2 Business cases: a literature review

Research has shown that developing business case for organizational investments, especially in IT, is common practice currently. A conducted survey of over 100 European organizations showed that 96% of the respondents reported that they are required to produce some form of business case when seeking approval for their investments (Ward et al., 2008).

According to a publication of the Harvard Business School Press (HBSP) (2010), a business case is a tool for identifying and comparing multiple alternatives for pursuing an opportunity and then proposing the one course of action that will create the most value.

In this section, the business case concept is further investigated. After an overview of the literature search process towards business cases, in the first section the origin, different types, and the use and goal of business cases will be discussed. Next, the different components of a business case will be discussed. Finally, some effort will be spend on investigating how the literature says a business case should be made.

2.2.1 Literature criteria, search and selection process

To increase knowledge about business cases or as Google says: ‘building on the shoulders of giants’, a literature study is conducted starting with clarifying the search process. For the course of this research, it is interesting to find out what has already been written about business cases to answer the following knowledge problems:

- What is meant with business cases?
- What is the goal of business cases and where is it used?
- What are components of business cases?
- How should business cases be developed?
- How can business cases be evaluated?

A forward literature search will be performed using Scopus, the largest abstract and citation database of peer-reviewed literature. Search results should meet the following criteria:

1) Papers published before 2009 should have 3 or more citations
2) Papers must be published between 1998 and 2012
3) Papers must have at least 20 references
4) Subject area is limited to:
    a) Engineering
    b) Computer Science
    c) Business, Management and Accounting
    d) Decision Sciences
    e) Economics, econometrics and finance
    f) Mathematics

Based on the selected articles, a backward search will be performed to gather the relevant articles for business cases that did not meet the criteria of the literature search or did not show in the results for other reasons. ‘*usiness cas*’ is the used keyword for this search, for all publications which have the exact phrase of a variation of the term ‘business case’ in title, abstract, or keywords, can be interesting for this literature review. Figure 17 shows the exact search query as it was entered in Scopus.com on April 22, 2012. The search resulted in 2149 results in the title, abstract, and keywords of publications. After applying the citation restriction, 557 results remained.

```
TITLE-ABS-KEY(
      ("*usiness cas*"))
AND PUBYEAR > 1997
```

Figure 17: Business case literature search query

The number of search results is large. This can be adjusted by sharpening the criteria, but then the risk increases of excluding good articles. The main reason for the large number of results by this search is that many articles use the word 'business case' in their abstract without spending any text on the fundamentals of business cases.

The selection process continues as follows. First, the results are selected or excluded based on their title. Next, the remaining articles will be selected or excluded based on their abstracts. Then the articles without an available full text (directly via Scopus or indirectly via Google Scholar) will be excluded. After reading the full texts of remainder, only the articles with relevant content concerning the knowledge problems above will be kept and used further. Figure 18 shows this process.

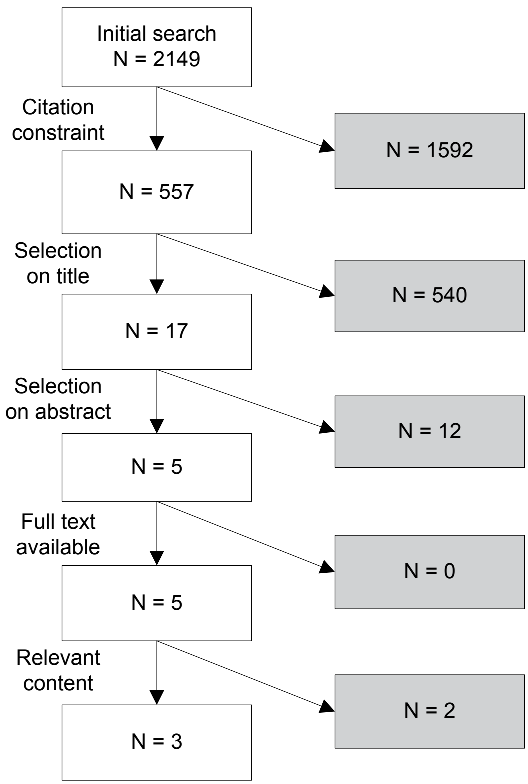

Figure 18: Business case literature selection process

From the 557 hits that meet the selection criteria, only three articles are selected at the end of the process. The reason for the large number of non-useful hits is a combination of a few factors. In the first place, all articles which talk about case studies done in an organization (business case studies), are not about business cases but about case studies. Another part of the results just used the word 'business case' as a common word to express that their invention is profitable in at least one of the possible value proposition. The last group of non-useful hits is formed by articles making a business case for a wide variety of projects as if it is the most normal thing to do, causing no use of any reference towards what a case study is or how it should be developed. Next to the found literature the book 'Developing a business case' (Harvard Business School Press, 2010) will be used.

2.2.2 Short literature overview

The selected literature is used to solve the knowledge problems. Table 12 shows which literature (partially) addresses the knowledge problems.

Table 12: Business case literature overview

	(Al-Twairesh and Al-Mudimigh, 2011)	(Nielsen and Persson, 2012)	(Ward et al., 2008)	(Harvard Business School Press, 2010)
What is meant with the term 'business cases'?	p.44	p. 2	p.1	p.3
What is the goal of business cases and where is it used?	P.44	P.1, p.2	p.2	p.5
What are components of business cases?	p.45		p.4	p.6
How should a business case be developed?	p.45		p.5	p.73
How can business cases be evaluated?			p.8	

2.2.3 Business case: what it is, what it is used for, and what it is not

In this section, the business case concept will be further defined. Not only is effort put into defining what a business case is, but also in what it is not and what it often gets confused with. This section is based on academic literature found as described in the previous section, and the literature found by a backward search on the citations used in those articles. Next to that the book 'developing a business case' (Harvard Business School Press, 2010) will be used. Before exploring and defining the concept based on the academic literature, it must be said that plenty of information and discussion about business cases exists in the non-academic field. A quick search on Google on the search term 'business case', results in a multitude of hits that are good to use as information source in practice. Stating this in contrast with the limited amount of useful in-depth academic articles on this subject on the one hand, and research results showing that business case development is a common practice nowadays on the other hand, it might be the case that a richer source of information on this subject exists in the non-academic field.

2.2.3.1 Business case: what it is

In literature, business cases are usually related to IT projects and investments. Nielsen and Persson (2012) define business cases as artefacts in the form of a document specifying the main rationale behind the expected value and cost of an IT investment for the adopting organization. Also Ward et al. (2008) relate business cases with IT projects in terms of a method, amongst others, to get funding for the investment. Al-Twairesh and Al-Mudimigh (2011) give a more general applicable definition of business cases, but then also relate it to the role of business cases in ERP implementation. They define a business case as Ross and Beath (2002) define it, "a structured proposal for business change that is justified in terms of expected costs and benefits". HBSP (2010) defines and applies business cases in general; they state that a business case is a tool for identifying and comparing alternatives for pursuing an opportunity and then proposing the one course of action that will create the most value.

In this research, the term business cases refers to the definition by Ross and Beath (2002), because it does not purely focus on IT investments alone as other definitions do. HBSP (2010) gives a general applicable definition as well, but they include the components 'identification' and 'comparison'. In the literature, too little is referred to a business case as a tool for opportunity/alternative identification. This does not mean that opportunity/alternative identification cannot be a component of business cases, but there is little reason to state that is per se a part of a business case.

2.2.3.2 Business case: what it is used for

According to Ward et al. (2008), traditionally the main purpose in building the business case for an IS/IT project has been to obtain funding approval for the financial spend. In their publication, they expand the role of business cases with the following points stating that business cases should be used also to:

- Enable priorities to be set among different investments for funds and resources
- Identify how the combination of IT and business changes will deliver each of the benefits identified – a benefit realization plan

- Ensure commitment from the business managers to achieving the intended investment benefits
- Create a basis for review of the realization of the proposed business benefits when the investment is complete

While Ward et al. (2008) focus specially on IT projects, their ideas about business cases are applicable in general for the goal and definition of business cases as discussed in 2.2.3.1 are equal. In addition, their business case components seem to be are applicable to non-IT related projects as well.

HBSP (2010) presents a list of situations where a business case is useful. They state that the process of building a business case is similar to solving a problem. Developing a business case would not only help to identify potential solutions to problems, but also help to sell the ideas to key decision makers. According to them, a business case is useful in situations where the goal is to:

- Demonstrate the value a proposed product or service would generate for your organization
- Prioritize projects within your group and identify which ones to eliminate
- Demonstrate the value of a product or service to a customer to make a sale
- Obtain additional resources for a new project, initiative, or organization
- Modify an existing offering
- Invest in a new capability, such as a software program or training
- Decide whether to outsource a particular function

2.2.3.3 Business case: what it is not

Business cases are in practice not always used as a structured proposal for organizational change. For example, Nielsen and Persson (2012) describe that, in some of the municipalities they investigated, business cases were developed after an investment decision was made already, to justify and promote the IT investment decision internally. In contrast with the ideas of HBSP (2010) about business cases (i.e.; business cases as a tool for identifying and comparing multiple alternatives for pursuing an opportunity and then proposing the one course of action that will create the most value), this post hoc use is wrong.

Furthermore, HBSP (2010)stresses the difference between business cases and business plans. They argue that a business case answers the question “What happens if we take this course of action?”, while a business plan describes how an organization or business unit intends to navigate successfully through its own unique competitive environment. Business plans feature long-range projections of revenues, expenses, business strategy, and other information. Typically, business plans are used to secure financing from investors or to plan strategy execution for an organization or business.

2.2.4 Business case components: two perspectives

It is clear what business cases are and what they are used for. In this section, two different ways of developing a business case with their components are discussed. According to the literature overview (Table 7), three publications discuss components of business cases. After a closer look however, it shows that Al-Twairesh and Al-Mudimigh (Al-Twairesh and Al-Mudimigh, 2011) only give a short summary of the model proposed by Ward et al. (2008), split into more parts and adjusted towards ERP implementation projects. Therefore, in this section the model of Ward et al. (2008) will be discussed, followed by the method of HBSP (2010).

2.2.4.1 Building the business case by Ward et al. (2008)

From their research and work with management teams in a wide range of organizations in both private and public sectors, Ward et al. (2008) developed a six-step approach to building business cases more rigorous and robust:

1. Define business drivers and investment objectives
2. Identify benefits, measures and owners
3. Structure the benefits
4. Identify organizational changes enabling benefits
5. Determine the explicit value of each benefit
6. Identify costs and risks

The six steps are discussed further now.

2.2.4.1.1 1. Define business drivers and investment objectives

In their opinion, a business case should start with a statement of the current issues facing the organization that need to be addressed, which are the business drivers. The business drivers can be both internal as external. Then the business case should state clearly what the proposed investment seeks to achieve for the organization, i.e. the investment objectives. These should clearly show that it addresses some or all of the business drivers.

2.2.4.1.2 2. Identify benefits, measures, and owners

In the second step, the expected benefits need to be identified that will arise if the objectives are met. The investment objectives and benefits differ in the following way: investment objectives are the overall goals or aims of the investment, which should be agreed by all relevant stakeholders. In contrast, benefits are advantages provided to specific groups or individuals because of meeting the overall objectives.

Next, two essential pieces of information need to be added to each benefit. Firstly, it is important how the benefit could be measured because the precision about what was meant by a particular benefit will increase often. Secondly, an individual who will be the owner of the benefit should be identified and assigned to the benefit. This is because the benefit owner is willing to work with the team undertaking the project to ensure the benefit is realized. This may either be personally or through the resources and influence that the owner has. Making individuals, particularly senior managers benefit owners not only builds commitment to the project but also demonstrates the importance of the investment, adding to the weight of the business case.

2.2.4.1.3 3. Structure the benefits

To structure the benefits expected from meeting the investment objectives, Ward et al. (2008) developed the framework that Table 13 shows. This framework seeks to differentiate or structure these benefits according to two factors: the type of business change that gives rise to benefit and how much is known already or can be determined about the benefit before the investment is made, that is, the degree of explicitness. Each benefit should be placed within one column and one row, resulting in a spread of benefits across the framework. Instead of a list of benefits as found in most business cases, this framework clearly shows the mix of financial and more subjective benefits and the types of business change necessary to deliver these benefits. Furthermore, the framework encourages greater discussion and evidence gathering about the expected benefits. Moreover, the use of the framework across all business cases enables comparison across investments and assists prioritization.

Table 13: Framework for developing a business case by Ward et al. (2008)

Degree of explicitness	Do new things	Do things better	Stop doing things
Financial			
Quantifiable			
Measurable			
Observable			

2.2.4.1.4 4. Identify organizational changes enabling benefits

Both step four and five are about using and filling the framework. In step four, expected benefits are classified as either doing new things, doing things better, or stop doing things. Identifying the changes necessary to deliver some benefits may be straightforward. However, in other cases the necessary business changes may be less obvious. In such cases, it is important to identify the change owners. In a similar way to the identification of benefit owners, a named individual should be made responsible for each of the changes that have been identified. This helps to build commitment to the investment and shows, not only what the investment is likely to yield, but how it can be achieved as well.

2.2.4.1.5 5. Determine the explicit value of each benefit

In this step, each benefit is assigned to a row in the framework. The degree of explicitness of each row is based upon the ability to assign a value to the benefit from information that is known already or can be determined before the investment is made. Each benefit should be allocated to the observable row initially. The benefit owner should then provide evidence to move it to the rows above. These represent increasing levels of explicitness and knowledge about the value of the benefit.

Observable benefits: are benefits that can only be measured by opinion or judgment. These are often described as subjective, intangible, or qualitative benefits. Important is that a clear statement of the criteria used to assess achievement, and also the person who is qualified or appropriate to make the judgment, should be agreed at the outset of the project. Observable benefits can be identified if the following rule applies: By use of agreed criteria, specific individuals/groups decide, based upon their experience or judgment, to what extent the benefit has been realized.

Measureable benefits: are benefits where an identified measure for the benefit exists already or where one can be put in place easily. This allows current performance to be determined as the baseline prior to the investment. However, importantly, it is not possible to estimate how much performance will improve when the investment is completed. Measurable benefits can be identified if the following rule applies: This aspect of performance is being measured currently or an appropriate measure could be implemented. However, it is not possible to estimate by how much performance will improve when changes are completed.

Quantifiable benefits: are the benefits where an existing measure is in place or can be put in place relatively easily. However, in addition to being able to measure performance before the investment is made, the size or magnitude of the benefit can be reliably estimated too. Without legitimate quantification, it will be difficult to agree a realistic financial value. Quantifiable benefits can be identified if the following rule applies: Sufficient evidence exists to forecast how much improvement/benefit should result from the changes.

Financial benefits: are benefits that can be expressed in financial terms. A benefit should be placed in this row only when sufficient evidence is available to show that the stated value is likely to be achieved. Hence, all financial benefits should be the result of applying a financial value or formula to a proven quantifiable benefit. The financial benefits can then be combined to calculate an overall financial value of the investment, rate of return or payback.

2.2.4.1.6 6. Identify costs and risks

In addition to the benefits, a full business case must include all the costs and an assessment of the associated risks. Once a total financial value of the relevant benefits has been determined and the expected costs have been identified, a financial assessment can be made. In terms of assessing the investment risks, Ward et al. (2008) refer to some well-established ways of estimating financial and technical risks for IT investments. The risks of the project should be assessed, but how this is done depends on the type of investment and the assessment can be done by applicable risk assessment methods. On this part, Al-Twairesh and Al-Mudimigh (2011) have a good addition. They argue that the risk of no investment is often overlooked, but just as critical in developing a business case is the 'risk of no investment' outcome. If the investment is not made, then it is important to know what could happen to the company's bottom line. For example, the chances of losing customers, or market share, or maybe some future costs can be avoided if the investment is made.

2.2.4.2 Seven steps to a business case by HBSP (2010)

The following part discusses the method by HBSP (2010). They start with differentiating between the product and the process. Here they mean that the product is a document or presentation, for which many companies have their own templates and specific guidelines. However, they focus on the process of defining the business case. Regardless of the format of the business case, the following steps can be used to prepare it:

1. Define the opportunity
2. Identify the alternatives
3. Gather data and estimate time frame
4. Analyse the alternatives
5. Make a choice and assess the risk
6. Create a plan for implementing the idea
7. Communicate the case

All the steps need to be completed to build a strong business case. The depth of analysis and extent of documentation necessary to support the case, likely varies depending on the proposed initiative's scope, costs, organizational impact, and risk.

2.2.4.2.1 1. Define the opportunity

To define the pursued opportunity, the following elements are needed:

- Problem or opportunity identification
- Crafting an opportunity statement
- Identify the business objectives in pursuing the opportunity

- Prioritize the objectives
- Assign metrics to the objectives

The first step in building a business case is the identification of the problem or opportunity. Then a statement that describes the benefits that will come with solving the problem or seizing the opportunity needs to be developed. After this, the most relevant business objectives that are hoped to be achieved by pursuing this opportunity need to be identified. Next, the objectives need to be prioritized. To end the first step, metrics for each of the defined objectives need to be identified.

2.2.4.2.2 2. Identification of alternatives

This step consists of three tasks. First, they argue, it is vital to brainstorm a full set of alternatives rather than latching on to the first one or two good ideas that occur. Second, the stakeholders are identified and contacted. Because a big part of building a business case is about selling the idea, it makes sense to involve stakeholders early in the process. Next to that, they may also provide ideas and additional information, and it becomes clearer what they value most. The final task is to narrow the list of alternatives down to two or three options that best address the business objectives and stakeholders needs.

2.2.4.2.3 3. Gather data and estimate time frame

Based on the chosen metrics for each business objective, all information needs to be gathered to compare the options making use of the metrics. Next, a time frame for implementing the initiative and achieving the benefits of the defined opportunity needs to be made. The following guiding questions can be used to accomplish this:

- When would the initiative get under way?
- Would it be phased in over the course of one year, three years, or more?
- Would it be synchronized with calendar years, fiscal years, or other initiatives?
- Would it have a clear end at which all its benefits would be generated?

Setting the time frame requires a lot of estimating. While doing this, the used information and assumptions should be documented so that in a later stage the reasoning can be explained.

2.2.4.2.4 4. Analyse the alternatives

In the end, the decision-makers want to know the financial implications of each of the alternative courses of action presented in the business case. Financial implications can be described by possible impact on revenues, return on investment, payback period, and so forth.

When the financial ramifications and the impact on non-financial metrics of the alternatives are defined, using an alternative comparing table, the alternatives can be compared. Suggested is a table with the alternatives in the rows and the pros and cons in the columns. The following eight steps are presented to structure this process:

- List the costs
- List the benefits of expected additional revenues
- Point out any cost savings to be gained
- Identify when the anticipated costs and revenues can be expected
- List the impacts on other corporate metrics, such as customer satisfaction, customer retention, and operational efficiency
- List any unquantifiable benefits and costs
- Conduct the business impact analysis
- Organize the information into a table for comparison

2.2.4.2.5 5. Make a choice and assess the risk

Based on the information in the comparison table, the best alternative can be chosen. This is not exact science for also non-quantifiable benefits could play a part in the decision. Again, the rationale needs to be documented so the reasoning can be explained in later stages.

After the choice is made, the potential risks need to be identified. Next to risks for the organization, also the risk of implementation of the choice needs to be assessed, as well as the risk for peers and stakeholders. A good way to explain the risks is by conducting a worst-case and best-case scenario. After the risk assessment, ways to migrate the risks need to be identified.

2.2.4.2.6 6. Crafting an implementation plan

An implementation plan lays out how the progress can be tracked and the success can be measured if the proposed solution is put into action. Next to lists of action items, due dates, and responsible people, the following things should also be in the implementation plan:

- The primary milestones
- Individuals responsible for each milestone
- Resources required to reach each milestone
- Dates when the benefits can be shown
- Impacts on the company’s expense and headcount budgets
- Increases in revenue
- A plan for demonstrating that the solution’s intended results have been realized

2.2.4.2.7 7. Communicate the case

The final step is about communicating the business case to the decision makers. It is important to know what the decision makers value and that it becomes clear to them what they need to do. For example, do they need to approve resources or do they need to 'talk up' the proposal to others?

Furthermore, it is important that both the document and the presentation (if there is one) are short and to the point.

2.2.4.3 Business case method comparison

After explaining how Ward et al. (2008) and HBSP (2010) suggest that a business case should be developed, Table 14 lists and compares the different components used in the two methods to see how they differ.

Next to some minor differences between the two methods, a couple of bigger differences can be identified. The first is the inclusion of alternatives in the method of HBSP (2010). They state that the biggest mistake, which can be made when developing business cases, is going for the first and only option without seriously thinking about alternatives. The only alternative, which Ward et al. (2008) consider, is the (non-) financial consequences of not implementing the proposed idea. This 'alternative' is not mentioned by HBSP (2010).

The second difference is how stakeholders are involved in the business case. Ward et al. (2008) involve benefit owners in the beginning of the business case development to get knowledge of what stakeholders want and what ideas they have concerning the issue that needs to be addressed. In addition, by assigning a benefit to an owner, this individual should therefore be willing to work with the team undertaking the project to ensure the benefit is realized.

Next, the method of Ward et al. (2008) categorizes the benefits. First, they are categorized based on the type of need for organizational change, and then based on the degree of explicitness. This way, not a long list of benefits is not shown which need to be valued by the reader to see what the benefits are really worth, but the value and consequences of the benefits are easy to estimate.

In the final step of Ward et al.'s method, the costs and risks are assessed. Both methods agree that costs and risks are important decision criteria. However, in the method of HBSP (2010), only the best alternative is chosen based on the (non-)financial benefits, excluding the risks. After the choice has been made, the risks for this choice are assessed. It would be more logical, to assess the risks of all alternative as the costs are assessed, and based on that information the choice is made. Another good aspect of the method of HBSP (2010) is the creation of an implementation plan. If the business case is good, but the plan or approach to implement the project lacks, the risk that the project fails increases.

To summarize, both methods have a lot of common, and some unique components. Combining the two methods will produce an even stronger and better business case.

Table 14: Business case development comparison

Ward et al. (2008)			Harvard Business School Press (2010)	
Step	Component	Explanation	Component	Explanation
1	Business drivers	Organizations current issues that need to be addressed	Problem or opportunity	A problem that the organization currently faces or an opportunity for the organization
	Investment objectives	Which business drivers are addressed with the proposed investment	Business objectives	Most relevant business objectives that are hoped to be achieved by pursuing this opportunity
			Objective metrics	Metrics for each defined objective are identified
2	Benefit identification	Identification of the benefits that are hoped to be achieved	Alternative identification	Identification of two or three alternatives that best address the business objectives
	Benefit metrics	Defining the metrics which can be used to measure each of the benefits		
	Benefit owners	Identification of an individual who will be the owner of the benefit		
3	Benefit structuring	Structure the benefits according to type of organization change, and degree of explicitness	Data gathering	Data gathering to compare the alternatives based on the used metrics
			Time frame estimation	A time frame shows when the initiative is implemented and when benefits are achieved
4	Organizational change identification	Identify the (organizational) changes necessary to deliver the benefits	Alternative analysis	Compare the alternatives based on quantitative and qualitative measurements
5	Determine explicit value of the benefits	Assign financial, quantifiable, measureable or observable value to each benefit	Chose best alternative	Choose the best alternative based on the analysis
			Risk assessment	Assess the risk of the chosen alternative
6	Identify costs	The costs of the project as well as estimated financial returns	Implementa-tion plan	A plan that lays out how the progress can be tracked and the success can be measured
	Identify risks	Organizational risk that is caused by the project		
7			Communi-cation of the case	A plan how the case can be best communicated aligned to the needs of the decision makers

2.2.5 Business case evaluation

As stated before, a big gap in academic research towards business cases exists. An even bigger gap exists concerning business case evaluation. In the reviewed literature (including backward search (Webster and Watson, 2002)), only Ward et al. (2008) give a short remark on evaluation.

The first empirically assessed point they make, is that business cases which overstate the benefits to obtain funding, are least likely to put effort into reviewing the outcome. Moreover, if they do, less than 50% of their business case projects deliver the expected benefits. A good business case should enable the outcome of the investment to be assessed in terms of the benefits delivered, or if they were not achieved, to explain why. Based on their field research, they found that of all the aspects of business case development that differentiate the successful from the unsuccessful, evaluation and review of the benefits was where the differences were most pronounced. Evaluation of business cases can be done by reviewing which benefits were delivered and which not. This followed by explaining what caused the lack benefit delivery and what can be learned from that.

3

Business Modelling: A Meta-Meta Viewpoint

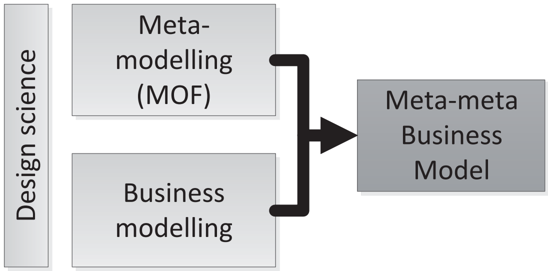

Figure 19: Answering research question 5: A conceptual model for business modelling

In general, a business model is a simple and, usually, graphic depiction of a company, often using boxes and arrows. It mostly describes a single company, a group of companies, or part of a company. In the broadest sense, a business model is an abstract (which means simplified) representation of the company, a "model of the business". The business model field of research is strongly growing and maturing over the last decade, mostly since 2000 (Osterwalder et al., 2005; Zott et al., 2011). Since to this date, no unified view exists regarding its conceptual foundation, this young and emerging discipline is "finding itself in a state of prescientific chaos", in the sense of Kuhn (1970).

Practitioners using business models have a need for a common language, especially since they come from different disciplinary backgrounds: strategic management, industrial organization, and information systems (Pateli and Giaglis, 2004). In addition, links to other research domains are necessary to establish the business model field as a distinct area of investigation (Pateli and Giaglis, 2004). However, researchers still have to build more on each other's work, and research generally advances slowly and often remains superficial (Osterwalder et al., 2005).

Currently, researchers use different terms to describe similar things, and the same term for different things. Business model often means "a model of a single company" and, specifically, of the way a company does business, creates, and captures value. However, other things are called business model as well, for example when referring to a pattern in the phrasing "...the freemium business model..." In addition, ontologies or frameworks such as the Business Model Ontology (BMO), e3-value, RCOV or activity system are sometimes referred to as a business model too (Demil and Lecocq, 2010;

Gordijn, 2002; Osterwalder, 2004; Zott and Amit, 2010). In our research, we refer to such frameworks (BMO, e3-value, RCOV) as meta-business models. We define these analogous to meta-models in software or systems engineering (Van Halteren, 2003):

A meta-business model is the set of concepts that is used to create business models. A business model developed from this set of concepts is an instance of the meta-business model.

For example, a meta-business model may define that "a business model consists of a value proposition, organization, and finances." Thus, the meta-business model defines the rules for building a business model. Consequently, a business model is an instance of the meta-model, following those rules. An example of a meta-business model is the BMO (Osterwalder, 2004), which can serve to make a business model of any company. This business model would be an instance of the BMO. However, the BMO is itself also a model. It is a model for creating business models. As such, it is a "business model"-model or, in modelling terms, a meta-"business model".

Stimulating researchers to build more on each other's work can be achieved by developing instruments for comparing meta-business models. A conceptual framework can help to analyse shared or distinctive features of different meta-business models. *"...A conceptual framework will provide a basis for business model theory development by providing a structure from which researchers can debate, recognize points of agreement and disagreement, identify potential points of integration or linkage along with areas of future research*" (Lambert, 2008).

Consensus on the theoretical underpinnings of the business model concept has not yet been achieved (Al-Debei and Avison, 2010), which undermines its applicability in different contexts. "*...The business model remains a theoretically underdeveloped (and sometimes overloaded) concept, which may raise doubts concerning its usefulness for empirical research and theory building*" (Zott et al., 2011). For future research, more clarity on the theoretical foundation and conceptual consolidation is necessary (Zott et al., 2011).

The articles referenced above are all review articles, specifically aimed at providing an overview of the status and developments of business model research and the emergence of the discipline. From our point of view, the authors discuss the need for a common set of rules to build business models: a common meta-model.

Another area of research, software and systems engineering, has more experience dealing with a great variety of meta-models. Already, this research area has addressed the need for a generic framework to manage, manipulate, and exchange these models. This generic framework is the Meta-Object Facility (MOF), created by the Object Management Group (OMG) (1999). The MOF represents a layering of meta-models (Figure 20) for describing and representing meta-data: data about other data (Van Halteren, 2003). Although it originates from an object-oriented software design domain, the MOF allows the definition of (meta-) models independent of the application domain.

In this chapter, we introduce the meta-meta-viewpoint on business modelling. We introduce a new perspective on business modelling to identify differences and commonalities of business modelling languages and concepts. We use the MOF to create a meta-meta-business model that promotes further theory development of the business modelling discipline. The structure of this chapter is as follows. Having given the motivation in this introduction, we first present the different (meta-)layers for modelling in general and business modelling specific. Second, we provide our methodology for creating the top layer for business modelling. Third, we apply this methodology and create the meta-meta-business model (Me2BM). We validate the Me2BM by comparing several meta-business models with it. Finally, we discuss limitations, future research ideas, and conclude the chapter.

3.1 Meta- (meta-) modelling: Layers for modelling

The Meta Object Facility (MOF) is a generic framework for working with a great variety of models and meta-models, specified by the Object Management Group (OMG). This section clarifies the concept. The central idea of MOF is that every model has one meta-model and multiple instances. The meta-model describes how the model should be built. The instances are also models on their own, but built according to rules defined by the model. In other words, a meta-model is a vocabulary for creating models. Using these notions, we can construct a stack of layers, where layer N+1 is the set of meta-models for models in layer N, and the N-1 layer is the set of instances of the model at layer N.

The account of the MOF given here follows Van Halteren (2003). Modelling data in terms of meta-data can continue indefinitely, in theory, with an infinite number of meta-layers. The MOF is defined as four layers only, M0 to M3, as shown in Figure 20.

- Layer M0 – instances: an instance is the flat data, which can describe a running system's state. This data is an instance of elements in the M1 layer.
- Layer M1 – models: the model provides the vocabulary for the instance. For example, if the instance is a running system, the model is its source code. The model is itself an instance of the M2 layer.
- Layer M2 – meta-model: the meta-model consists of generic elements used for description of the model at the M1 layer. For example, having a system's source code at the M1 layer, the M2 layer is a programming or modelling language such as java or UML. While the M1 layer is an instance of the M2 layer, this layer is again an instance of the even more generic elements of the M3 layer.
- Layer M3 – meta-meta-model: the meta-meta-model consists of the elements providing the most generic vocabulary for the M2 layer. For example, the M3 MOF model, can be used to describe a language such as java or UML. While in theory an

infinite number of meta-layers exists, for our purpose, we follow the M3 layer as standardized in the OMG MOF specification, also called the MOF model.

Figure 20: The MOF layers

The M3 layer is the MOF vocabulary itself. The MOF vocabulary comes from the context of object-oriented formalism in software engineering The MOF model itself consists of only four concepts: classes, associations, packages, data types, and packages. These concepts can be used to create meta-models for object-oriented software, such as the Unified Modelling Language (UML).

3.1.1 Meta layers in Business Modelling

Applying the MOF layers to business modelling leads to Figure 21. It shows how the MOF layers encompass the concepts of business modelling. It is analogous to Figure 20.

- Layer M0 – business (model) instance: In other words, the real world, not a model of it. A specific business or organization at some point in time.
- Layer M1 – business model: the central construct of this research area is a business model, which can describe an organization, situation, or pattern. This business model is built with elements of the M2 layer.
- Layer M2 – meta-business model: the meta-business model provides the vocabulary for a business model. The meta-business model is itself an instance of the M3 layer.
- Layer M3 – meta-meta-business model: the meta-meta-business model consists of generic elements used for description of the meta-business model at the M2 layer.

3.1.2 Simple Examples for each Layer

Starting from the bottom up, many possible examples exist at the M0 layer for business modelling. Examples for this layer are trivial, as they are real-world organizations. This may be organizations, such as a big corporation, or your local grocery store. It may also be a network of organizations, such as a specific supply chain, value network, or industry.

At the first level of abstraction, the M1 layer contains business models. Any business model that describes an organization, situation, or pattern would fit here. Real life

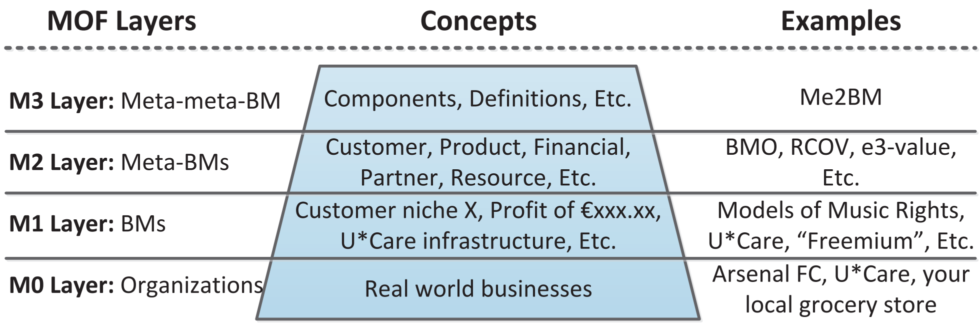

Figure 21: The meta layers applied to business modelling.

examples of a business case as business models are two models of the clearing of music rights for internet radio stations (Gordijn et al., 2005), and modelling of the development of Arsenal FC over a period of eleven years (Demil and Lecocq, 2010). A pattern, such as “freemium”, also belongs on the M1 layer (Osterwalder and Pigneur, 2010).

At a higher level of abstraction, the M2 layer contains meta-business models. They provide the vocabulary for the business models. Previously often called frameworks or even ontologies, examples of meta-business models are plentiful. For example, the music rights case is modelled in two different meta-business models, e3-value and the BMO (Gordijn et al., 2005). The Arsenal FC case is modelled using the meta-business model RCOV (Demil and Lecocq, 2010). Figure 22 provides more examples, while focussing on their components.

Since this is the first time the M3 layer is recognized in business modelling, nobody has presented examples as such at this layer yet. Following the MOF perspective, the M3 layer contains a meta-meta-business model that provides a common vocabulary for meta-business models at the M2 layer. This means that such a meta-meta-business model must consist of generic elements that capture meta-business models, such as the BMO, e3-value, and RCOV. Literature that presents a review of business modelling research, such as Zott, Amit, and Massa (2011), suggest those generic elements. In the remainder, we focus on creating a meta-meta-business model (Me2BM) that belongs on the M3 layer.

3.2 How to create a meta-meta-business model

While an interpretation of business modelling in MOF terminology ensures conceptual consolidation, a meta-meta-business model at the M3 layer would provide a common language for business modelling. The meta-meta-business model would be overarching the meta-business models. This section describes what is necessary to create such an overarching meta-meta-business model. The first subsection describes what exactly should be in this layer. The other four subsections describe each of four steps, which we use to get the content for this layer. The next section provides the results from these four steps. For an overview, Table 21 shows the resulting elements.

3.2.1 What should be in the Meta-Meta-Business Model?

Business modelling is the act of creating a business model; this is an instance of a meta-business model. The instance is a M1 layer model, the meta-business model is a M2 layer concept. Many of these meta-business models exist already, some with a strong link to information systems, others closely related to strategic management or industrial organisation. For example, Vermolen (2010) identified nine such meta-business models published in the top 25 MIS journals. The Business Model Ontology from Osterwalder (2004) was also mentioned previously.

All meta-business models, as M2 models, must follow generic rules for meta-business models. These should be defined at the M3 layer as a meta-meta-business model: Me2BM (Me2 both for meta-meta-). Such a meta-meta-business model does not exist yet; however, as the introduction shows, creating it is what different researchers in the business model discipline are asking for.

The different meta-business models at the M2 layer give a first hint of what this meta-meta-business model looks like. Every model at the M2 layer must be an instance of more generic elements at the M3 layer. The meta-meta-business model must consist of such concepts that it allows the creation of any model that can be regarded a meta-business model.

The required coverage of M3 concepts can be discovered with a commonality analysis amongst different meta-business models. For example, all meta-business models propose some set of components, so one of the concepts of the meta-meta-business model should be components.

Several researchers have in fact performed such commonality analyses. We argue that the meta-meta-business model should come from review literature on meta-business models. As a review synthesizes the concepts used in business modelling literature, the resulting concepts can be considered to be elements of the M3 layer.

Our method consists of a four-step process. Using these four steps, we aim to develop a complete – yet concise – list of elements. The first step is to create a preliminary list of elements. In the second step, we separate elements that we consider composite elements. The third step is the first step that reduces the number of elements; it combines similar elements. In the fourth and final step, we remove redundant elements.

3.2.2 Step 1: Create a preliminary list of classes

The first step, creating the preliminary list of elements, follows the systematic literature review method proposed by Pateli and Giaglis (2004). It consists of the search for literature described previously, and takes the resulting set of publications as the source for the preliminary list of elements.

3.2.3 Step 2: Separating composite elements

The second step, separating any composite elements, is an interpretive activity. We read the definition of each element and decide whether it is composite or atomic. If it is composite, we choose which two or more atomic elements are in it, and adopt a definition for each of these. At the end of this step, we have an extended list of possible elements.

3.2.4 Step 3: Combining similar elements

The third step, combining similar elements, is accomplished by experts' judgment. Several experts study the list of elements and determine which elements are duplicates. If the experts agree, we combine the duplicates, and settle on a definition. This produces a more compact list of possible elements.

3.2.5 Step 4: Removing redundant elements

The fourth and final step, removing redundant elements, is based on logical reasoning. At this stage, several elements will not fit into the Me2BM because they are superfluous. We can reason that these elements do not contribute to the vocabulary of meta-business models; for example, because they act on a different meta-layer, or because the definition of meta-business model includes the element. The remaining elements form a concise and complete list: the building blocks of our Me2BM.

3.3 Elements of business modelling (Me2BM layer)

To obtain a list of elements that fit into a meta-meta-business model, we use the above 4-step method.

3.3.1 Step 1: Five papers lead to a set of classes.

Following the previously described method, we conduct an extensive literature review to find the classes for the Me2BM. For the search process, we use SciVerse Scopus. This search engine provides many search specification options and searches quickly through the world's largest database of title, abstract, and author information of leading scientific journals. We look for articles that deal with meta-business models, by conducting a search with two search terms: 1. *"business model*"* in title, and 2. *"business model*" AND ontology OR ((framework OR e-commerce) AND (design OR analysis))* in title-keywords-abstract. This provides an initial set of 171 journal articles and conference papers.

The initial set of literature is examined more in-depth for presenting a meta-business model or some form of business modelling review. In total, 76 articles present 43 different meta-business models. Other than that, only five articles present a review of business model literature or an (implicit) attempt at creating a meta-meta-business model. These five articles, listed in Table 15, form the basis of our Me2BM.

Table 15: Five articles form the basis of the Me2BM

Authors	*Title*	Year
Pateli and Giaglis	A research framework for analysing eBusiness models	2004
Gordijn, Osterwalder and Pigneur	Comparing two Business Model Ontologies for Designing e-Business Models and Value Constellations	2005
Lambert	A Conceptual Framework for Business Model Research	2008
Al-Debei and Avison	Developing a unified framework of the business model concept	2010
Zott and Amit	The Business Model: Recent Developments and Future Research	2011

From the five relevant publications, we present the elements they use. These elements form the foundation for the Me2BM.

3.3.1.1 Paper 1: A research framework for analysing eBusiness models (Pateli and Giaglis, 2004)

While eBusiness is in the title of their paper, Pateli and Giaglis provide a framework for business models more generally. They provide a bottom-up review approach for defining an analytic research framework for business models. This literature review forms the basis for selecting research, which they analysed to extract eight elements. They state that these are not necessarily exhaustive, as they base them on pattern identification of the analysed previous research. The eight elements are definitions, components, taxonomies, conceptual models, design methods and tools, adoption factors, evaluation models, and change methodologies.

Many definitions exist, yet none is accepted as standard. In their analysis, Pateli and Giaglis mention several possible dimensions of definitions, ranging from the logic of doing business, to components of a meta-business model, to linking strategy and IS. For the components of a meta-business model, they identified three ways of defining BM components, namely top-down analysis and hierarchical decomposition, matrix analysis, and value analysis. Independently of the way of defining the components, most research identifies similar core elements. The taxonomies element found two factors on which to differentiate: classification criteria and object classified. No exhaustive taxonomy for meta-business models yet exists. Pateli and Giaglis identify two streams of research for conceptual models. The first analyses BMs at one layer (ontology), while the second identifies multiple levels and tries to integrate them. Design methods and tools, as an element, covers methods, languages, standards, and software to use in the development (and subsequent leverage) of business models. The sixth element, adoption factors, handles the beforehand analysis of ("to-be") business models to guide them to success. Evaluation models are similar to the adoption factors, except that they assess success with hindsight. Four reasons for evaluation exist: benchmarking, assessment of alternative business models, risk identification, and economic evaluation (of both feasibility and profitability). The final element that Pateli and Giaglis mention is change methodologies. These provide an approach to implementing a new or changed BM (instance) in the organization.

Table 16: Elements for a meta-meta-business model by Pateli and Giaglis (2004)

Definitions
Components
Taxonomies
Conceptual models
Design methods and tools
Adoption factors
Evaluation models
Change methodologies

3.3.1.2 Paper 2: Comparing two business model ontologies for designing e-business models and value constellations (Gordijn et al., 2005)

Having publishes his PhD thesis about the Business Model Ontology (BMO), Osterwalder published an article comparing the BMO and e3-value with his promoter (Pigneur) and Gordijn. They created a comparison framework with parameters based on the work of both Jasper & Uschold (1999) and Pateli & Giaglis (2004). This framework was split in two parts, characteristics and applications.

For characteristics, Gordijn et al. use all the concepts proposed by Jasper and Uschold, a few concepts from Pateli and Giaglis, and add some themselves. From Pateli and Giaglis, they use definition, components, and representation. Gordijn et al. add two concepts: focus of the ontology, and origins. The focus of the ontology has several dimensions. Those that Gordijn et al. name are strategy-operational, technology versus business innovation. The concept origins indicates from which area of research the meta-business model emerged, ranging from business strategy to computer science.

For applications, the following concepts of Pateli and Giaglis are used: evaluation, change methodology, and classification (taxonomy). Gordijn et al. add three concepts: Tool support, visualization, and other applications. Tool support describes which tools were developed to support using the meta-business model. Visualization indicates whether the researchers specified a notation to represent (instances of) the meta-business model, whether textual or graphical. The element other applications is a "catch-all" for the element of applications.

From Pateli and Giaglis, the subdomain conceptual models is not used, as both Gordijn and Osterwalder have been classified on the same layer in this subdomain. One more subdomain of Pateli and Giaglis is not used: adoption factors.

Table 17: Elements for a meta-meta-business model by Gordijn et al. (2005)

Purpose of the ontology
Business model definition
Ontology content & components
Origins
Ontological role
Actors using the ontology
Supporting technologies
Ontology maturity & evaluation
Representation
Tool support
Visualization
Evaluation method for business model instances
Change methodology
Classification
Other applications

3.3.1.3 Paper 3: A Conceptual Framework for Business Model Research (Lambert, 2008)

Among other work on business models, Lambert (2008) presents a conceptual framework for business model research (BMCF). She bases it on the financial reporting conceptual framework (International Accounting Standards Committee, 1989) from the financial accounting field. The BMCF consists of five levels. From the financial reporting conceptual framework, she drops the levels related to regulations and standards, as they do not apply to business modelling. The levels emphasise a hierarchy, the lower levels require the ones above to be completed.

The top-level concept Lambert identifies is the definition of business modelling. She argues that the domain of business modelling must be agreed upon, before discussion on other parts. As part of the domain, she identifies three user groups. The objective of business modelling should include which potential user group to serve. She uses two dimensions for this: level of abstraction, and aspect of the view. In the third level, fundamentals, she includes two parts: Qualitative characteristics of business model information, and elements of business models. The first part, the characteristics, for accounting includes such things as relevance, reliability, understandability, and comparability. Which characteristics are important for business modelling, still has to be researched. The second part, elements, is the list of components and their relations. Lambert suggests that the elements are derived from the previous levels. The element that has primacy of concept should serve as starting point. She argues value proposition has this primacy for business modelling. She discusses the last two levels only briefly. The fourth level, operationals, includes two parts. The first part is about when and how to recognize the elements. The second part focuses on how to measure them. The last level, business model representations, should standardize how to display business model (instances). In addition, Lambert creates an meta-business model, based on the notion of primacy of concept. It is a list of basic business model elements, with a further detailed element, the value adding process. She represents these as the basic and comprehensive business models.

Table 18: Elements for a meta-meta-business model by Lambert (2008)

Definition of Business Modelling
Objectives of Business Modelling
Fundamentals (Qualitative characteristics of business model representations, Elements of business models)
Operational (Basis of recognition, Basis of measurement, Measurement techniques)
Business Model Representations

3.3.1.4 Paper 4: Developing a unified framework of the business model concept (Al-Debei and Avison, 2010)

Recently, Al-Debei and Avison (2010) published an overarching guide to business modelling. In their work, they create a unified framework for business models (BMs) based on twenty-two scholarly descriptions of the business model concept. Their unified framework consists of four upper classes: V4BM dimensions, BM functions, BM reach, and modelling principles.

The first class, V4BM Dimensions, consists of four core components of a meta-business model. The Dimensions identified by Al-Debei and Avison are Value Proposition, Value Architecture, Value Finance, and Value Network. The second class, BM functions, identifies three non-exclusive functions of a meta-business model. 1) A meta-business model may function as an alignment instrument to fill the gap between strategy and business processes (including supporting IS). 2) It may serve as an interceding framework (mediating construct) between technological artefacts and strategic goals. 3) A meta-business model may function as (strategic-oriented) knowledge capital, so it provides (the necessary level of) information if it is made explicit. The third upper class, BM reach, explains the positioning of the BM concept within organizations, as an intermediate layer between strategy and business processes including their supporting IS. The fourth and final upper category covers five modelling principles, which act as guidelines and features for creating BMs. The identified principles are: coherent (represent the business logic comprehensively), conceptual (abstract, covering only key business components), granular (components can be broken down into dimensions to be subdivided into elements), multi-level (a. individual organizations; b. parts of an organization; c. business networks), dynamic (able to cope with continuous change).

Table 19: Elements for a meta-meta-business model by Al-Debei and Avison (2010)

V4BM
BM functions
BM reach
Modelling Principles

3.3.1.5 Paper 5: The Business Model: Recent Developments and Future Research (Zott et al., 2011)

The broad and multifaceted literature review on business models, which forms the core of the paper, is the most up to date review of the relevant literature currently available. The authors use it to examine the business model concept through multiple subject matter lenses. As opposed to the other reviews that we examined, no single figure or table lists the core concepts used. However, they structured their analysis of the literature in such a way, that the subheadings indicate their ten core concepts.

First, they treat the emergence of the business model concept, to analyse where the concept comes from and how it has developed. Second, they handle definitions and point to the lack of definitional clarity. Their review revealed three main objectives for business modelling: e-business, strategy, and innovation. The third concept Zott et al. describe is typologies. Many researchers have focussed on describing generic business models and classifying them. Fourth, they consider components that make up business models. Fifth, they deal with representations. These range from informal textual, to formalized ontologies. Sixth, they tell about strategic marketing, for which business models are often used. The seventh concept, value creation in networked markets, indicates another goal of business modelling. Firm performance, the eighth concept, received plenty attention, as it corresponds to profitability. Especially, it evaluates profitability in a competitive environment. This also relates to the ninth concept, strategy. According to Zott et al., it focuses more on competitive advantage, and less on the role of the customer. The final concept Zott et al. cover is innovation. This goal of business modelling can be achieved in two ways. Either through connecting new technology to customers' needs, or through innovating the business model itself.

3.3.2 Step 2: Separate composite elements

Having presented the results of the literature search, we now follow our method for analysis described previously. It leads to the Me2BM. The first step in this four-step process is to create a preliminary list of elements. These elements are the ones listed in the tables in the previous sections. They all come from the respective publications directly. Together they form our preliminary list.

The second step is to separate elements. Only in the case of Lambert, we separate two elements because they are composites. These are the levels fundamentals and operationals. Lambert also identifies that both of these levels consist of multiple parts.

Table 20: Elements for a meta-meta-business model by Zott et al. (2011)

Emergence	Emergence of the business model concept and Definitions
	Emergence of the business model concept
Definition	Business model definitions
Typology	E-Business and the use of IT in organizations (Business Models for e-Business)
	Description of generic e-business models and typologies
Components	Components of e-business models
Representations	Business model representations
Strategic marketing	Strategic marketing
Value creation in networked markets	Strategic issues (Business Models and Strategy: Value Creation and Value Capturing Through Activities)
	Value creation in networked markets
Firm performance	Business model and firm performance
Strategy	Strategy and the business model
Innovation	Innovation and technology management (Business Models, Innovation, and Technology Management)
	Business model innovation

She splits fundamentals into elements and qualitative characteristics of business model representations. She also divides fundamentals into a part measurement and a part recognition. We follow both these separations.

3.3.3 Step 3: Combine similar elements

In the third step, we combine similar elements. For this purpose we use the design theory framework that Gregor and Jones (2007) propose. Table 21 explains most of this interpretive step. Each of the rows indicates which elements are combined.

The first elements combined are those that describe what the business model is for and what it covers. As these elements are themselves not part of the business model, but provide information about the business model, we also take definition as part of this group in the business model context. This group of elements can be mapped onto the **purpose and scope** element of Gregor and Jones' (2007) design theory framework. The second group consists of the central business modelling construct: components. Gregor and Jones call this **constructs**. The third group of elements describes how the business model is represented or visualized. In Gregor and Jones, this is called **principles of form and function**. The next group contains elements focused at assesing a business model. These elements provide Gregor and Jones' **testable hypotheses**. What Gregor and Jones call **justificatory knowledge** is about what theories are used for the fundaments. The following group of elements is somewhat complicated; it is about business model design as an activity and the tools to support that. This is part of what Gregor and Jones (2007) call **principles of implementation**. In addition, implementation shows some focus on actually using and applying a business model in a company, thus adding adoption factors. Finally, change methodology is also a form of business model design; it is about changing one business model to a new design. The last group of elements that is extensively discussed in the literature is taxonomy. Authors name this taxonomies (Pateli and Giaglis, 2004), classification (Gordijn et al., 2005), operational (recognition) (Lambert, 2008), and typologies (Zott et al., 2011). Every class in a taxonomy is a business model instantiation of a meta-business model. This maps to Gregor and Jones' **expository instantiation**, for it shows how meta-business models are applied.

One of Gregor and Jones' elements is absent in (the reviews of) business model literature: artefact mutability. This element is about modifying a meta-business model, adding or removing a component, combining different meta-business models. A few articles pay some attention to this, but none of the review literature explicitly mentions this.

3.3.4 Step 4: Remove redundant elements

The fourth, and final, step is to remove redundant elements. Only two elements from the preliminary list are redundant in our view. Not because they are inapplicable to business modelling, but because they act on a different meta-layer. The two elements are ontological role, and ontology maturity and evaluation, both from Gordijn et al. (2005). The first element points to layers of modelling, similar to those provided by MOF. Therefore, the ontological role is not part of Table 21, but rather indicates which level in Figure 20 we are looking at. The latter element is not an evaluation of a business model, such as the evaluation methods for business model instances. Rather, it is the evaluation of the maturity of a meta-business model. Therefore, it is not part of Table 21. However, Table 21 can serve as a checklist to measure the maturity of meta-business models. We demonstrate this in the next section. The remaining elements form a concise and complete list: the building blocks of our Me2BM, as Table 21 shows them to the left.

3.4 Validating the Me2BM by comparing meta-business models

The Me2BM, presented in the previous section, will now be applied to compare several meta-business models. This serves as validation of our conceptual framework. The elements of the Me2BM come from business model review literature and design theory (Gregor and Jones, 2007). Whether or not these elements play a role in business modelling is evaluated by checking against meta-business models.

While we identified 43 meta-business models during the literature search, using all of them is impossible due to space limitations. We use the smaller set that Vermolen (2010) identified. The meta-business models are Gordijn's (2002) e3-value, Demil and Lecocq's (2010) RCOV, Hedman and Kalling's (2003) business model concept, Osterwalder's (2004) Business Model Ontology, Zott and Amit's (2010) activity system

Table 21: Elements of the meta-meta-business model

Gregor and Jones, 2007	Pateli and Giaglis, 2004	Gordijn et al., 2005	Lambert, 2008	Al-Debei, Avison, 2010	Zott et al., 2011
Purpose and scope	Definition	Purpose of the ontology	Definition	BM reach	Definition
		Definition	Objective	BM Functions	Strategic marketing
		Focus of the ontology			Value creation in networked markets
		Actors using the ontology			Strategy
		Other applications			Innovation and technology
Constructs	Components	Ontology content and components	Fundamentals (elements)	V4 BM dimensions	Components
Principle of form and function	Conceptual models	Representation	Fundamentals (characteristics of representations)		Representations
		Visualization	Representations (display)		
Artefact mutability					
Testable propositions	Evaluation models	Evaluation methods for business model instances	Operational (measurement)		Firm performance
Justificatory knowledge		Origins			Emergence
Principles of implementation (and design)	Design methods and tools Change methodology	Supporting technologies Change methodology		Modelling principles	
	Adoption factors	Tool support			
Expository instantiation	Taxonomies	Classification	Operational (recognition)		Typologies

perspective, Morris et al. (2005) entrepreneur's business model, Yunus' et al. (2010) social business model, Kim and Mauborgne's (2000) business model guide, Wirtz et al. (2010) 4C typology, and Lumpkin and Dess' (2004) internet business models.

3.4.1 Purpose and scope

This first element to compare meta-business models describes what the meta-business model is for and what it covers. As Table 22 shows, most of the treated meta-business models provide a definition of business model. When they do not, still they make the purpose and scope clear. Demil and Lecocq (2010) give no explicit definition while treating RCOV. However, they indicate that *"the BM is considered as a concept or tool to address change and focus on innovation, either in the organization, or in the BM itself."* Similarly, Yunus et al. (2010) give no definition for their social business model, but explained it as *"close to 'social entrepreneurship', defined by Mair and Marti as 'a process involving the innovative use and combination of resources to pursue opportunities to catalyze social change and/or address social needs'."* For their business model concept, Hedman and Kalling (2003) do not give a definition themselves; instead, they reference three other articles, to produce an initial list of concepts. Kim and Mauborgne's (2000) business model guide also comes without a definition. They use it as management tool.

Table 22: Definitions of meta-business models

Zott and Amit	Activity system perspective	"The content, structure and governance of transactions designed so as to create value through the exploitation of business opportunities."
Gordijn	e3-value	"Constellation of enterprises and final customers that jointly create, distribute and consume things of economic value."
Morris and Schindehutte	Entrepreneur's business model	"A concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets."
Wirtz	4C typology	"A business model reflects the operational and output system of a company, and as such captures the way the firm functions and creates value."
Lumpkin and Dess	Internet business models	"A method and a set of assumptions that explains how a business creates value and earns profits in a competitive environment."
Osterwalder	Business Model Ontology	"A conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm."

This comparison makes three things clear. First, several authors use the term business model without providing a definition. Second, nearly all authors, who do provide a definition, provide a different one. Both of these issues were found and discussed previously. Third, all meta-business models cover this element of the Me2BM in some respect, and differ on it. Therefore, this is a suitable element to evaluate meta-business models.

3.4.2 Constructs

The second element of the Me2BM is central to business modelling, constructs. These make up the components in meta-business models, which are filled in the instantiations. All the treated meta-business models have clear constructs. Figure 22 presents the comparison of the mBMs, based on the components they use. At the top are the ten meta-business models. Below the authors/titles are all the components used in the meta-business model. The horizontal lines connecting components from different meta-business models indicate similarity of these components. Analogue concepts appear on approximately the same height, labelled by a generic name on the far left.

While every meta-business model has some constructs, none of them covers all the generic concepts found. This shows that the meta-business models serve different purposes; the constructs used in meta-business models greatly influence their possible use. The constructs used are one of the most noticeable characteristics of meta-business models. It is relatively easy to recognize the meta-business model of a business model by looking at its constructs only. This signature allows for an, almost intuitive, comparison between meta-business models.

3.4.3 Principles of form and function

The third element to compare meta-business models describes how the business model is represented or visualized. As one of the goals of business models is to communicate, they are expressed in graphical form often. Usually, models and ontologies are strongly connected with a visual element that presents meaning, both in the components and the connections. However, the graphic elements are not always explained well. By looking at the representation, experienced business modellers easily recognize which meta-business model is being used in an instance. The principles of form and function provide visual representation and, therefore, easy recognition.

In e3-value (Gordijn, 2002), every graphic element represents a construct. Both constructs and relations are well defined. Similarly, Osterwalder (2004) goes into great depth to explain the relationships between components. He also elaborates on the constructs, giving them attributes with data-types. Both Demil and Lecocq's (2010) RCOV, and Hedman and Kaling's (2003) BM Concept use causal relations expressed by arrows between constructs. Other meta-business models may provide some graphic representation with arrows between the components, but fail to explain what those arrows mean. Morris et al. (2005), Wirtz et al. (2010), and Lumpkin and Dess (2004) rely on textual explanations, but also make use of tables/matrices to give a better overview.

The comparison shows differences in formality of representations. It also points to maturity of the meta-business models. This element is suitable for comparison, as all meta-business models have some principles of form and function, and the variations in them influence the possible uses.

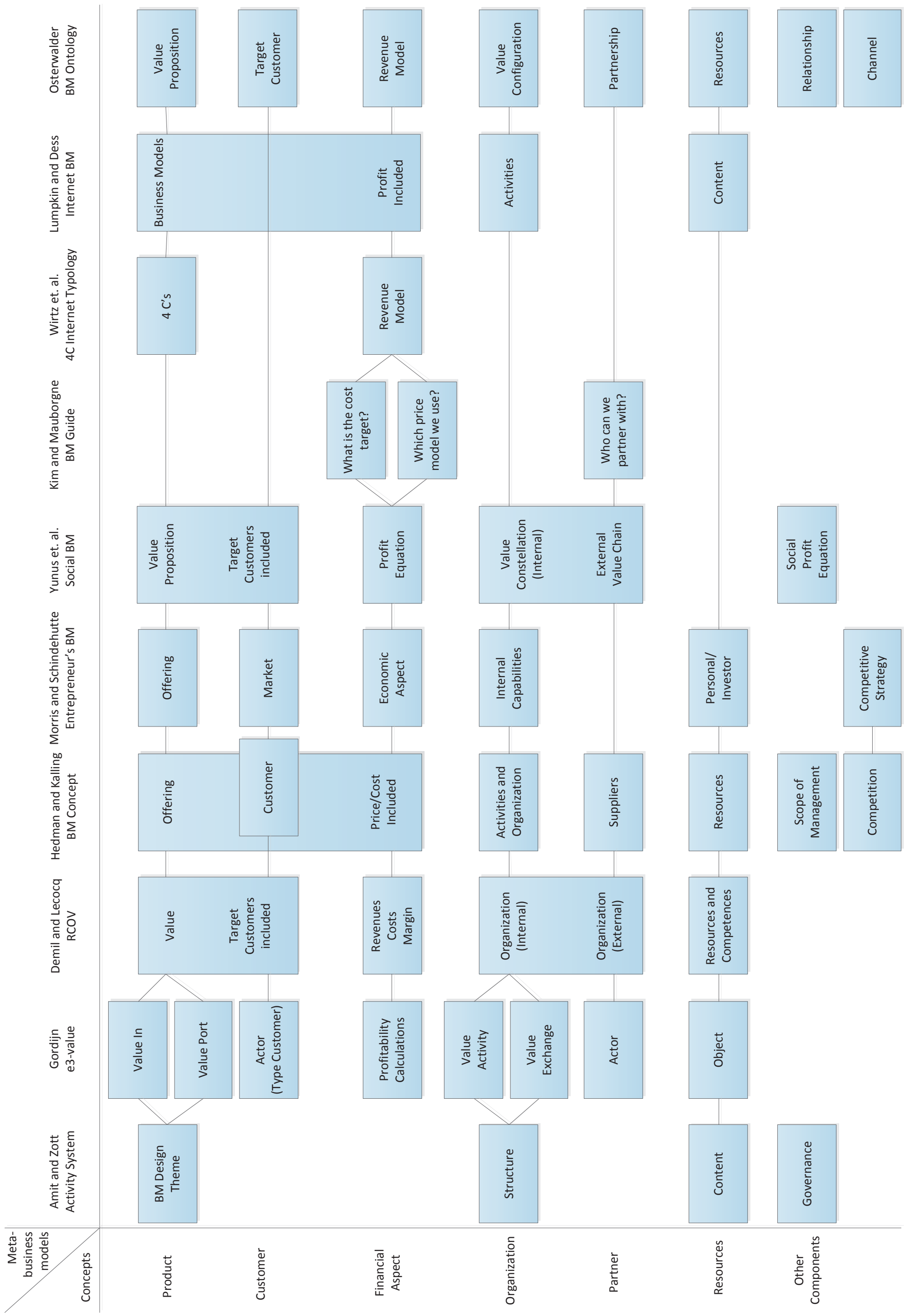

Figure 22: Components of meta-business models

3.4.4 Artefact mutability

The fourth element of Gregor and Jones, artefact mutability, is absent in the reviews of business model literature. This element is about modifying a meta-business model, adding or removing a component, or combining different meta-business models. Few authors touch this subject in the description of their meta-business model. However, they sometimes implicitly handle possible mutations in sections such as discussion, limitations, or future research.

For example, in the validation of the BMO is a section on the completeness it (Osterwalder, 2004). However, this does not go beyond impressions. Later, the appearance of a new version (Osterwalder and Pigneur, 2010) demonstrates that the "artefact" BMO, was "mutated". Other meta-business models may be sensitive to advancing insights as well.

This element reveals part of the flexibility of a meta-business model. While few authors (are willing to) discuss this, it may be relevant to evaluating meta-business models still. If possible changes are thought through in advance, it exposes part of the maturity of the meta-business model.

3.4.5 Testable propositions

The fifth element focusses on assesing a business model (economically). Evaluation models provide ways to measure or predict the viability of a business model and firm performance.

Nearly none of the authors in the set of meta-business models discusses this issue explicitly. Demil and Lecocq (2010) make a remark about it, turning the argument around: "*a model may be said to be consistent when the various choices about its RCOV core components lead to a sustainable performance – profit is the indicator for BM consistency.*" Gordijn and Akkermans (2003, 2001) provide an evaluation model for e3-value, based on assessing incoming and outgoing values of each actor.

While few authors are explicit about methods to evaluate instances of their meta-business models, the financial aspect is a construct of nearly each of them. This shows that the evaluation of business models is either underdeveloped, or underexposed. The second case may be because related areas of research, such as finance and accounting, already focus on this. Nonetheless, this element is important to comparing meta-business models, especially if the situation requires quantitatively assesed business models.

3.4.6 Justificatory knowledge

The sixth element is about what theories are used as fundaments. Also called kernel theories, they indicate the research areas from which the meta-business models came. Only a few authors explicitly mention this in their articles. However, when they do not mention it explicitly, another way to determine this is to look at what research area the authors work in, and what other research they have published.

Zott and Amit (2001; 2010) use management literature mainly. Their work is based on concepts such as virtual markets, value-chain, Schumpeterian innovation, resource-based view, strategic network, and transaction cost economics. Gordijn (2002) combines both computer science and management literature. From computer science, he uses requirements engineering, conceptual modelling, and automated reasoning. From management, he uses value chain and business web. Demil and Lecocq (2010) based RCOV on what they call a Penrosian view of the business model concept, "*adopting Penrose's view of the firm as a bundle of resources…at once dynamic, and based on the interaction between distinct core components.*" Hedman and Kalling (2003) combine strategy theory with business research and ebusiness research. Strategy theory reveals three 'paradigmatic' perspectives: industry organization, resource based view, and strategy process perspective. Morris et al. (2005) describe theoretical underpinnings, using and combining approximately twenty articles on strategy, architecture, and business models. Yunus et al. (2010) base their work on business literature and social entrepreneurship. Kim and Mauborgne (2000) use an elementary understanding of what a business model is. Other publications by them focus on business strategy mainly. Lumpkin and Dess (2004) mainly research entrepreneurship and strategy. Osterwalder (2004) referred to business literature mainly. He models the four main elements after the Balanced Scorecard (Kaplan and Norton, 1992).

Zott et al. (2011) point to several directions of research from which the business model concept emerged. These are information systems, strategy, and innovation. The above shows that the background of the meta-business models closely follow these origins. The justificatory knowledge for the meta-business models gives an indication of their maturity and their field of use. Therefore, it is suitable for comparing them.

3.4.7 Principles of implementation

The seventh element is about business model design as an activity and the tools to support that. In addition, implementation deals with applying a business model in a company and the change methodology to achieve that.

Gordijn (2002) and Osterwalder (2004) describe (electronic) tools used in the development of the meta-business models. Gordijn (2002) also provides a tool for profit calculations after a business model has been designed. Kim and Mauborgne (2000) have analysed over 100 companies, providing a solid base for the tools delivered. Morris et al. (2005) provide three different levels, forcing business model developers to think carefully about implication for implementation. Change methodology is discussed little. Especially in the case of Demil and Lecocq (2010) this appears strange, as they strongly emphasize continuously changing environment a company is in. However, they provide no concrete tools for business model change. Gordijn (2002) talks about "*veritable change methodology that accompanies the user from the deconstruction of an existing business model to the design and reconfiguration of a new business model.*" On the other hand, Doz and Kosonen (2010) hardly create a meta-business model, but instead provide a concrete tool for business model change. They identify three 'meta-capabilities': strategic sensitivity, leadership unity, and resource fluidity. Their Leadership Action Agenda provides five steps per meta-capability.

While most authors cover part of implementation, few of them cover design, tools, and change methodology. Especially, the design activity of business models seems to receive little attention. Often a meta-business model is presented, without instructions on how to fill it in. Tool support makes it easier to develop business models. If business models only serve for communication, change methodology may not have priority. However, if the business model is to be implemented in real live, it is critical. Together, design, tool support, and change methodology influence the suitability of meta-business models for a specific case. Therefore, it is important to compare them on this element.

3.4.8 Expository instantiation

The eighth and final element provides examples of business model instances. They show what a business model looks like. The review literature often treats these in the form of classifications. Every class in a taxonomy is an instantiation of a meta-business model.

When discussing meta-business models, the expository instantiation is often present in the form of a case study. Besides that, several authors provide taxonomies of business model patterns that the meta-business model can express. For example, Zott and Amit (2010) mention four design themes (Novelty, Lock-in, Complementarities, Efficiency), which are more general types of value propositions. The four Cs from the 4C internet typology (Content, Commerce, Context, Connection) are the four main types of value proposition in e-businesses found by Wirtz et al. (2010).

While a single case study shows that the meta-business model is suitable for that case, pattern classifications demonstrate the applicability in a broader spectrum. Assessing meta-business models on this element shows their usefulness in certain settings.

3.5 Discussion

3.5.1 A second dimension of abstraction

At the M1 layer, it is interesting to see that even business models made with the same meta-business model can differ greatly in abstraction. A business model can depict a concrete real-world company, such as your local grocery store. However, a second business model may represent a type of company, and model grocery stores in general. A third business model may be so abstract that it can be considered a pattern, modelling brick-and-mortar stores. Yet, for example, the BMC allows modelling all three of them.

This shows that a second dimension of abstraction exists, and can be further researched, next to the meta-layers.

3.5.2 Meta-modelling/ontology

One element that was not used in the Me2BM is *Ontological Maturity* (Gordijn et al., 2005). While not in itself part of the Me2BM, the Me2BM may be used to score different meta-business models on their maturity. One very crude way of doing this is to take a meta-BM and run it through the Me2BM and see which elements it fulfils. A meta-BM then gets a score of x out of 8, which represents its maturity.

3.5.3 Related work

From the different articles used in Me2BM, the two most recent call for the need for consensus on the theoretical underpinnings (Al-Debei and Avison, 2010) and conceptual consolidation (Zott et al., 2011) in their future research directions. The Me2BM is our way to address this issue and to support this consensus and consolidation. However, in constructing the Me2BM, it appeared that the elements from different articles combined relatively easy. It may thus be said that some consensus and conceptual consolidation in the business model concept already exists. We simply made this explicit by showing connections between several articles.

An important point of discussion and possible future research direction is the business model's relation to strategy. From the business model perspective, strategy is about selecting the right business model for the company. The first step is then to select the right meta-business model. There are two ways to approach this: focus on primacy of concept (Lambert, 2008), or focus on taxonomy. Lambert put primacy of concept on the component *Value Proposition*, meaning that all other components are defined in their relation to the value proposition. This may seem obvious when looking at business model literature, but may not work for every company. In selecting a meta-business model, a strategic question (for a board of directors) may be: "*where does your primacy of concept lie?*" The answer may be "*the product we sell*" or value proposition, but does not necessarily have to be. A company could instead also say: "*our customers*", "*the product*", "*our employees*", "*strategic alliances and partnerships*", or whatever else the company values most. This becomes the most important aspect, and must be represented by the meta-business model used. A company that places conceptual primacy in strategic alliances may be wise to select a meta-business model that features partners as a prominent component or clearly shows network structure.

Another way to go about this is to look at BM patterns and taxonomy. The question then is really about which BM patterns are dominant in a market and which meta-business models allow for modelling those patterns appropriately. The first issue is to collect and define different BM patterns (Fritscher, 2013) and see which patterns are used in which industries and markets. The second issue is in modelling these patterns in different meta-business models. Here it may appear that certain patterns do not model well with certain meta-business models; in that case, the meta-business model is not right for the market that features this pattern.

3.6 Conclusion

This chapter starts by highlighting current issues in business model research as an emerging discipline. We improve the theoretical foundations of the discipline by introducing design theory and the meta-object facility. These two concepts are used to structure existing review literature and create the Me2BM: a conceptual framework to support business model theory development. The Me2BM is validated by checking it against existing meta-business models.

The Me2BM is a combination of existing business model review literature, placed in context of meta-layers using MOF and structured following the components of design theory. The basis consists of the elements identified by various review articles as important lines of research. These elements are on the M3-layer, describing the elements that make up the meta-business models at the M2-layer (Figure 21). Most of the elements describe the same things as some other elements, these are grouped and those groups could all be mapped to the components of design theory (Table 21). The comparison of meta-business models serves multiple purposed: Firstly, the comparison as such provides insight in the meta-business models. Secondly, it gives content to the elements of the Me2BM, and finally it validates the Me2BM by checking it against actual business model literature.

The Me2BM attends to the need for a common language amongst practitioners and strengthens the internal consistency of the business model discipline. This allows for researchers to build more on each other's work, but also to compare meta-business models, analyse shared and distinctive features, and create links to other fields of research. The Me2BM is a conceptual framework that supports further theory development and improves the shared vocabulary used in business modelling. We have shown that, while some aspects of the business model concept yet remain underdeveloped, a lot of consensus already exists.

4

Business Modelling Method: Qualitative to Quantitative

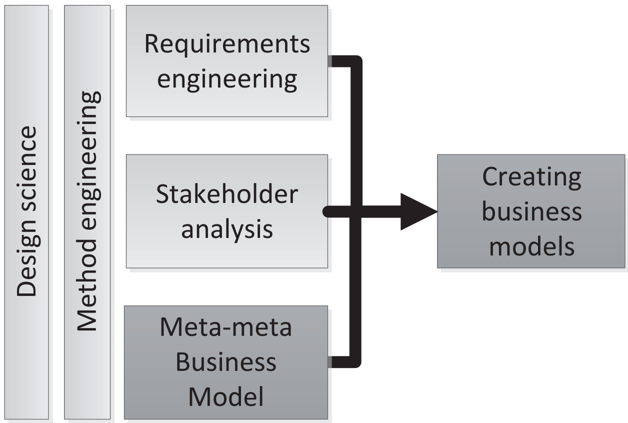

Figure 23: Answering research question 1: How to create business models

Currently, business modelling is more an art, than a science, as no widely accepted method exist for design and specification of business models. This could be an important reason why many IT innovation projects fail to be absorbed in a real life setting. We propose a structured method to create "as-is" business models in a repeatable manner. The method consists of the following steps: identify the involved roles, recognize relations among roles, specify the main activities, and quantify using realistic estimates of the model. The resulting business model reflects the current situation. This is the basis for further analysis of possible business cases, scenarios, and alternative innovations, which may enable successful projects to be implemented, instead of ending on a shelf after the pilot stage. We illustrate the proposed method by means of a case in the healthcare sector.

To the best of our knowledge, no widely accepted methodological approaches exist in the literature for the design and specification of business models (Vermolen, 2010). This is in contrast with well-established approaches, such as TOGAF (The Open Group, 2009), and Unified Process (Jacobson et al., 1999; Scott, 2002), which have emerged in the other, yet closely related, areas of enterprise architecture and information system design. Since the context of our research is the design and implementation of services in the healthcare sector, we particularly look at this issue in relation with healthcare IT projects. A majority of them fail in some sense, according to Kaplan and Harris-Salamone (2009). They recognize that, for systems to be successful, design methods must include organizational, behavioural, cognitive, and social factors. Also, a systematic review of cost effectiveness of telemedicine by Whitten et al. (2002) concludes that "there is no good evidence that telemedicine is a cost effective means of delivering health care" (neither do they present evidence that it is not cost effective). While we do not go into any further detail whether or not telemedicine is cost effective, their review also shows that only a low ratio (55 out of 612) of studies present cost/benefit data. Even from this small amount, only a few did this according to the standards otherwise applied in medicine. This shows the lack of attention the financial aspect of innovations is getting. In the case of telemedicine, previously published research by Broens et al. (2007) indicates one of the reasons for the pilot-illness, namely that financial aspects and organizational aspects are considered only after the pilot phase.

This state of affairs motivates us to propose a method, which enables the development of business models in a structured and repeatable manner. This chapter contributes by proposing a business model development method and illustrating it by means of a case study from the healthcare domain.

4.1 Theoretical Background

A simple analysis of the two words "business model" already gives an idea of what a business model is about. On the one hand, there is "business": the way a company does business or creates value. On the other hand, there is "model": a representation of something – in this case, of how a company does business.

We extend this common and simplistic interpretation of a business model as "the way a company earns money", into a broader and more general definition of the concept: "a simplified representation that accounts for the known and inferred properties of the business or industry as a whole, which may be used to study its characteristics further, for example, to support calculations, predictions, and business transformation."

The last part of the definition above, namely the indication of the possible uses of a business model is of particular importance in the context of this chapter. The method we propose not only facilitates the development of such a design artefact – a business model – but also takes a business engineering perspective. Thus, its application will result in two (or more) business models: one that reflects the "as-is" situation of the business and one or more alternative "to-be" business models that represents possible modifications of the business as result of, for example, adoption of innovative technologies or more efficient business processes.

To the best of our knowledge, such a method does not exist yet for what we define as business models (Vermolen, 2010). In the remainder of this section, we position our work in the context of design science, method engineering, and methodology-related contributions in the field of business modelling.

4.1.1 Business Modelling Related Work

Several contributions in the area of business modelling are related and relevant in the context of this research. Montilva and Barrios (2004) recognize the idea that information system design should consider the enterprise context of these systems, and that it should be enhanced with business modelling elements. They propose three types of models, two of which we discuss as well, namely that of a business model (the "BMM product model"), and that of a process model that specifies the steps to be taken to produce the business model. However, a significant difference exists between these results and our research, caused by the very definition of the business model concept. Thus, Montilva and Barrios' business model concept is closer to that of an enterprise architecture model than to our understanding of the business model concept, both in terms of content and in level of detail. Montilva and Barrios' business model contains rather detailed specifications of elements such as goals, events, business rules and processes, business objects, and technologies, which are typically captured by enterprise modelling languages, such as ArchiMate (Iacob et al., 2009). Furthermore, the process model that Montilva and Barrios propose only focuses on the design of a business model with the sole purpose of serving as source of requirements for the future IS design.

Barrios and Nurcan (2004) follow the same line of thinking in another paper, which focuses on the relationship between business models and enterprise information systems in a changing environment. Nevertheless, neither of the papers mentioned above addresses the issue of quantifying business models and using them to evaluate the business value of the future system by means of one or more business cases or cost/benefit analysis.

4.1.2 Design Science

A business modelling method can be seen as a design-science artefact. It is the process of creating a product, the business model. We use the seven guidelines of Hevner et al. (2004) to frame how we use the methodology engineering approach from Kumar and Welke (1992) to create our method.

The first guideline advises to design as an artefact. Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation. As said, we produce a method.

The second guideline tackles relevance. The objective of design-science research is to develop technology-based solutions to important and relevant business problems. Viable business models lie at the heart of business problems. However, our solution is not yet technology-based. Partial automation of the method is left for future research.

The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods. We demonstrate the business modelling method using a case study.

Research contribution is the topic of the fourth guideline. Effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies. We provide a new artefact to use and study for the academic world. The methodology may be extended, improved, and specialized.

Guideline five expresses the scientific rigour: Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact. We aim to be rigorous through using the methodology engineering approach. Existing, proven methods are used as foundation and methods where applicable. Evaluation was handled in the third guideline.

The sixth guideline positions design as a search process. The search for an effective artefact requires using available means to reach desired ends while satisfying laws in the problem environment. Whenever possible, we use available methods for each of the steps. Following the methodology engineering approach helps us to satisfy the laws for creating a new methodology.

The final guideline instructs us to communicate our research. Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences. This thesis is one of the outlets where we present our research.

4.1.3 Methodology Engineering

Methodologies serve as a guarantor to achieve a specific outcome. In our case, this outcome is a consistent and better-informed business model. We aim to understand (and improve) how business models are created. With this understanding, one can explain the way business models help solve problems. We provide a baseline methodology only, with a limited amount of concepts. Later, we can extend, improve, and tailor the methodology to specific situations or specific business model frameworks.

The business modelling method has both aspects from the methodology engineering viewpoint: representational and procedural (Kumar and Welke, 1992). The representational aspect explains what artefacts a business modeller looks at. The artefacts are the input and deliverables of steps in the method. The procedural aspect shows how these are created and used. This includes the activities in each step, tools or techniques, and the sequence of steps.

We define six individual steps of business modelling, which the rest of this section elaborates. To describe each step, we use the following elements:

- inputs of the steps,
- activities to perform during the steps,
- possible techniques to use during the steps' activities, and
- deliverables resulting from the steps.

Each step in the proposed method requires specific methods, techniques, or tools that are suitable for realizing the deliverables. We will mention examples of those. However, others may also be useful and applicable, and it is not our aim to be exhaustive in this respect. Table 23 shows an overview of our method.

Table 23: Business Modelling Method (BMM)

Step	Inputs	Techniques or Tools	Deliverables
Identify Roles	Documentation, domain literature, interviews, experience, previous research	Stakeholder analysis (Pouloudi and Whitley, 1997)	Role list
Recognize Relations	Role list, Stakeholder map, value exchanges	e3-value (Gordijn, 2002)	Role-relation matrix
Specify Activities	Role-relation matrix, Role list, business process specifications	BPM methods, languages and tools	List of activities
Quantify Model	Process specifications, accounting systems and annual reports	Activity based costing	Total cost of the business "as-is"
Design Alternatives	As-is business model, Ideas for innovations and changes	Business modelling method (steps 1 to 4), Brainstorming	One or more alternative business models
Analyse Alternatives	Alternative business models	Sensitivity analysis, technology assessment, interpolation, best/worst case scenarios	Business case for each alternative

4.2 Creating an as-is model

As mentioned in the previous section, our business model development method takes a business engineering perspective. Thus, the first four steps of our method focus on creating a business model that reflects the current state of the business. Therefore, steps one through four create an as-is model.

4.2.1 Step 1: Identify roles

Identifying the relevant parties (which we refer to as roles) involved in a business model should be done as systematically as possible. The aim is completeness in this case. The business modeller must carry out a stakeholder analysis, to identify all roles. The input to this step includes for example, documentation, domain literature, interviews, experience, and previous research. The output is a list of roles.

For an example stakeholder analysis method, we refer to Pouloudi and Whitley (1997). They provide an interpretive research method for stakeholder analysis aimed at inter-organizational systems, such as most systems where business modelling is useful. The method consists of the following steps:

1. Identify obvious groups of stakeholders.
2. Contact representatives from these groups.
3. (In-depth) interview them.
4. Revise stakeholder map.
5. Repeat steps two to four, until...

Pouloudi and Whitley do not list the fifth step, but mention that stakeholder analysis is a cumulative and iterative approach. This may cause the number of stakeholders to grow exponentially, and the question remains when to stop. Lack of resources may be the reason to stop the iterative process at some point. Closure would be good, but seems hard to achieve when the model is more complex. Probably, the modeller has to make an arbitrary decision. Nevertheless, one should choose stop criteria (a quantifiable measure of the stakeholder's relevance for the respective business model and a threshold for the measure) before starting the process (Pouloudi, 1998).

"Revising the stakeholder map" (step four) could use extra explanation, which can be found in the description of the case Pouloudi and Whitley use to explain the method. The stakeholders gathered from interviews can be complemented with information found in the literature. The business modeller then refines the list of stakeholders by focussing, aggregating, and categorizing.

4.2.2 Step 2: Recognize relations

The second step of our method aims to discover the relations among roles. The nature of these relations may vary substantially, but it always involves some interaction between the two roles, and may assume some exchange of value of some kind. Much of the work and results from the previous step can be reused for this as input. In theory, all roles could have relations with all other roles. However, in practice, most roles only have relations with a limited number of other roles. Usually, these relations are captured in a stakeholder map, which often follows a hub-and-spoke pattern, as the focus is on one of the roles. This pattern may be inherent to the approach used, for example if the scope is defined as a maximum distance from the focal role.

To specify all relations, we suggest the use of a role-relation matrix with all roles on both axes as technique. Of this matrix, the cells point out all possible relations among the roles. Each of the cells could hold one or more relations between two roles. Assuming that roles have a limited number of relations, the role-relation matrix will be partially empty. However, one can question for each empty cell whether a relation is missing or not.

Cells above and below the diagonal can represent the directional character of relations. Usually, relations have a providing and consuming part. The providing part goes in the upper half of the matrix, and the consuming part in the bottom half. This especially helps with constructions that are more complex, such as loops including more than two roles.

The output of this step is a set of relations.

4.2.3 Step 3: Specify activities

For a first qualitative specification of the business model, the next step is to determine the main activities. Relations alone are not sufficient: the qualitative model consists of these main business activities (business processes) too. These activities originate from the relations identified in the previous step. Each of the relations in the role-relation matrix consists of at least one interaction between two roles, requiring activities by both roles. Besides work and results from the previous steps, existing process descriptions can be valuable input. Techniques from business process management may be used.

The output from these first three steps is a first qualitative business model, including roles, relations, and activities. It reveals what must happen for the business to function properly.

4.2.4 Step 4: Quantify model

Quantifying the business model helps us to see what is happening in more detail and compare innovations to the current situation. To turn the qualitative model into a quantitative model, numbers are needed. The numbers are cost and volume of activities (how often they occur). Together, these numbers form a complete view of the costs captured by the business model.

Several sources for costs and volumes are possible, such as accessing accounting systems or (annual) reports. The resulting quantitative business model shows the as-is situation.

4.3 Develop to-be model

The as-is model, created in previous steps, is suitable for analysis of the current state only. However, from the as-is model, it is possible to derive alternatives. Such alternatives can be created to assess how reorganisations, innovations, or other changes influence the business. These are the to-be models.

4.3.1 Step 5: Design alternatives

From here on, we aim to capture a future state of the business in a business model. To make predictions, the model may need further instantiations. Each instantiation is an alternative development that may happen (to-be). Using techniques such as brainstorming and generating scenarios, business modellers create alternative, qualitative, future business models. These alternatives are used to make predictions. Usually, such alternatives are built around a (technical) innovation. This may include allocating specific roles to various stakeholders. A base alternative, which only continues an existing trend without interventions, may help comparing the innovations. Next to the business model, ideas for innovations serve as input. The resulting alternative business models show future (to-be) possibilities.

4.3.2 Step 6: Analyse alternatives

The final step for a business modeller is to analyse the alternative business models. Besides the qualitative business models, several sources of input are possible to quantify the alternatives. Applicable techniques include sensitivity analysis, technology assessment, interpolation, and using best/worst case scenarios. Each alternative can be tested against several scenarios, in which factors change that are not controllable. We can use the models to predict the impact. This step and the previous one can be repeated several times to achieve the best results. The final output is a business case (including expected loss or profit) for each alternative. This is the focus of the next chapter.

4.4 Method demonstration and evaluation: A business model for an elderly care innovation

In this section, we follow the last two steps of the DSRM, demonstration and evaluation (Peffers et al., 2007). We demonstrate the business modelling method with a case study, which we evaluate at the end. To start, 4.4.1 introduces the case. In the subsequent sections (4.4.2 to 4.4.7), we apply the developed method to the case study, from identifying roles to analysing alternatives. Finally, section 4.4.8 evaluates the case study and the method.

4.4.1 Introduction to the case

Due to the aging population and subsequently increasing costs, elderly care - and healthcare in general - is one of the areas where governments fund research. In this case, we focus on an innovation researched in the U*Care project (U*Care Project, 2013). More information on the project is available in Chapter 7, where we use the complete project to demonstrate and evaluate the research in this thesis. For now, it is sufficient to know that it is about technological innovation in elderly care. In this example, we use a single innovation and focus on a single department of an elderly care centre.

4.4.2 Step 1: Identify Roles

The first step of the stakeholder analysis, leads to the identification of several groups of obvious stakeholders. The groups include all the project partners, as their participation in the project indicates their stake. Another group includes the main users of the platform: the clients and employees of the elderly care centre.

After identifying the obvious stakeholders, we contacted and interviewed representatives from all the project partners and several people in the care centre. These interviews did not explicitly focus on stakeholder analysis, but served as a general step in requirements engineering. Table 24 displays a partial list of identified stakeholders after steps two and three of Pouloudi and Whitley's method for stakeholder analysis have been performed (Pouloudi and Whitley, 1997).

Table 24: Partial list of stakeholders after step three of Pouloudi and Whitley's method for stakeholder analysis (Pouloudi and Whitley, 1997).

Clients	Care (& wellness) providers
Volunteer aid	Hospitals
Nurses	Elderly care centres
Doctors	Psychiatric healthcare
Administrative employees	Homecare
General practitioners	Technology providers
Federal government	User organizations
Local government	Insurance companies

The fourth step includes a search for stakeholders in the literature. Besides identifying the extra stakeholders, the literature mentioned the important issue that some actors in the list are individual players, while other actors are organizations or other forms of aggregations (groups). Consequently, overlap can occur in the list of actors.

The final action of the first iteration is not a trivial one. Refining the stakeholder list requires interpretation from the researcher. Different stakeholder theories (for example, from E. J. Emanuel and L. L. Emanuel (1996), J. Robertson and S. Robertson (2000), and Wolper (2004)) act as tools to minimize subjectivity.

The long list of identified stakeholders is not practical to continue with and has much overlap. Therefore, we grouped the stakeholders into a limited set of roles, shown in Table 25. This set of high-level roles is an interpretive choice. The small set helps to keep the rest of case clear instead of overcrowded. The larger set is kept in mind for the to-be situation to find potential "snail darters": stakeholders with only a small chance of upsetting a plan for the worse, but with huge results if they do (Mason and Mitroff, 1981). The small set of stakeholders was subject to prioritization based on Mitchell et al. (1997). While the prioritization is subjective, it shows that all roles in the list are important.

4.4.3 Step 2: Recognize Relations

The current situation consists of five categories of interacting roles. Table 24 shows them on both axes. The cells show relations between the roles. While the care provider has relations with all the other roles, it is not a clear hub-and-spoke pattern. Several of the other roles have relations outside the care provider.

The relations show that a main goal of the business is to provide care to the care consumer. The insurers and government handle much of the payment. Other (regulating) roles of the government remain out of scope, as the case is complex enough as it is.

The insurers handle most of the payments. The patient has to pay the care provider after receiving care. The patient can then declare the costs to the insurance company, which refunds the patient. The patient pays a premium to the insurance company. According to the Dutch Healthcare Insurance Act (Zorgverzekeringswet, ZVW), every citizen has to have basic care insurance (ZVW). For “uninsurable care” (including most home healthcare, similar to USA Medicare), the Dutch government set up a social insurance fund, termed General Exceptional Medical Expenses Act (Algemene Wet Bijzondere Ziektekosten, AWBZ). All employees and their employers contribute towards this fund. The AWBZ is similar to the regular insurance companies, except for collecting the premium. The premium is paid through taxation by the government, which outsources most of the further actions to insurers. A similar system is set up for wellness homecare, such as cleaning. This is the Social Support Act (Wet Maatschappelijke Ondersteuning, WMO). In contrast to the AWBZ, the government takes care of all WMO actions itself, through its municipalities.

Table 25: Role-relation matrix for elderly care

Consumer Provider	Care consumers	Care providers	Technology providers	Government	Insurers
Care consumers	X	Pay for care		Pay for AWBZ Pay for WMO	Pay for insurance
Care providers	Provide ZVW care Provide WMO care Provide AWBZ care	X	Pay for (use of) technology or service	Provide care to citizens	Provide care to insured
Technology providers		Provide technology or service	X		
Government	Provide AWBZ insurance Provide WMO insurance	Pay for WMO care to citizens		X	Pay for AWBZ care to citizens
Insurers	Provide insurance Refund AWBZ and ZVW care			Ensure AWBZ care for citizens	X

Several issues exist, which we do not handle in detail here. For example, it is inherent to insurance that not all people who pay premium are also (currently) care consumers.

4.4.4 Step 3: Specify Activities

Most of the relations between the roles in Table 25 are described using verbs. This signals that they are (part of) behaviour. Any relation not beginning with a verb is a candidate for rephrasing or being split into smaller parts.

Besides the relations, we focus on AWBZ to identify the main activities of the care providers. "Providing care" has four top-level activities: personal care, nursing, guidance/assistance, and accommodation. Each of these activities consists of many detailed activities. An example of a further refinement and specification of the personal care activities can be obtained from documents made available by the government for reimbursement purposes (Ministry of Health, Welfare and Sport, 2008). Figure 24 shows the qualitative model for AWBZ care in the Netherlands, as described above. Figure 25 shows a filled in business model canvas for the specific care provider that we focus on in the remaining sections, an elderly care centre.

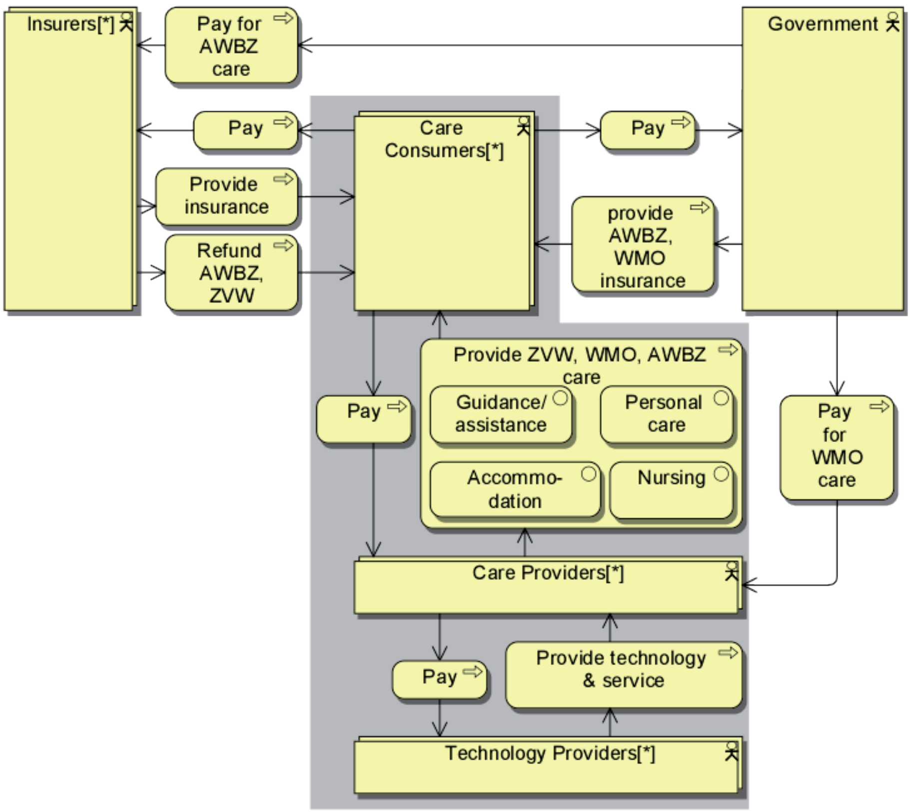

Figure 24: A model for healthcare in the Netherlands, including actors, relations, and activities.

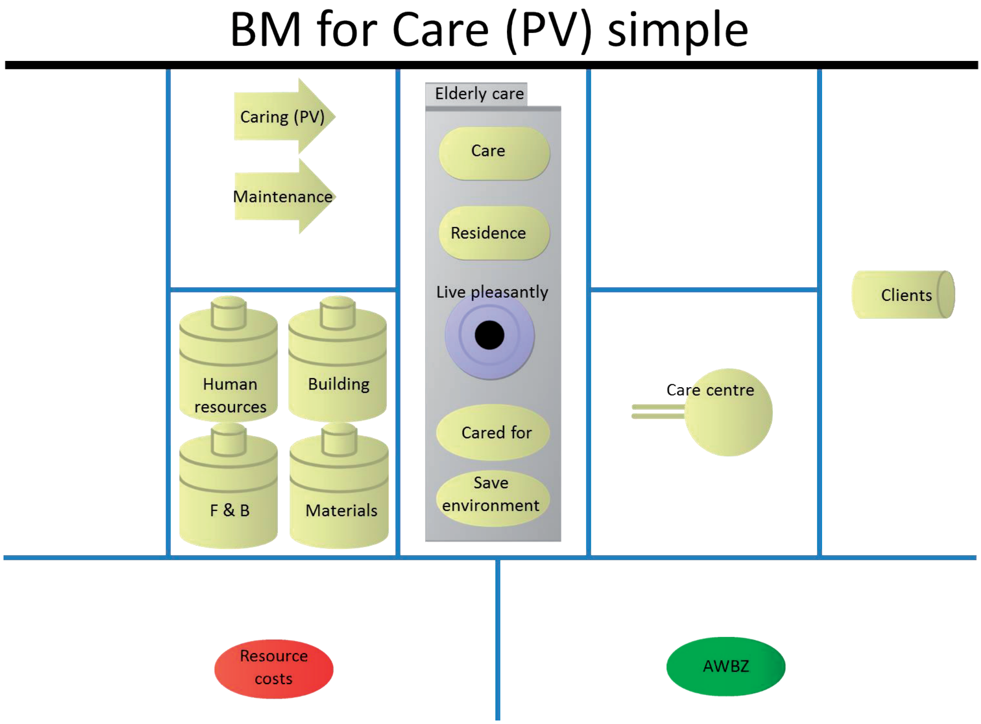

Figure 25: Simplified business model for an elderly care centre

4.4.5 Step 4: Quantify the Model

As we are interested in the actual healthcare and not so much in the insurance business, we zoom into the care provided by the care providers to the care consumers, as Figure 24 highlights. We scope this further to the AWBZ care that a home for the elderly provides. This is mainly personal care, and accommodation. Accommodation has two components, similar to those you would find in a hotel: food-related and living quarters. Personal care consists of many more activities.

For the U*Care case, we use the numbers of one department of a home for the elderly from Orbis Medisch en Zorgconcern. For confidentiality reasons, we have manipulated the numbers. However, they still represent such a department. The department houses 63 people, with an average care indication of “four” for the AWBZ care. This means that the care provider gets approximately € 100 per person per day. Therefore, the annual revenues of this department are approximately € 2.3 million (= 63 people x 365 days x € 100).

Table 26: Costs for a department in a home for the elderly (x € 1,000).

Food-related	250
Living quarters	510
Management	100
Personal care	910
Total costs	1,770

The total costs, which can be related directly to this department, are approximately € 1.8 million. This includes personal care, accommodation (both food-related and living quarters), as well as management. Table 4 shows these costs per component. The difference, of € 0.5 million between the revenues and the total costs, comes from costs that cannot be related directly to the department. It includes costs incurred by the overarching organization, such as cost of capital and other overhead costs.

Indications of volume (times a day, and minutes spend), which the government uses for reimbursement purposes, provide a further step to quantifying the model. With this information, we can assign costs to each of these activities, which the caregivers perform. We focus on this, as it is the largest part of the costs (95% of the personal care costs arise from human resources), and this is the area on which innovations can have the greatest influence.

The caregivers in this department combined work for approximately 30 FTE (Full Time Equivalent, which is 36 hours per week in the Dutch healthcare). So a total of approximately 154 hours can be spent per day (= 30 FTE x 36 hours / 7 days per week). The last column in Table 5 is the amount of hours caregivers spend on each medication activities per day.

Table 27: Personal care activities for medication, according to the Ministry of Health, Welfare and Sport (2008), extended with the amount of elderly in need of each activity, leads to the total amount of time spend on each activity daily.

Activity	Actions	Time in minutes	Frequency per day	Elderly in need	Hours per day
Medication	Present medicine	5	3x	48	12
	Administer medicine (oral)	5	3x	15	3.75
	Apply medical patch	5	2x	10	1.7
	Administer eye, ear, or nose drops. Administer medicine (non-oral)	10	2x	6	2
	Nebulise medicine	20	1x	3	1

An average hour of care costs approximately €15 (= €910,000 x 95% / 30 FTE / 52 weeks per year / 36 hours per week). Together with the hours spent per day, we can now calculate the costs of each activity. For example, the most expensive activity is presenting medicines. A total of 12 hours is spend on this each day, therefore the costs

per day are approximately €180 (= 12 hours x €15 per hour). This is approximately 8% of the total costs of personal care each day.
The same calculations can be made for the other activities and for the other costs of the home for the elderly, such as accommodation. It results in a complete quantitative business model of the current situation. For this case, we do not go into further detail.

4.4.6 Step 5: Design Alternatives

To come up with alternatives, we conducted interviews, held workshops, and constructed several scenarios for the U*Care project. Each of the scenarios features one or more innovations for a home for the elderly (Klooster et al., 2011)(Mohammad Zarifi Eslami et al., 2010).

For this case, we consider two scenarios: 1. keeping the current situation and 2. introducing a medicine dispenser. We focus on the scenario that includes the introduction of an electronic medicine dispenser. This innovative dispenser can present pre-packaged medicine to elderly on the right time and in the right dose. Using sound and light signals, it attracts the attention of the elderly. Besides this, it registers when the medicine is taken. Optionally, it can notify a caregiver if the medicine is not taken on time.

The expectation of the scenario designers is that the introduction of the electronic medicine dispenser will decrease the costs of care. To achieve this, it reduces the time

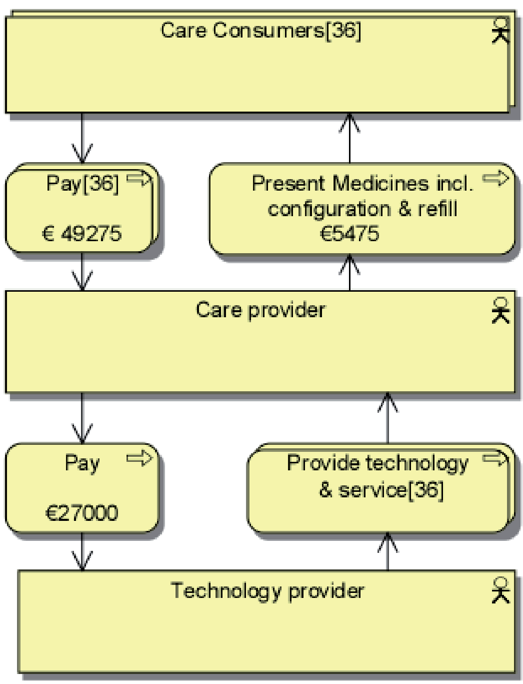

Figure 26: Alternative model for presenting medicine with an electronic medicine dispenser.

caregivers spend on presenting medicine, as elderly can get the medicines from the dispenser instead.

Of course, the introduction of the dispenser also brings along new costs. The dispenser has to be obtained, maintained, configured, and refilled. The dispenser will be leased from and maintained by a technology provider. The caregivers get to do extra activities in the form of configuring and refilling the dispenser for the elderly. Figure 26 and Figure 27 show models of the new situation.

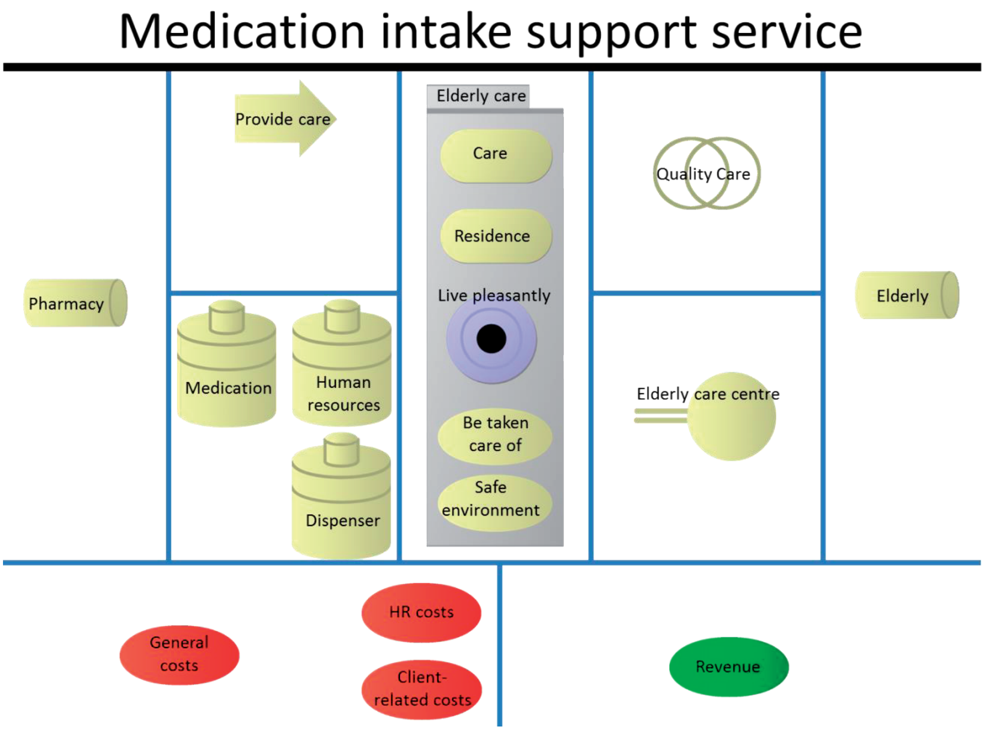

Figure 27: Business model alternative for presenting medicine with an electronic medicine dispenser.

4.4.7 Step 6: Analyse Alternatives

From a management perspective, the dispenser should only be introduced if the benefits exceed the costs. For this case, we only include monetary benefits and costs, as these can be quantified in a straightforward fashion. In contrast, potential benefits, such as quality of care, are hard to quantify. We assume the introduction of the electronic medicine dispenser does not result in a change in the quality of care.

The benefits arise from a reduction of the time spend on presenting medicine to the elderly. It is estimated that 36 (75%) of the elderly that currently get their medicines presented can make use of the dispenser. Therefore, the dispenser reduces the time spend on presenting medicine by 9 hours per day (= 12 hours x 75%). This amounts to € 135 saved each day (= 9 hours x € 15 per hour) or € 49,275 per year.

The costs of the innovation come in two forms. First, a fee paid to the technology provider for leasing and maintaining the dispenser. Second, time spend by the caregivers on the extra activities of configuring and refilling the dispenser. The fee for the technology provider is € 750 per year per dispenser. This amounts to € 27,000 per year (= € 750 x 36 dispensers). The time spend on the extra activities is estimated to be on average about an hour per day. We base this on configuring and refilling of the dispenser once a week, which takes twice the time that presenting the medicine normally takes. Therefore, the costs of this time is approximately € 5,475 (= € 15 x 365 days). The total costs for introducing the electronic medicine dispenser are approximately € 32,475 (= € 27,000 + € 5,475).

As the (monetary) costs of the introduction (€ 32,475) are less than the benefits (€ 49,275), the business case seems to be positive (by € 16,800). Therefore, we can recommend introducing the electronic medicine dispenser.

4.4.8 Evaluation

The presented case shows how the business modelling method results in a quantitative business model of the current situation, as well as the target situation.

The case first provides a high-level model of the elderly healthcare business in the Netherlands. To assess the particular innovation, we went into depth on only a small area, a single department of a home for the elderly. For other innovations, maintaining a higher-level view may be necessary.

The case is simplified and it also contains estimations. For example, we simplified the case by leaving out actors, such as the pharmacist, and start-up costs, such as training costs for the dispenser. Estimations include numbers that were not available, such as the amount of elderly that need an activity, or exact times spend on them.

4.5 Summary

The business modelling method provides a way to create business models. Innovators can apply the steps to create business cases for their ideas systematically. This helps them to show the viability and get things implemented.

We provide a new design-science artefact to use and study for the academic world. As business modelling has several goals, conducting only the first few steps may be enough. For example, if your goal is to achieve insight in the current state only, the last two steps are not useful.

The business modelling method may be extended. Situational method engineering seems suitable for this (Henderson-Sellers and Ralyté, 2010). For example, for information system development, it is interesting to research if steps towards enterprise architecture can be made from business models. This can be seen as a higher-level form of, or preceding step to, the BMM proposed by Montilva and Barrios (2004). On the other side, a step could be added before identifying roles. Other domains may require different improvements.

In addition, the steps in the method can be further specified. The steps can be detailed further. One of the ways to do this is to tailor the techniques at each of the steps of this method. In the future, new tools and techniques may help provide partial automation.

5

Creating a Business Case from a Business Model

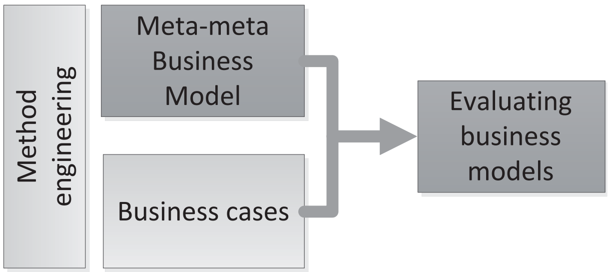

Figure 28: Answering research question 2: How to evaluate business models

Due to shortening product lives, intense global competition, a disruptive and agile environment, business models need to be renewed more rapidly and more frequently (Chesbrough, 2007). In addition, the chosen course of action is of great importance for the future performance of organizations. With the renewal of business models, multiple possible directions can be defined. A recent example is seen in the automotive industry. Car manufactures need to choose if they want to produce cars running on alternative energy, and next, which type of energy. Hybrid, bio-fuel, electric, or hydrogen are all options. Making the choice is hard, for each of the alternatives require a business model change and the success of the produced car is unsure. This is an example of the need for a method to objectively compare alternative business models, and choose the best course of action.

A business case can be of help to form the answer to this question. A business case is a tool for identifying and comparing multiple alternatives for pursuing an opportunity and then proposing the one course of action that will create the most value (Harvard Business Review Press, 2010). Making a business case for the defined possible business model alternatives, gives the decision makers a solid and objective as possible basis, to make the best choice.

Choosing one of the business model alternatives, should be well considered. Instead of a gut feeling, each of the alternative's consequences, impact, risks, and benefits for the organization, should be assessed as objectively as possible. This will result in a better choice, resulting in better organizational performance.

However, the main problem is that it is unclear how alternative business models can be compared to choose the best course of action. A business case could be one of the solutions, for it compares alternatives in terms of costs, benefits and risks. Existing problems are that it is unclear how a business case should be made from a business model. Also, it is unclear what good business case components are, and which business model components are of relevance for the development of the business case.

5.1 Developing a business case method

The research design is based on the design science research methodology (DSRM) by Peffers et al. (2007). This method is chosen because it creates an artefact as solution to a problem. In this research, the problem is the unstructured decision making of potential business models. The artefact designed is a business case method which enables objective comparison of business models. Further, the DSRM enables process iterations, so that it is possible to adjust previous phases to increase the quality of the artefact. However, because the review of academic literature is less emphasized, the method is adjusted to include the valuable academic literature in the process. For the literature study, the five-stage grounded theory method for rigorously reviewing literature by Wolfswinkel et al. (2011) is used. This method assures solidly legitimized, in-depth analyses of empirical facts and related insights, including the emergence of new themes, issues and opportunities (Wolfswinkel et al., 2011). Figure 29 shows the five sequential phases integrated with the DSRM method.

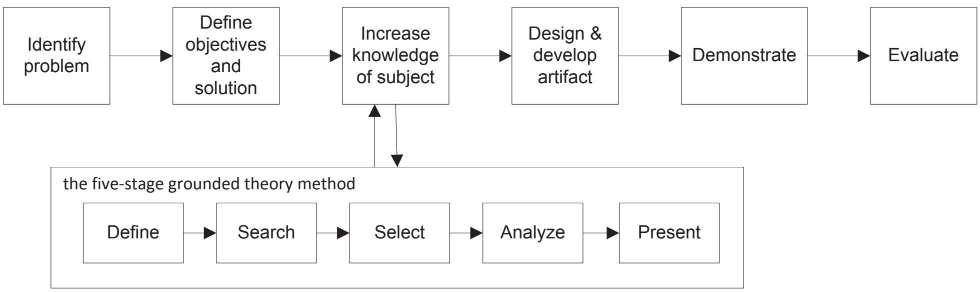

Figure 29: DSRM process of Peffers et al. (2007) with the grounded theory method from Wolfswinkel et al. (2011)

Starting with the first phase of the DSRM of Peffers et al. (2007), the introduction to this chapter identifies the problem. Namely, the need to objectively compare business models. Following the DSRM, we identify the research objective: design a structural method to create a business case of business models, to be able to objectively compare the assessed business models, and choose the best alternative. In chapter 2, section 2.2 provides the literature review of business cases, which increases our knowledge on the subject.

This chapter focusses on the remaining phases. Section 5.2 provides the design of the business case method, the artefact. The components of the method are further clarified in section 5.3. When the method is clear, we demonstrate it in section 5.5 using an example case study. Finally, section 5.6 provides an evaluation of the method.

5.2 The business case method

This section creates a new artefact in the form of a business case method. The design of our business case method is based on the two approaches identified by the literature review in chapter 2. Ward et al. (2007) and the Harvard Business Review Press (2010) both have a list of components. These lists partly overlap, yet each has distinct advantages and disadvantages. Section 2.2.4.3 describes the differences of which Table 14 gives an overview. Based on the comparison of these two approaches, eight main components can be identified. Table 28 lists them.

Table 28: Components of the business case method

1.	Business driver	The cause, problem, or opportunity that needs to be addressed
2.	Business objectives	The goal of the business case stating which objectives are aimed for
3.	Alternatives	Representing the options to reach the objectives
4.	Effects	Positive and negative effects that come with the pursued alternative
5.	Risks	Risks that come with the pursued alternative
6.	Costs	Costs that come with the pursued alternative
7.	Alternative selection	Based on gathered data the best alternative is chosen
8.	Implementation plan	Plan which explains when and how the alternative is implemented

In contrast to the business case method proposed by (Ward et al., 2007), this method does take alternatives into account, similar to the model of (Harvard Business Review Press, 2010). This is because in most cases more than one solution can be thought off and applied to reach the goal. Therefore, it would be bad to go with the first possible solution without putting some effort in the quest for other compelling solutions.

Furthermore, the fourth point, alternatives, is different from the business case methods proposed in the reviewed literature. There, the authors only look to the benefits that the proposal brings. Of course, the benefits are important for the business case. The possible negative effects, however, cannot be dismissed. Therefore, a good overview of not only the benefits but also the disadvantages should be presented in the business case as an overview of the caused effects of the proposed project. According to (Ward et al., 2007), organizations who overstate the benefits to obtain funding are the least likely to review the outcome and less than 50% of their business case projects deliver the expected benefits resulting in unsatisfied senior management.

5.3 Business case component clarification

As the components are the main concepts of the proposed method, we clarify all eight of the components individually in this section.

5.3.1 Business drivers

The meaning of the business drivers originates from the business case method by (Ward et al., 2007) and has not changed. The business drivers stand for a statement of the current issues facing the organization that need to be addressed. These can either be problems or opportunities and ideas with enough potential to make it worth pursuing. Applied to business models, the business driver is most likely to originate from the need for business model innovation. (Chesbrough, 2007a) argues that due to shortening product lives, even great technologies can be relied upon no longer to earn a satisfactory profit before they become commoditized. Practice has learned that even great business models do not last forever. Therefore, he argues, a company needs to think hard about how to sustain and innovate its business model. For future markets will be smaller, more highly targeted (and effective), and the new environment will require different processes to develop and launch products successfully.

5.3.2 Business objectives

The business objectives are the goals of the innovation. Both methods discussed in the theoretical framework advice to set business objectives. They state which business drivers are addressed and how these are hoped to be achieved with the proposed project. This can be one or more specific aspects of the strategy that need to be improved or modified; one or more of the business model components that need improvement; or processes or products that need to become more efficient and better address the needs of customers.

5.3.3 Alternatives

The alternatives represent the available options to reach the objectives. Section 5.2 describes the reasoning to include identification and assessment of alternative solutions in the method. Summarized, the argument is that it would be unwise to go with the first idea that comes along that addresses the business drivers, without investigating whether other, perhaps better, alternatives exist.

Sometimes, the benefits of a single specific opportunity or idea are assessed. In such cases, it might be hard to find a substitute or alternative to the opportunity. Thinking of alternatives and assessing them increases the chance of pursuing a better-balanced alternative, instead of the first that comes to mind. All alternatives need to be compared with the current situation.

Amongst others, identification of alternatives can be done by assigning a senior manager with the task to define and launch business model experiments (Chesbrough, 2007a). (Harvard Business Review Press, 2010) proposes brainstorm sessions as a tool to identify alternatives. Both tools can be used to identify alternative business models. Next to those tools, market assessment tools or SWOT analysis may be suitable to come up with alternatives.

5.3.4 Effects

The effect component is the largest of all. This is because a variety of actions needs to be performed with the effects to create a consistent and structured overview of the effects on the organization per alternative. Effects are the positive (benefits) and negative (disadvantages) effects that an alternative causes. First, effects need to be identified. Second, it is important to come up with measures for each effect. Third, each effect must be connected to an owner. This increases involvement with the project within the organization, and stimulates owners of benefits to help establishing the alternative when it is approved. Fourth, each effect needs to be placed in the framework in Table 13 (Ward et al., 2007). For each effect, the framework determines the type of organizational change (do new things, do things better, or stop doing things) and the degree of value explicitness (from observable to financial).Fifth and final, a time frame is estimated per alternative. This time frame gives information of when the project starts, when it delivers results, and when the project finishes. Each alternative goes through these five steps.

5.3.5 Risks

The fifth component is concerned with risk assessment of each alternative. Risk is defined as the probability that input variables and outcome results vary from the originally estimate (Remenyi, 1999). How risks are assessed depends on the situation and needs further research per case. Amongst many others, the "best case/worst case scenario" method can be used to assess the risk of the alternatives. With this method, two scenarios are developed and the effects of each scenario on the organization are estimated. In the first scenario, the alternative will perfectly result in the expected benefits. In the second scenario, the worst reasonable possible situation will evolve caused by the alternative.

5.3.6 Costs

Costs are one of the most important aspects of a business case. The costs give an indication of the total expected investment costs, and expected profit over a specific time period. The investment costs represent the money needed to implement the business model change in the organization. Also, in the costs section, the expected payback time is calculated to indicate how long it will take for the break-even point is reached.

5.3.7 Alternative selection

After gathering the data for all alternatives in the previous steps, the best option can be chosen by weighting the expected effects against the expected calculated costs. (Harvard Business Review Press, 2010) suggests that the best alternative is partly chosen based on feelings. However, if the risks are translated into expected costs, this can be added to the costs-effect equation. Then the alternatives have to be compared based on the non-financial effects and the total expected costs/profit of the alternative. Many methods to do this exist, varying from complex to rather simple. For example, the direct-rating method, point-allocation method, and analytical hierarchy process (Van Ittersum, Pennings, Wansink, & Van Trijp, 2004).

A rather simple three-step method could be derived from the direct-ranking method. First, all effects and cost/profit numbers are listed together. Second, positive effects and profit are ranked according to importance relative to each other from “0-100”. Negative effects and costs are ranked relative to each other on a scale from “-100 – 0” as well. Third, the values of the effects and cost/profit per alternative are added up. The alternative with the highest total score wins.

5.3.8 Implementation plan

Now that the best alternative is selected, it is important to develop a plan of action. Tasks, roles, objectives, resources, dates, and responsibilities are parts of this implementation plan. The level of detail of an implementation plan varies depending on the case. The plan lays out how progress can be tracked and success measured when the proposed solution is put into action. Without this, actual success of a business case is hard to verify.

5.4 Connecting the business case method to business modelling

While sections 2.1 and 2.2, in chapter 2, describe business modelling and business cases respectively, and the previous section develops a business case method, this section relates these subjects. To start, we place business model in an organization. Later, this supports better understanding of which organizational parts are influenced by a renewed business model, and what parts cause a change in the business model. Then, we discuss the concept of innovation in more depth, and relate it to business models. Next to innovation, we discuss other causes that lead to changes in business models. Finally, we relate business modelling to the newly developed business case method.

5.4.1 Business models and organizations

As discussed in the theoretical framework of business models in chapter 2, Casadesus-Masanell & Ricart (2010) present a framework to separate and relate the concepts of strategy and business models. They argue that a business model is a reflection of the firm's realized strategy. Therefore, business models are on a lower abstraction level than strategy. Strategy is, according to them, often defined as a contingent plan of action designed to achieve a particular goal. Porter states that strategy is the creation of a unique and valuable position, involving a different set of activities. Further Casadesus-Masanell & Ricart (2010) argue that the word "creation", in Porter's definition, implies a choice as to the particular way in which the firm competes. Thus, while the resulting business model created through strategic "creation", this "creation" is a reflection of the strategy, and not the strategy in itself. Consistent with this notion, strategy refers to the contingent plan as to what business model to use. Strategy is a high-order choice that has profound implications on competitive outcomes. Choosing a particular business model means choosing a particular way to compete, a particular logic of the firm, a way to operate and create value for the firms stakeholders.

Next to strategy and business model, the meaning and position of tactics need to be defined. Casadesus-Masanell & Ricart (2010) refer to tactics as the residual choices open to a firm by virtue of the business model that it employs. To illustrate this, they use the example of the free newspaper Metro. This newspaper is free for the reader and is completely ad-sponsored. Per region, Metro can make choices about its advertising rates, as well as the number of ads and pages in each edition, the balance between news and opinion pieces, and so on. All of these choices are part of Metro's tactics. However, its business model dictates that it must be available to readers for free. This way is precludes Metro from using selling price as a variable that can be changed depending on the intensity of competition and other factors. Therefore, price does not belong to the set of Metro's tactics. It resides at a previous choice. Figure 30 shows these relations between the concepts of strategy, business models, and tactics. Figure 10 in chapter 2 provides a more elaborate view of this framework.

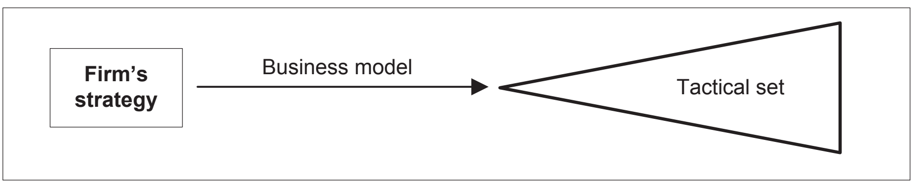

Figure 30: Relations between strategy, business models, and tactics according to Casadeus-Masanell and Ricart (2010)

5.4.2 Innovation as a common factor

In the face of discontinuities and disruptions, convergence, and intense global competition, companies now need to transform their business models more rapidly, frequently, and far-reaching than in the past. Shortening product lives mean that even great technologies no longer can be relied upon to earn a satisfactory profit before they become commoditized. Today, innovation must include business models, rather than just technology and R&D (Chesbrough, 2007a).

Business model innovation is important for an organization to adapt to the continuously changing market it operates in. Yet, what is meant with innovation? According to Garcia & Calantone (2002), in just 21 empirical studies in the new product development literature, over fifteen constructs and at least 51 distinct scale items have been used, which model product innovativeness. A commonly used typology of innovation is described in the book: "Driving growth through innovation" by Tucker (2002). He defines innovation as: "Bringing new ideas to life". In its simplest definition, innovation is coming up with ideas and bringing them to life. Creativity and innovation are often used interchangeably. But this should not be, because while creativity implies coming up with ideas, it is the "bringing ideas to life" part of this simple definition that makes innovation the distinct undertaking it is (Tucker, 2002).

The purpose of innovation strongly correlates with the value proposition of a business model, for the purpose of innovation is to create new customer-perceived value. Tucker (2002) differentiates both types and degrees of innovation in three parts, as Table 29 shows, where it is applied on the McDonald's case.

Table 29: Innovation opportunity grid: the McDonald's case (Tucker, 2002)

Degree / Type	Product	Process	Strategy
Breakthrough	Big Mac	Consistency	Global expansion
Substantial	Value meals	Hamburger University	Opening for breakfast
Incremental	Green Milkshake for St. Pat's day	New French Fry cookers	Boston markets acquisition

5.4.2.1 Innovation types

The three types of innovation are product, process, and strategy innovation. Product (or service) innovation is the result of bringing to life a new way to solve the customer's problem that benefits both the customer and the company. In the McDonald's case, this is the Big Mac: A tasteful fast-food product for a low price.

Process innovations increase bottom-line profitability, reduce costs, raise productivity, and increase employee job satisfaction. The unique trait about process innovations is that they are out of view of the customer most often; they are back office changes. Only when a firm's processes fail to enable the firm to deliver the product or service expected does the customer become aware of the lack of effective process. An example is the consistency of products and tastes around the world at all McDonald's locations. Everywhere, the products are made according to the same process and with the same raw-materials, resulting in the same product experience all over the world.

Strategy innovation is about challenging existing industry methods of creating customer value to meet newly emerging customer needs, add additional value, and create new markets and new customer groups for the company (Tucker, 2002). An example of this is also given in the McDonald's case. In earlier times, McDonald restaurants only provided meals that could be used as lunch or dinner. Introducing breakfasts required a completely new product line, opening times, and customers.

5.4.2.2 Innovation degrees

Figure 31 shows the three degrees of innovation defined by Tucker (2002): breakthrough, substantial, and incremental innovation. Breakthrough innovations are defined as the commercialization of products and technologies that have strong impact on two dimensions. The first dimension is the market, in terms of offering completely new customer benefits. The second dimension is the company, in terms of its ability to create new business.

Substantial innovations are mid-level in significance to both market and the company. The innovation falls short of being a breakthrough, but enables and ensures that the organization meets or exceeds its goals to grow the business and increase market share.

Incremental innovation has the smallest impact and requires the least amount of change. It uses existing forms or technologies as a starting point. Either it makes incremental improvements to some thing or process, or it reconfigures it so that it may serve some other purpose.

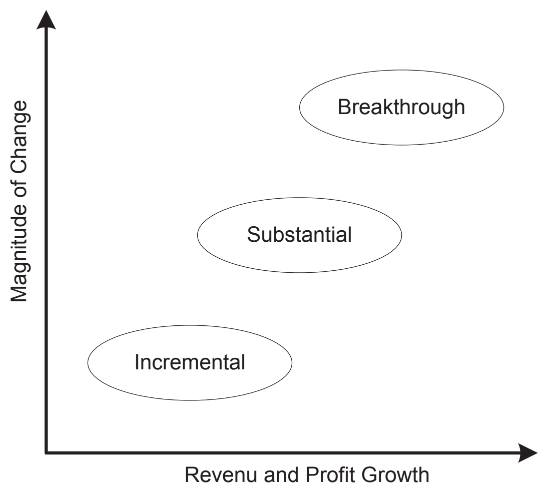

Figure 31: Degrees of innovation, according to Tucker (2002)

5.4.3 Business model innovation causes

Understanding the causes of business model change helps to develop and use a business case method for business models. As discussed in the previous section, Tucker (2002) defines three types of innovation. Combining these types of innovation with the framework of Casadesus-Masanell & Ricart (2010), shows that strategy innovation always leads to a changed business model, for strategy can be described as a creation process where the “creation” is the business model. Thus, changing the creation process leads to a different creation.

Process and product innovation belong to the tactical and operational levels, below the business model. Each business model enables a tactical set of choices, as the Metro case demonstrates. Therefore, not all process and product innovations have a direct influence on the business model. In other words, not all process and product innovations change the business model, but some of those innovations do change the business model. To better specify which of those innovations influence the business model, the framework of Casadesus-Masanell & Ricart (2010) can be used again. As discussed, each business model enables a tactical set (see Figure 10). If a process or product innovation exceeds the limits of the tactical set, it leads to a change in the business model.

A business model can be affected by strategy, process, and product innovation, but also from within itself. With business model innovation, the business model is assessed and approved.

In the canvas method of Osterwalder, the business model is modelled in nine building blocks. Each of the building blocks, individually or all together, can be innovated. For example, the revenue model of a value offering can be substantially innovated. An example of this is the recent history of the music industry. Where customers owned music by buying CDs first, now it is possible to pay a monthly fee to listen to music without owning it. This innovation of the business model resulted in changes on the tactical level of the music-providing organizations to make the new form of music delivery possible. In this case, the organizational change was initiated by a business model innovation.

To summarize, three situations can lead to business model innovation:

- Business model innovation (direct impact on business model)
- Strategic innovation (direct impact on business model)
- Product or process innovation (direct impact on business model only if innovation is outside the tactical set enabled by the business model)

In any of these situations, it is valuable to know whether the new business model is really the best model possible in the given situation. Here the business case comes in.

5.4.4 Relating business modelling to the business case method

In this section, the developed business case method is applied to the business model concept. Figure 33 visualizes the connection. The figure shows the business case steps on the left. The sources or types of information or input for each of those steps are on the right.

The first step contains the business driver. Business drivers for business model innovation can come from different sources. In general, shortening product lives, intense global competition, and the disruptive and agile environment (Chesbrough, 2007) are the main sources for business drivers. This can cause one of the three causes for business model renewal as discussed in the previous section. The business objective represents the goals that the business model change aims to obtain. The next step is identification of alternatives. In this step, multiple business models can be developed with the focus on meeting the business objectives.

Next, the effects, risks, and costs of each of the business model alternatives are assessed. The effects represent the positive and negative non-financial effects that alternatives cause. The effects can be represented with the framework for business case development as shown in Table 13 (Ward et al., 2008).

To assess the risks of the project, one of the risk assessment methods described in literature for project management can be used. The risk assessment part should at least cover the following points (Remenyi, 1999):

- Description of the risk
- Likelihood of risk occurring
- Potential impact of the risk
- Possible actions to handle or overcome the risk
- Identification of possible early warning sign indicators
- The risk owner

The risk can be represented in a risk probability vs. risk impact matrix, such as Figure 32 shows.

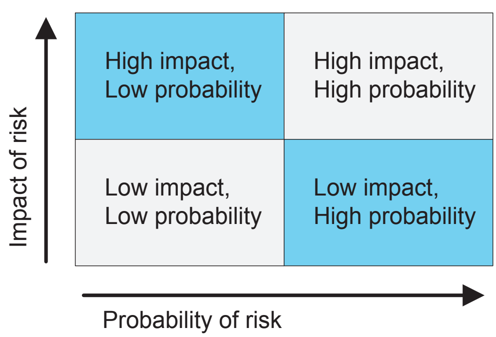

Figure 32: Risk assessment matrix

Often, the expected financial benefits, along with the costs of the project, are the most important part for decision makers using business cases. In the costs section, changes in the business models costs and revenue component need to be assessed. The cost component of a business model must cover costs created in other components, such as key activities. Next to the expected costs and profits, the payback period and return on investment rate should be presented.

Using a multi-criteria method, as discussed in 5.3.7, the most suitable business model can be selected in the seventh step. After that, an implementation plan can be developed. During step three till eight, alternative business models should be compared to the current business model to assess the changes and effects that it causes. For example, in the fourth step, only the effects that differ from the current business model are assessed. The reason for this is that the other effects remain the same for both alternatives, and thus only increases the size and complexity of the business case.

5.5 Method demonstration and evaluation: DEA Logic and housing associations

Having created the artefact (business case method), the section demonstrates it. We use a case study of the company DEA Logic, which provides products and services for Dutch housing associations.

In this section, we provide background in the form of a short overview of DEA Logic and Dutch housing associations first. Second, we introduce the case, especially the innovations which DEA Logic has in mind. Third, we apply the business case method to the case to create a business case. Fourth and final, we evaluate the results and the method.

5.5.1 Company overview

The main two stakeholders in the case are the company DEA Logic and the Dutch housing associations. The innovation is developed by DEA Logic, and the target customers for this innovation are Dutch housing associations. The innovation will have an impact on the business model of the Dutch housing associations. We describe both in the following two subsections. First, we present DEA Logic, the company that provided the case. Second, we discuss the Dutch housing associations.

5.5.1.1 DEA Logic

"*Development and innovation starts with DEA Logic*" is the company's slogan. DEA Logic is an engineering company specialized in advanced electronics, security software, and consulting in information technology, information management, and building management. Over the last years, DEA Logic developed an access control system called C-Lock, which has a major position in their product portfolio currently. The C-Lock

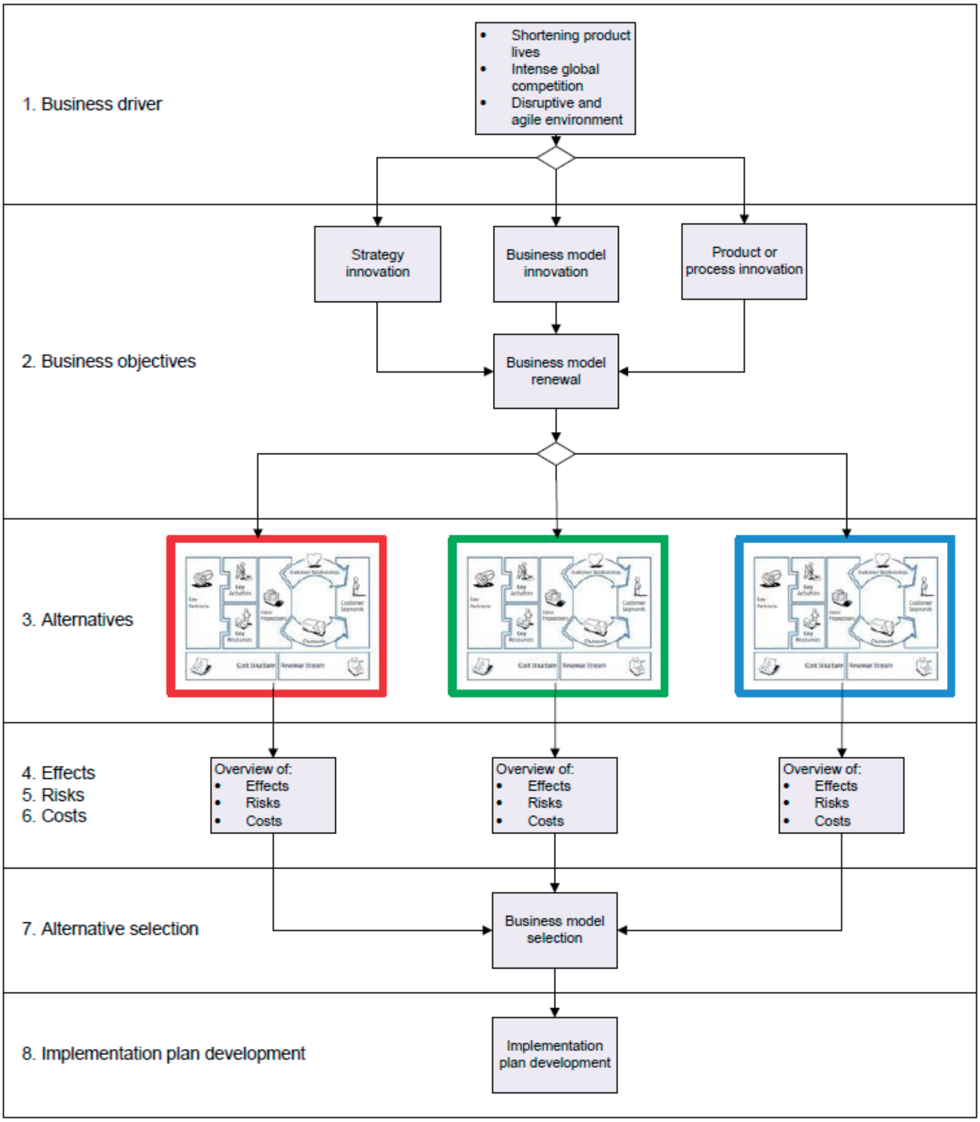

Figure 33: Business modelling connected to the business case method

system can be extended with multiple solutions. This way, apartments can be better adjusted to the needs of the tenants. In this case, DEA Logic wants to discover whether their product is favourable for (Dutch) housing associations. A business case needs to be developed.

5.5.1.2 Dutch housing associations

In the Netherlands, a housing association is a non-profit organization, which' mission is to build, manage, maintain, and rent houses and apartments. The responsibilities are defined and assigned by the Ministry of the Interior and Kingdom Relations. Each housing association is private, but can only operate within boundaries set by the Dutch government. Therefore, housing associations do not differ much. In addition, all housing associations have more demand than supply currently, which causes waiting lists. The houses they rent are favourable for citizens with a low income (an annual income of € 43.000 is the maximum). The associations are tasked to supply good housing possibilities for the relatively more vulnerable and poorer people in society. Similar constructions exist in other countries. For example, the United Kingdom has government-regulated housing associations with the same goal; to provide housing to people on a low income or people who need extra support.

Thanks to the public character of the housing associations, all needed information for this case is public and presented on websites of housing associations, the government, and the central fund for people housing. For the scope and purpose of this research, applying the DEA Logic case on Dutch housing associations in general is sufficient to demonstrate the designed method.

5.5.2 Case description: IP-infrastructure

DEA Logic develops technological and electronic innovations for real estate amongst others. The C-Lock access control system is one of those products. The latest innovation for newly built or renovated apartment buildings is IP-infrastructure. In the current situation, each apartment in a building complex is supplied with public utilities and digital infrastructural connections. In the Netherlands, each apartment is provided with at least a telephone line, television cable, intercom system, and often fiberglass connection for internet. Each of these connections makes use of their own wires. The main idea of IP-Infrastructure is to supply each apartment with only one TCP-IP connection, combining telephone, television, intercom, and internet, as well as other possible data connections. Figure 34 shows a schematic overview of IP-Infrastructure. The normal cables enter the building and are connected to a central server. Ethernet (CAT-5 or fiberglass) cables supply each apartment with the necessary connections.

This infrastructure not only reduces infrastructural costs and materials of newly built or renovated apartments, but also increases the amount of possible functionalities. The currently developed functionalities are derived from the C-Lock access system, and can be connected to the receiver easily. Tenants can choose individually which solutions they need. The core of the innovation is to increase apartments' flexibility, functionality, and luxury, and to minimize the maintenance costs. Table 30 gives examples of solutions that help with this.

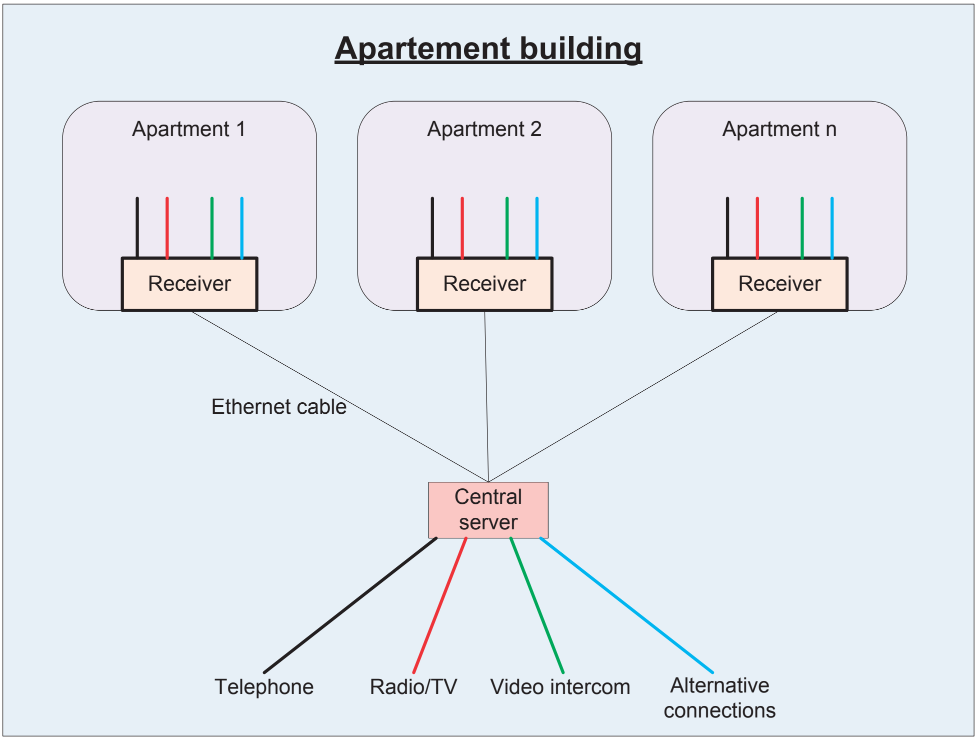

Figure 34: Schematic representation of IP-infrastructure

Table 30: Examples of IP-infrastructure functionality

Access	Electronic keys are used to grant access to the building and the apartment. If favourable, the system can be extended with an automatic door opener, which opens the door if the tenant with the right key is standing in front of the door.
Intercom	This is a door phone system with video support as seen in most newly build apartment buildings nowadays.
Security	This module contains a burglar alarm, smoke detector, and camera monitoring. In case other tenants also have this module, the alarm message can also be send to them, for example in case of a fire.
Care	The intercom phone with touchscreen system can be extended with additional modules for extra functionalities. This could include personal alarm, telemedicine, telemonitoring, and even location detection to prevent people from wandering off.
Communication	Currently, tenants and housing associations communicate by letters or phone. With the communication solution, housing associations can send information through the intercom system, for example about maintenance. Tenants are also able to send requests for maintenance using the intercom system.

The C-Lock and IP-Infrastructure innovations by DEA Logic are suitable for Dutch housing associations, for they build, rent, manage, and maintain apartments for a diverse target group. The target group is diverse, as their customers are young as well as old people. In addition, families with children and people who need daily nursing support belong to the target customers. Introducing DEA Logic's innovations increases the suitable target group for each apartment, as it can be adjusted to the needs of the tenant more easily. Furthermore, the use of IP-infrastructure decreases maintenance costs.

The innovations affect the housing association's business model. Renting out C-Lock solutions and IP-infrastructure becomes a new key activity. DEA Logic becomes a new key partner, together with several service providers. Also the value proposition is extended, for apartments are more secure and luxury. The suitable customer segment for each apartment increases, as it can be adjusted to the needs of various tenants. Finally, a new revenue stream is added, for the IP-infrastructure is rented out, in combinations with C-Lock solutions, in addition to the traditional rent of apartments. Therefore, DEA Logic's innovation and Dutch housing associations form a good combination to test the business case development method.

5.5.3 A business case for IP-infrastructure in Dutch housing associations

In this section, we apply the business case method developed previously to the case described above. The goal of this case study is to demonstrate the developed method. The data and numbers used in the business case are based on calculations by DEA Logic, and internet sources. For reasons of confidentiality, the numbers are not accurate. The business case gives an indication of the order of magnitude of the costs difference between the two discussed alternatives. If in the future, a housing association would like to realize the project, a new business case has to be made, to assess the effects of the innovation on their specific situation. For the purpose of demonstrating the business case method, the used numbers and accounted variables are sufficient.

The following eight paragraphs present the eight steps of the business case method. We compare two scenarios. In both scenarios, the same apartment complex is built with one hundred apartments. The first scenario represents the current situation. In the second scenario, the IP-infrastructure is implemented together with C-Lock solutions.

5.5.3.1 Business drivers

Based on the vision and strategy of the three largest housing corporations (CFV, 2012), their mission is to build, manage, and maintain quality tenement housing for people with a low income and vulnerable groups in society. Therefore, it is preferable that building, managing, and maintenance costs of the houses are low. Housing corporations continuously seek possibilities to reduce costs and still deliver high quality, affordable, and luxury homes for a large and diverse target group. IP-infrastructure, in combination with the variety of possible C-Lock solutions provided by DEA Logic, is an innovation that contributes to the corporations' mission.

5.5.3.2 Business objectives

In accordance with the business drivers, the pursued objectives of the IP-infrastructure presented in this business case are the following:

- Reduce maintenance costs
- Increase compatibility with target tenant group
- Increase quality of living environment
- Increase security of tenants
- Increase luxury

5.5.3.3 Alternatives

Figure 35 shows the current business model of a Dutch housing association. The value proposition offers low-priced rental houses in a good living environment for people with low income belonging to vulnerable groups in society. Revenue is generated via monthly rent and subsidy from the government.

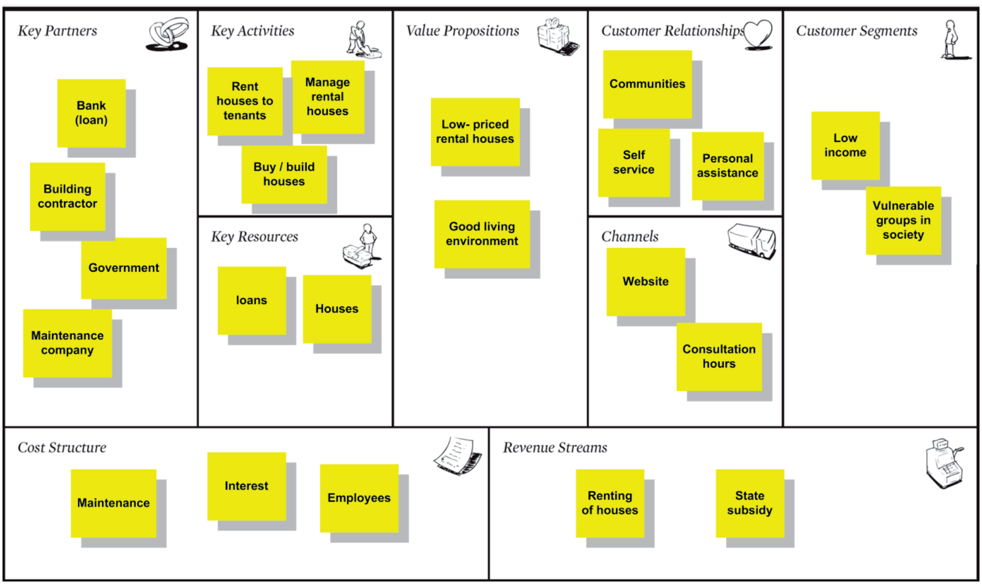

Figure 35: Current business model of Dutch housing associations

Figure 36 shows an alternative business model of a housing association with an apartment complex with IP-infrastructure. Blue post-it notes indicate the changes relative to the current business model in Figure 35. In addition to the current key activities, renting out infrastructure and solutions form a new key activity. DEA Logic becomes a new key partner of the housing corporation, as they provide the solutions and maintain the system. Furthermore, the customer segments are extended with an increased target group including tenants who require special care. The fourth change is in the revenue stream building block. Next to the rent of houses and state subsidy, the housing corporations receive rent for the use of the IP-infrastructure by tenants.

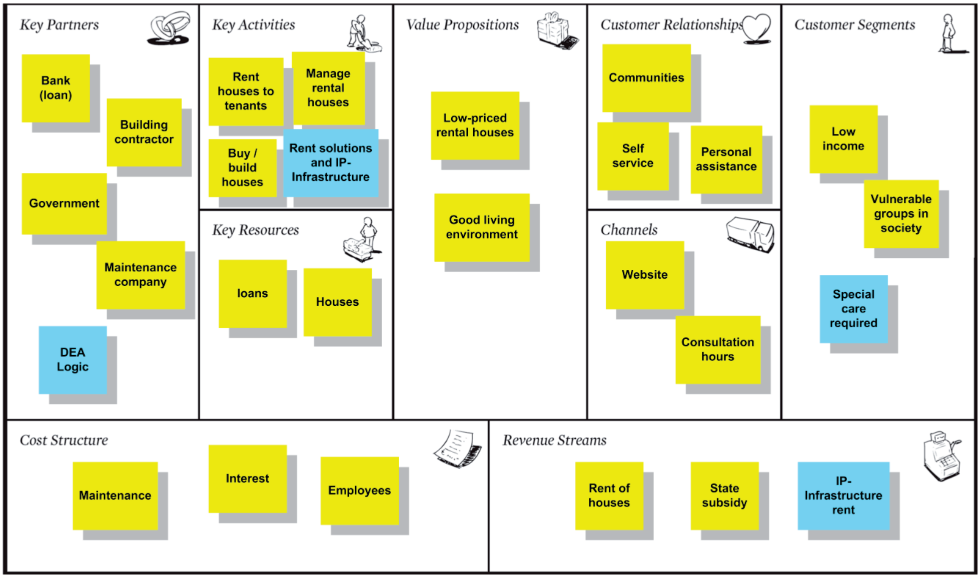

Figure 36: Business model of Dutch housing associations with IP-infrastructure and C-Lock solutions

Next to changes visible in the business model, many benefits of IP-infrastructure are within the tactical set of the current business model. Therefore, they do not influence or change the business model. However, the resulting business case includes those effects as well.

5.5.3.3.1 IP-Infrastructure

Many technologies are used in apartment buildings at the present time. Examples include video-intercom systems, triple play network connections, access control systems, and ventilation installations. When a new apartment building is built, all of these technologies are placed, for placing additional wiring after the building is completed is expensive and causes inconvenience for the tenants. With the IP-Infrastructure, only one cable type is placed to each apartment within the building. Via a central server, all external connections can be transferred to the apartments using the IP-infrastructure. The IP-infrastructure has three main advantages compared to the old situation. The first advantage is that future technology extensions, which require wiring through the building, can be implemented without rigorous rebuilding. The second advantage is that the reduction of wiring through the building results in decreased building costs. However, the installation costs for triple play connections are paid by the providers, causing no extra building costs currently. The third advantage is that apartments can be adjusted easily towards tenant specific requirements provided by the multiple C-Lock solutions.

5.5.3.3.2 C-Lock solutions

The various C-Lock solutions are a flexible extension to the IP-infrastructure. Currently developed solutions can be divided into four categories: access, security, care, and luxury.

Access solutions contain various options with regard to access to the building. Instead of multiple doorbells and nameplates at the central entrance, a single vandalism proof touchscreen monitor is fitted together with an RFID reader. Via the touchscreen, visitors can ring the right apartment. Via a video intercom system, the tenants can see who is at the main entrance and can choose to grand access, or deny it. Instead of a traditional key, tenants get a wireless electronic key, which makes use of secure RFID technology. The video intercom system in each apartment can be extended with various other options, some of which we describe below.

Security solutions contain functions like burglar and fire alarm. In case of a fire, not only tenants of the apartment are warned, but also their neighbours. Via an additional video camera system, the tenants can receive a live feed of their apartment on a remote location if the burglar alarm is triggered. Security extensions are modular extensions for the video intercom system.

Care solutions can also be fitted modularly to the video intercom system. It includes functions such as personal alarm, telemedicine, telemonitoring, and detection systems for tenants who might wander off.

These are solutions that are currently developed, but the possibilities are practically unlimited, according to DEA Logic. The solutions make apartments suitable for a large and diverse target group. Older people or those who need extra support can choose to fit the apartment with a selection of the care solutions.

5.5.3.4 Effects

Implementation of IP-infrastructure in renovated or newly build apartment buildings affects the organization. The effects of the new IP-Infrastructure compared to the current, classic infrastructure are discussed below. Table 31 presents an overview of them. The table structures them according to two factors. Horizontally, they are categorized according to the type of required organizational change. Vertically, they are categorized according to the degree of explicitness. Because the only difference between the two alternatives, in terms of business model, is the revenue model, other effects of both alternatives are equal. Therefore, they are represented in only one effects overview table.

Table 31: Effects of IP-infrastructure

Degree of explicitness	Do new things	Do things better	Stop doing things
Financial	Rent C-Lock solutions and IP-infrastructure		Reduce maintenance costs by not replacing door locks & nameplates
Quantifiable			
Measurable		Increased target group Increased security	
Observable	Dependable on non-standardized technology In line with mission and vision	Increase quality living environment	

5.5.3.4.1 Financial effects

Starting with the financial effects, the revenue model behind the IP-Infrastructure is new in the business model. For some solutions, an additional rent is incurred for the use of the IP-infrastructure. Furthermore, the tenants may rent some non-standard C-Lock solutions from the housing association.

The second financial effect is a reduction on maintenance costs. Normally, if an apartment is rented to a new tenant, the door lock and keys are renewed together with the nameplates. With the IP-infrastructure, this can be done remotely, saving both time and money. At the main entrance, the touchscreen shows nameplates digitally. Names can be edited from behind the desk by logging into the building's central server. Access rules for the keys can be changed in the same way. New tenants receive new keys with a different RFID chip. Access to the apartment is then only granted by using the new key.

In the cost section, the benefits and reductions are calculated and presented.

5.5.3.4.2 Measurable effects

Two measurable benefits make the organization better. The first benefit is the increase in target groups for apartments. With C-Lock solutions, apartments can be adjusted easily to meet requirements and demands of tenants. For example, if elderly people, who require extra care functions, rent the apartment, a selection of care solutions can be connected to the system, providing the required services. No longer is a specific group of apartments suitable for only a single special target group, but all apartments with the system can be adjusted to be suitable for each target group.

The second benefit is increased security with the IP-infrastructure in combination with C-Lock solutions. Electronic keys are much harder to forge compared to classic keys, keeping unwanted visitors out. Furthermore, with the fire alarm, neighbors are notified as well to be careful and investigate the emergency.

5.5.3.4.3 Observable effects

The influences of two observable effects are hard to estimate. First of all, the IP-infrastructure and C-Lock solutions are developed by DEA Logic. At the moment, no direct interchangeable alternatives to the DEA Logic's product exist. This makes the apartment building technologically dependent on DEA Logic.

The second effect is the increased quality of the direct living environment for tenants. Each apartment can be fitted with various C-Lock solutions to make living more comfortable. For example, automatically opening doors, curtains, and lights may provide more comfort.

5.5.3.5 Risks

As with each innovation, risks are involved. To assess the risks, we use a construction project risk assessment method (Tah & Carr, 2000). This method is suitable, as renovating or building the apartment complex is a construction project. First, the risk sources, and risks per source are identified for both alternatives.

Table 32: Risks for a construction project

Product	1)	malfunctioning of software
	2)	malfunctioning of hardware
	3)	compatibility issues with external parties
Service	4)	unavailability of maintenance
	5)	unavailability of training
	6)	unavailability of upgrades and improvements
Political	7)	changes in laws and regulations
Market	8)	lack of customer demand
	9)	too complicated user interface
Nature	10)	vulnerability for fire
	11)	vulnerability for water
	12)	vulnerability for lightning

Next, for both alternatives, the likelihood and severity in terms of costs, quality, and safety of the risks is estimated. To compare the risk of both alternatives, the value of likelihood of occurring is multiplied by the value of severity. The severity value is the sum of the values for costs, quality, and safety. Table 35 gives an overview of the risks of the classic infrastructure. Table 36 represents the likelihood and severity of risks of the IP-infrastructure alternative. Table 33 and Table 34 define terms for quantifying likelihood and severity, which are used in Table 35 and Table 36, based on Tah & Carr (2000).

Table 33: Terms for quantifying likelihood, according to Tah and Carr (2000)

Likelihood	Value	Description
Very very high	7	Expected to occur with absolute certainty
Very high	6	Expected to occur
High	5	Very likely to occur
Medium	4	Likely to occur
Low	3	Unlikely to occur
Very low	2	Very unlikely to occur
Very very low	1	Almost no possibility of occurring

Table 34: Terms for quantifying severity, according to Tah and Carr (2000)

Severity	Value	Costs	Negative effect on product quality	Negative effect on safety
Very high	5	>20% above target	Very poor	Injury
High	4	10% < target < 20%	Poor	Safety hazard
Medium	3	5% < target < 10%	Average	Average
Low	2	1% < target < 5%	Above average	below average
Very low	1	1% < target	OK	OK

Table 35: Risk likelihood and severity of a classical infrastructure

Risk	Likelihood of occurring	Costs	Negative effect on product quality	Negative effect on safety	Multiplied risk effect	Risk prevention option
1	2	3	3	1	14	Warranty contract
2	2	2	3	1	12	Warranty contract
3	-	-	-	-		-
4	2	2	2	1	10	Service contracts
5	-	-	-	-		-
6	-	-	-	-		-
7	2	3	1	1	10	-
8	-	-	-	-		-
9	2	2	4	3	22	Preventative surveys
10	2	4	3	4	22	Fuses to prevent short-circuiting
11	2	4	3	4	22	Waterproof components
12	4	4	3	2	36	Uninterruptible Power Supply
Total					148	

Table 36: Risk likelihood and severity of IP-infrastructure

Risk	Likelihood of occurring	Costs	Negative effect on product quality	Negative effect on safety	Multiplied risk effect	Risk prevention option
1	3	3	3	2	24	Warranty contract
2	3	4	3	2	27	Warranty contract
3	4	4	4	1	36	Warranty contract
4	3	4	2	2	24	Service contracts
5	3	2	1	1	12	Service contracts
6	3	-	2	1	9	Service contracts
7	2	3	1	1	10	-
8	2	1	-	-	2	Preventative surveys
9	3	2	4	3	27	Preventative surveys
10	1	4	3	4	11	Fuses to prevent short-circuiting
11	2	4	3	2	18	Waterproof components
12	4	4	3	2	36	Uninterruptible Power Supply
Total					236	

As Table 35 and Table 36 show, most risks can be prevented, resulting in a very low overall project risk. However, some risks of the IP-infrastructure alternative remain, due to the following two points:

1. The technology is new. So far, it has been deployed in one apartment building only.
2. The technology is developed and built by one company. The current market does not provide any substitutes that work with the same infrastructure.

These two points are interconnected. A small change exists that the technology does not work as good as was hoped for, or the subcontractor stops supporting the technology. In that scenario, the costs to transform the infrastructure back to the current standard are high.

Other risks for both alternatives can either be prevented, or do not have a negative influence on the organization. Figure 37 and Figure 38 present the risks in a risk assessment matrix. The total risk of IP-Infrastructure, before prevention, is one and a half times the risk of the classic approach. This is mostly because the classic infrastructure is used almost everywhere and has been improved over time.

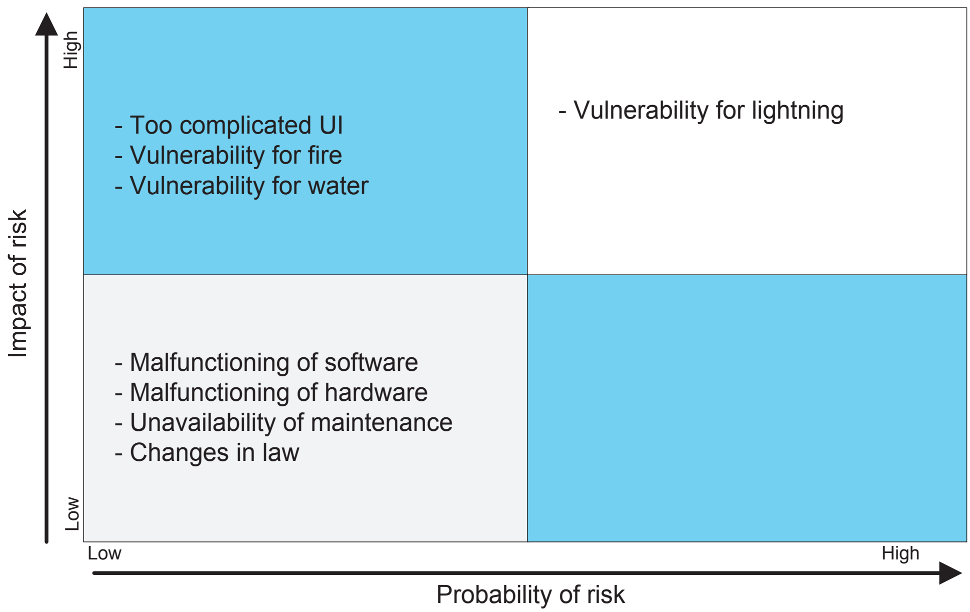

Figure 37: Risk assessment matrix for classic infrastructure

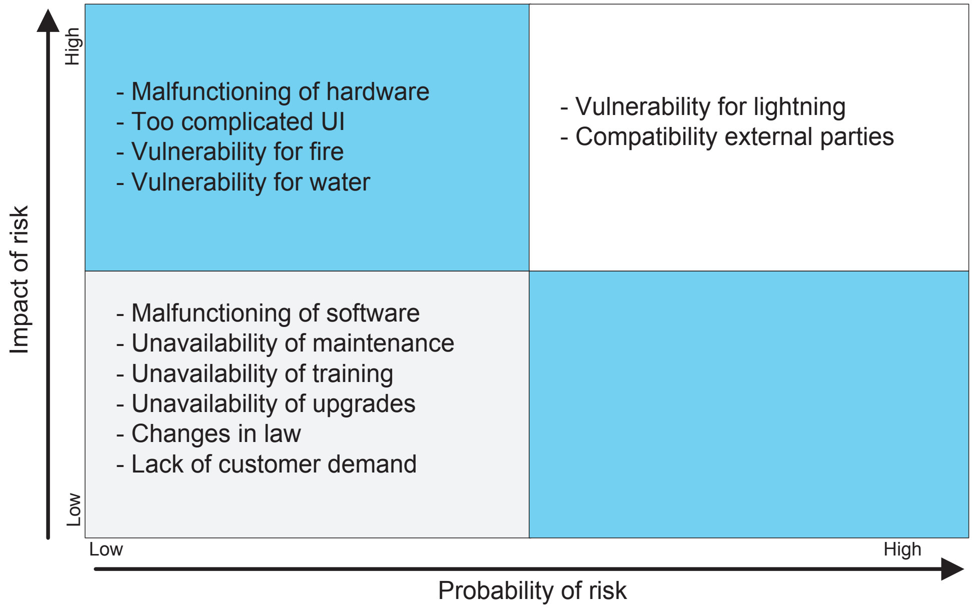

Figure 38: Risk assessment matrix for IP-infrastructure

5.5.3.6 Costs

The cost difference, between the current situation and the IP-Infrastructure alternative, depends on two variables. First, the number and type of C-Lock solutions affect the costs. The second variable is time. Time is important, as the housing association's objective is not only to build apartment complexes, but also to maintain them. Therefore, the cost overview also includes maintenance.

To compare the costs of both approaches, an indication of the costs for an apartment complex with 100 apartments is calculated. Only the costs for the infrastructure and the C-Lock solutions are covered. The other building costs are equal for both alternatives. Because the costs for construction and maintenance of the infrastructure and the C-Lock solutions vary from situation to situation, the following assumptions and raw cost estimates are used:

- A new apartment complex is made with 100 apartments.
- In the current situation, multiple apartments use the same wire instead of having their own individual wire. Therefore, the infrastructural costs are estimated to be only half of IP-infrastructure costs.
- Costs for IP-infrastructure are estimated at € 26,000, based on calculations of DEA Logic.
- Cost estimates for access, video intercom system, and the care solution are also based on calculations of DEA Logic.
- 10% of the tenants make use of the care solution.

- Costs for communications are based on 5 letters per year per apartment, at a cost of € 1.50 per letter.

Table 37 shows estimates of construction costs, yearly maintenance costs, and yearly profit, per function. Next, the maintenance costs and profits are extrapolated over five years to get more insight in the breakeven point of the alternatives. Because of the raw input data, assumptions, and extrapolation of five years, the outcome of this analysis is relatively unreliable and can only be used as an indication for expected costs of both alternatives over a time span of ten years. If the project is deployed in a real situation, more data gathering is needed to calculate the specific values and come to more accurate estimates.

Table 37: Estimated costs of construction and maintenance, and estimated profit

Function Costs (€)	**Infrastructure**		**Access**		**Intercom**		**Care**		**Commu-nication**	
	Old	New	Old	New	Old	New	Old	New	Old	New
Construction (Initial)	13,000	26,000	30,000	30,000	52,000	50,000	800	400	-	-
Maintenance (Yearly)	500	1,000	11,250	6,950	16,500	7,000	3,600	1,800	750	0
Profit (Yearly)	-	-	-	-	-	-	-	300	-	-

Based on the numbers shown in Table 37, the expected cumulative costs over five years are calculated for both situations. The costs are influenced by both time and functions. More functions leads to more costs, and due to the maintenance costs, over time the total costs increases. The initial costs for the IP-Infrastructure are higher compared to the current situation. However, the difference is not very big, and within three years, the IP-Infrastructure in combination with the access C-Lock solution is cheaper than the current alternative.

In the cost overview, financial differences between IP-infrastructure and the classical approach are assessed. The initial costs for IP-Infrastructure are higher, but due to lower maintenance costs, this difference is equalized within one to three years, depending on the functions. Especially with real estate, long term thinking is important as buildings last for decades. In the cost overview, cost estimates are used. Therefore, they are only extrapolated over five years. However, in case a project is realized with the IP-Infrastructure and building plans are better established and concrete, the costs have to be reassessed to improve reliability before they can be used to make the definitive decision.

5.5.3.7 Alternative selection

The effects, risks, and costs of IP-infrastructure, compared to the classic infrastructure, are discussed in the previous sections. Based on this information, one of the alternatives needs to be selected. Looking at the effects, IP-infrastructure is the best choice as it increases the amount of target groups, quality of living, and security of tenants. Additionally, with the new technology, apartments become more luxury. The risks, however, are one and half times higher than with classic infrastructure. Then again, this can be reduced strongly using the available risk prevention options.

Initial costs of IP-infrastructure are higher, but within four years it becomes cheaper than the classic alternative. Depending on the functions, the estimated IP-infrastructure savings are around € 70.000 after five years. Initial costs are higher, yet maintenance costs are much lower.

IP-infrastructure offers new functionalities and increases security of tenants, quality of living, and target group. Risks are higher, but can be prevented. Initial costs are higher, but money is saved due to the low maintenance costs over time. Therefore, IP-infrastructure is the best alternative to choose.

5.5.3.8 Implementation plan

After their board of directors approves this project, the housing association can implement the project. In this phase, however, it is too far stretched to determine an explicit implementation plan. However, the following can be used as an indication of the steps that need to be made to achieve a successful implementation. The steps are based on the Deming cycle, which is an iterative management method for the control and continuous improvement of processes and products (Kanji, 1996).

The first project implementation step concerns planning the project. After the decision to build a new apartment building, the exact installation costs and system specifications can be determined and contracts can be drawn up. In the second step, the apartment building needs to be realized and the IP-infrastructure in combination with C-Lock solutions need to be installed. In the third phase, the system check need to be performed to determine whether the system is secure and works as planned. In the fourth phase, the apartments are rented out to tenants and the solutions can be rented. In addition, problems, flaws, and obscurities need to be analysed.

After this fourth step, the cycle starts again with planning how the determined flaws and problems of the previous phase can be assessed and solved, followed by taking action, checking solutions and implementing them, and assessing if the problems are solved and if others have occurred. If needed, the cycle can start again, until the system is optimized.

5.5.4 Evaluation of the business case method in the housing case study

After demonstrating the designed artefact, it needs to be evaluated. The goal of evaluation is to observe how well the artefact supports a solution to the problem. We do this by comparing the goals of a solution to actual observed results from the demonstration. We assess the overall goal, followed with general remarks to the complete method.

5.5.4.1 Overall objectivity assessment

The goal for designing the business case development method to compare business models was to design a method to create a business case of business models, to objectively compare the assessed business models, and choose the best alternative.

First, we assess the objectivity of the method. Because of the abstract, descriptive nature of business models, it is often required to involve more tactical and operational details, only implicated by changes in the business model. Deciding which details are useful and which are not must be judged by the maker of the business case. This allows for a certain amount of subjectivity. Table 38 represents which method steps are objective and which are open for subjectivity.

Table 38: Assessment of the objectivity of the business case method

Method step	Objective / Subjective
Business driver	Objective
Business objectives	Objective
Identification of alternatives	Subjective
Effects	Subjective
Risks	Subjective
Costs	Objective
Alternative selection	Objective / Subjective
Implementation plan	Subjective

Business drivers and objectives are fixed input variables. On the other hand, identification of alternatives is variable in most cases. This gives freedom for interpretation and creativity, therefore it is subjective. The same argumentation is valid for assessment of effects and risks. These steps are subjective as well and the output depends on the builder of the business case. The cost step of the method is objective, but depends on the scope of the project. The alternative selection step can be either objective or subjective, depending on the non-financial effects of alternatives and their weight. In case alternatives only differ financially from each other, the decision is made objectively; the most profitable alternative is selected. In case other, subjective variables play a role as well, it depends on the person making the decision; how much weight does he give to these variables. Development of the implementation plan is also subjective and depends on the developer. However, this step does not influence the selected alternative. To reduce the effects of human bias, it is preferable that the business case is made by an independent actor, to increase the objectivity of the business case.

5.5.4.2 General remarks to the method

During creation of the business case, one of the experienced difficulties was switching between abstraction levels. A business model is an abstract representation of an organization. Processes and products are on a more tactical or even operational organizational level. The outcome of comparing business models in the business case depends on choices made in organizationally lower abstraction levels, like the tactical and operational level. The distinction between a process or product business case, and a business model business case needs to be made. In the first case, focus is on cost and benefit comparison of the innovated process or product. In the second case, it is about choosing the best alternative way of how an innovated product or process affects the business model.

Furthermore, we found some empirical evidence supporting the "strategy – business model – tactical set" framework by Casadesus-Masanell & Ricart (2010). In hindsight, the case study is mostly a product innovation within the tactical set of the building association's business model. Some minor changes were made in the business model. This made it hard to devote the business case to the business model, and forced us to include more operational aspects in the business case. This is not per se negative for the demonstration, the method, or the outcome of the business case, but the goal and focus of the designed method, is to objectively compare two business models, in contrast with assessing the costs and benefits of a product innovation.

Overall, the method does what it is designed for. It is a method to develop a business case, which allows different business models to be compared, and the best one to be chosen as objective as possible.

5.6 Conclusion

The designed business case method to objectively compare business models can be used to compare and choose the best business model successfully, as demonstrated by the case study. The goal of this research was to increase the quality of the decision making process between possible business models, by developing a method to objectively compare the alternatives. Based on literature research, the business case method was designed. This method contains the eight components that Table 28 lists.

The need for a method like this comes from the increasing popularity of business models over the last decennia in practice as well as in academic literature. As discussed in the literature overview, companies that are aware of their business model performed significantly better then companies who are not aware of it (Chesbrough, 2007; Doz and Kosonen, 2010; Shafer et al., 2005). Not only is the concept used more, but it also seems to increase organizational performance. Because a business model is an abstract description of a company, it is affected if the company changes. Whether on strategic level, business model level, or process and product level, innovation changes the company, and the business model. Most organizational changes can be modelled variously in the business model, each with a specific effect on the organization. Instead of just choosing one business model, a method is needed to compare the business models, and choose the best in terms of costs, benefits, and risks. The objective of this research was therefore to investigate the possibilities of the use of a business case as a method to compare business models, with the goal to define a method that increases the quality of business model decision making.

The case study showed that the developed method can be used to compare business models and choose the best one. However, the output of the business case depends partially on the people making the business case. Steps 3, 4, 5, and 7 are relatively subjective steps, which gives freedom to decision makers. Further research is needed to establish the effects of this decision freedom on the quality of the outcome of the business case. Still, the method fulfils the defined goal of the research.

6

From Enterprise Architecture to Business Models and back

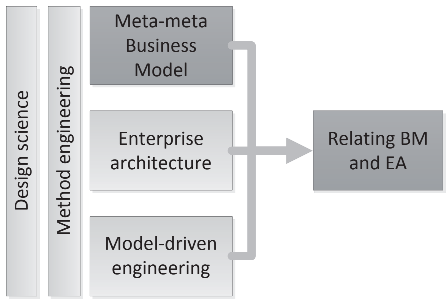

Figure 39: Answering research question 3: How to relate business models and enterprise architecture

In this chapter, we argue that important (IT) change processes affecting an organisation's business model are also mirrored by a change in the organization's enterprise architecture. An analysis of the business model may establish whether the architecture change has value for the business. Therefore, in order to facilitate such analyses, we propose an approach to relate enterprise models specified in ArchiMate to business models, modelled using Osterwalder's business model canvas. Our approach is accompanied by a method that supports business model-driven migration from a baseline architecture to a target architecture, and is demonstrated by means of a case study.

Many expensive IT innovation projects suffer from the fact that the technical solutions they propose never materialize. Considerable research and investments go into specification and development of yet another information system or prototype proving a novel concept that, eventually, fails to be absorbed into real life settings. We argue that such projects fail because they are the result of yet another technology push, and are initiated without a proper analysis of the problem in its enterprise context. Changes in systems often do not consider the financial impacts. Usually, questions such as "who benefits from the product?", and "who will pay for it?" are not included in the design of new system. Yet, they may have a huge impact on the system requirements.

Especially, when the answers to the above questions may concern multiple stakeholders, the chance that the product is adopted and implemented is severely limited. To avoid such situations, any architecture change (any new IT project) should be judged from the perspective of its business fitness first. Therefore, we advocate that a business model should be built and analysed before any implementation decision is made about the (new) architecture design. Consequently, a technique is necessary for relating enterprise architectures to business models. Of course, the statement above rests on the assumption that such an enterprise architecture does exist. Indeed, since IT innovation projects are often triggered by (consortia of) well-established organizations, they rarely occur in a green field situation (the latter is probably the case for start-ups only).

Therefore, the main goal and contribution of this chapter is to explore the relationships between two modelling approaches used to specify enterprise architectures and business models, respectively: The Open Group's enterprise architecture modelling standard, ArchiMate (Iacob et al., 2012a) and Osterwalder's Business Model Canvas (BMC) (Osterwalder and Pigneur, 2010; Osterwalder, 2004). The first one is the modelling language and open standard for the specification of enterprise architectures (going from business to technology infrastructure) and of their motivation. The second one is the most popular business model specification framework. The choice for these specific modelling approaches is justified by their representativeness and wide acceptance in the academic and practitioner communities in their respective application domains. A discussion of their limitations and their comparison with similar approaches will follow in the following section.

Before going into further details about how to relate enterprise architecture (EA) to business models (BM), first we explain what motivates us to tackle this problem and why we consider that a solution would be beneficial. Many organizations undergo expensive architectural changes without having a clear idea of how efficient and effective their investments in these changes are. Furthermore, many enterprise architects have difficulties in demonstrating and quantifying the value of architecture changes for the business. We argue that these both could be accomplished if an approach would exist to relate EAs and BMs. With such an approach, it is possible to assess, at strategic level, the global balance between costs involved in the architecture change and benefits one may expect. Furthermore, the architecture change can be mirrored by a business model change, and thus the impact of architecture change for the business becomes explicit.

In the enterprise architecture field, several methods exist to assess the gap between an enterprise architecture's current situation and some desired situation in design terms - see for example (The Open Group, 2011). Although research has been done concerning the development of EA model-based cost analysis techniques (for example, Jonkers and Iacob (2009)), these enterprise approaches do not assess what such a gap means in terms of costs and revenues at a business strategy level. To accomplish this, it must be possible to relate the results of EA-based cost analyses to business model-based costs/revenues analyses. Hence, business models must be elicited from and for an organization's current and future architectures. These business models can take the results of architecture-based cost analysis calculations as quantitative input. This input already incorporates detailed fixed and variable cost components, propagating throughout the architecture layers, from the bottom (infrastructure costs) up to the top (business process costs). Thus, business model frameworks, such as the BMC, can produce a more accurate and realistic cost/revenue analysis of the target architecture, which can be used to motivate implementation decisions concerning new innovation projects.

The need for this refinement has been also recognized by Tom Graves, who wrote (in a rather informal, yet expressive fashion) (Graves, 2011):

"And who would want to go from Business Model Canvas to ArchiMate, anyway? [...] People like building business-models. It's wonderfully abstract, and it's fun – like playing with model-trains, where the passengers are only imaginary and the trains really can run on time. Unfortunately (or fortunately?) the real world is a bit different from that... Real-world detail can break the best-looking business-model without even breaking out a sweat. We need to know that detail – or at least have a better sense of that detail – before committing ourselves and others to a lot of hard work and ultimate heartache."

He pinpoints that crafting an instance of the BMC is not enough. Before attempting to design a business model, more details have to be filled in. In our view, many of these details can be found in the enterprise architecture and must be "translated" to BMC terms. This can only be realized if (a) we can relate enterprise architecture and business models at the modelling language level, and (b) if we have a method to guide the migration from a current situation to a desired situation, in which a new or improved business model motivates the architecture change. Summarizing the above arguments, we conclude with the formulation of our research goals:

1. To relate enterprise architecture to business models through their modelling approaches;
2. To explore the chaining of architecture-based cost analysis and business-model based revenue analysis techniques such that realistic cost/benefit analyses can be made;
3. To develop a method for migrating from an as-is to a to-be architecture, resting on the relationship between enterprise architecture models and business models.

The remainder of the chapter is organized as follows. Sections 6.1 and 6.2 cover some background information on ArchiMate and BMC. Then, Section 6.3 presents the proposed approach for relating the two modelling approaches. We compare the (definitions of) concepts and relationships as defined by the ArchiMate meta-model to the concepts and relationships defined by the BMC. Furthermore, Section 6.4 explains how architecture-based cost analysis can be used to provide quantitative input for the BM-based cost/revenue analysis. Section 6.5 follows-up on this with the presentation of the migration method, which is positioned with respect to TOGAF (The Open Group, 2011). To demonstrate both the method and how we relate enterprise architecture and business models, in Section 6.6 we consider (and elaborate) a new scenario for an example often used in the enterprise architecture domain, the ArchiSurance case. We conclude this chapter with a discussion of the related work (Section 6.7), a summary of our contribution and some pointers to future work (Section 6.8).

6.1 Enterprise Architecture: ArchiMate as Foundation

Our interpretation of enterprise architecture (EA) comes from ArchiMate. It provides a language and framework for EA. ArchiMate has been developed in such a way that the core can be extended. We use two of the existing extensions, as they relate to business modelling aspects. The first extension is the motivation extensions, which contributes concepts such as goals. The second extension contributes value-related concepts. Before getting into details of ArchiMate in later sections, first we motivate our choice for ArchiMate. In the later sections, we briefly describe ArchiMate 2.0 (Sections 6.1.2 and 6.1.3) and its extension with value-related concepts (Section 6.1.4). A full description can be found in the ArchiMate specification (Iacob et al., 2012a), and in the proposal for extension (Iacob et al., 2012b) respectively.

6.1.1 Why ArchiMate?

Many frameworks, reference architectures, and methodologies are relevant for the field of enterprise architecture (see The Open Group (2011), and Iacob et al. (2012a) for an overview). In the last decade, in the scientific community, two schools of thought have been recognized as dominating EA modelling:

- The ArchiMate language and framework, and
- Design and Engineering Methodology for Organizations (DEMO)

The ArchiMate language and framework (Jonkers et al., 2003) has become for EA design what UML is for software design, with its own international open standard (Iacob et al., 2012a). The next section provides a more detailed description.

Design and Engineering Methodology for Organizations (DEMO) is a predominantly academic approach. It emerged in the nineties as a methodology for describing business processes, and evolved into an enterprise engineering ontology and method that includes several types of models for the description of organizations. DEMO takes a language-action perspective and looks at organizations at an ontological, infological, and datalogical level. Central to DEMO is the basic pattern of a business transaction. DEMO further distinguishes the construction, process, state, and action aspects (Dietz, 2006). Results have been reported with respect to the use of DEMO for organizational composition and decomposition modelling (Op 't Land, Martin, 2008).

More recently, the TOGAF standard proposed the Content Framework, which emerged in the consultancy world, and categorizes architecture artefacts according to the TOGAF development phases (The Open Group, 2011). The Content Framework constitutes a kind of conceptual map of the EA domain, but lacks both a formal meta-model and a graphical notation. Therefore, it cannot be considered a modelling language.

In their attempt to compare ArchiMate to DEMO, Ettema and Dietz (2009) conclude that they are hardly comparable. However, besides expressive power, an important advantage of ArchiMate over DEMO is its rapid acceptance in the industrial community as well. This motivates our choice for ArchiMate.

6.1.2 The ArchiMate 2.0 core

Figure 40 shows a simplified version of ArchiMate's meta-model. The language distinguishes between three layers: the business layer, the application layer, and the infrastructure layer. Furthermore, the language considers the structural, behavioural, and informational aspects within each layer. It also identifies relationships between and within the layers. Figure 40 does not show all permitted relationships, however: every element in the language can have composition and aggregation relationships with

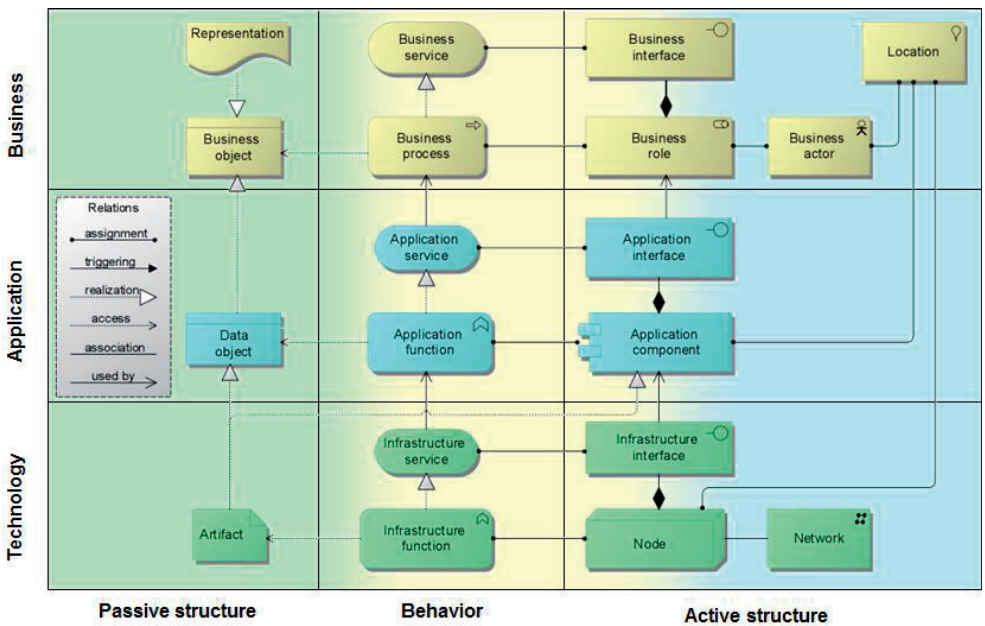

Figure 40: Simplified ArchiMate (2.0) meta-model

elements of the same type; furthermore, indirect relationships can be derived through a relationship composition mechanism (Buuren et al., 2004).

To facilitate architecture-based (quantitative) analysis, ArchiMate model elements could be annotated with attributes, which quantify measures associated with the concepts and relationships. The nature of these measures may vary depending on the purpose of the concrete analysis technique used. For example, one may associate core elements with costs, performance measures, KPIs, etc., which then can be used as input for quantitative analysis techniques (for an example of quantitative attributes and performance analysis techniques see Iacob and Jonkers (2007). Attributes can be defined for both input parameters and analysis results, although the distinction may not be sharp always: the result of one analysis technique may be the input of another analysis technique. In our approach, the specific quantitative attributes are related to costs and revenues, as defined in the BMO.

6.1.3 Motivation Extension

A proposal for extending ArchiMate with motivation concepts has been made by Engelsman et al. (2011) first. This extension is now part of the official ArchiMate 2.0 standard specification, and is described briefly in the sequel. The motivation extension facilitates the identification, description, analysis, and validation of requirements, and their realization in enterprise architecture models.

A motivational element is defined as an element that provides the context or reason behind the architecture of a system, or behind architecture decisions. Intentions are pursued by people, called stakeholders, which can be some individual human being or some group of human beings, such as a project team, enterprise or society. In addition, intentions may be organized into certain areas of interest, called drivers such as customer satisfaction, compliance to legislation or profitability. Drivers represent internal or external factors, which influence the plans and aims of an enterprise. Assessments of these drivers are needed to decide whether existing intentions need to be adjusted or not. The actual intentions are represented by goals, principles and requirements. Goals represent some intended result – or end – that a stakeholder wants to achieve (for example, increasing customer satisfaction with 10%). Principles and requirements represent intended properties of solutions – or means – to realize the goals. Principles represent intended properties that are required from all possible solutions in a given context. For example, the principle “Data must be stored only once” represents a means to achieve the goal of “Data consistency” and applies to all possible designs of the organization’s architecture. Instead, requirements represent intended properties of specific solutions. For example, the requirement “Use a single CRM system” is a specialization of the aforementioned principle by applying it to the current organization’s architecture in the context of the management of customer data. For a more detailed description of this extension, we refer to Iacob et al. (2012a). Figure

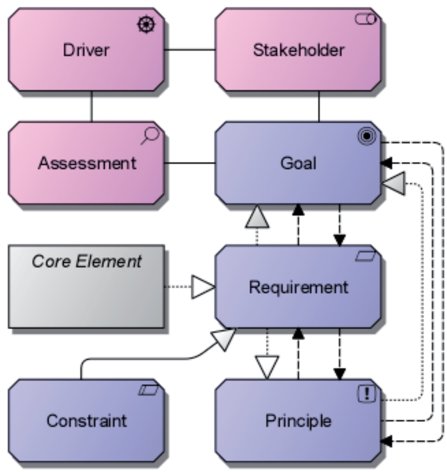

Figure 41: ArchiMate motivation extension meta-model

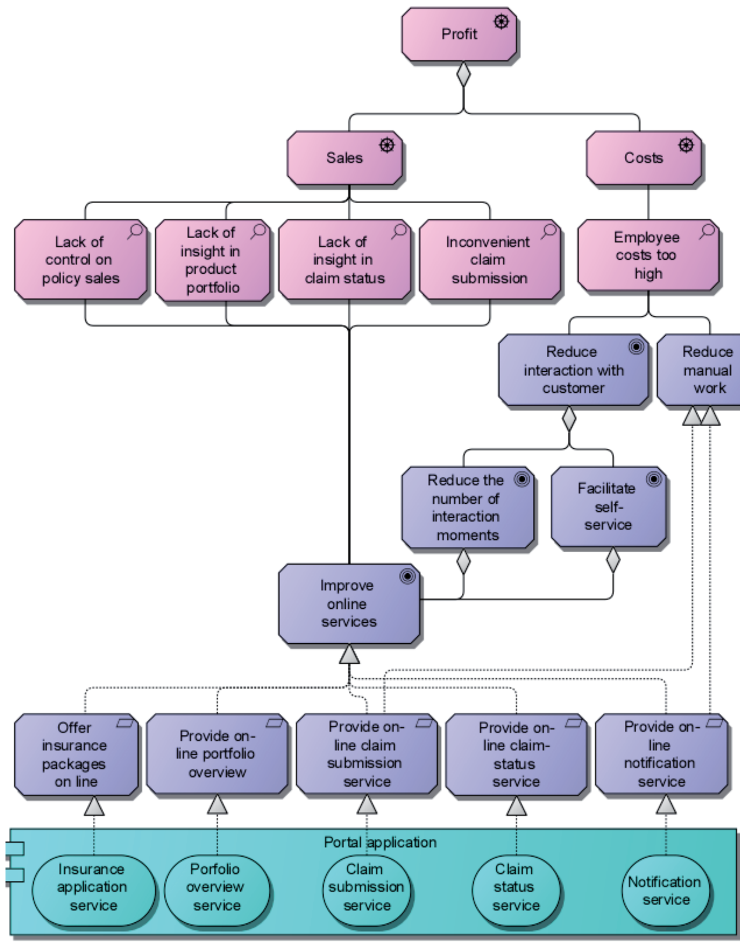

Figure 42: ArchiMate motivation model example (ArchiSurance)

41 shows the complete meta-model of the motivation extension and Figure 42 shows an example of a motivation model.

6.1.4 Value-related concepts

Recently, we have completed research concerning several additional concepts that make modelling value and value-related concepts possible. This research (Iacob et al., 2012b) aims at supporting architecture-based IT valuation models and portfolio management techniques. We have identified concepts such as value, risk, constraint, resource, and capability, which make it possible to use ArchiMate in conjunction with portfolio management techniques, such as Financial and Economic Models, Constrained Optimization Models, Multi-criteria Decision Making Models, Checklists, Scoring models, and Relevance Trees. Furthermore, these concepts are linked with the existing ArchiMate concepts and aligned with the ArchiMate meta-model. In the remainder of this section, we describe them briefly, without going into technical details concerning the motivation of their underlying meta-model (which can be found in Iacob et al. (2012b)).

ArchiMate's value concept, although limiting, fits in the general definition of value as assumed by most valuation techniques (see Iacob et al. (2012b) for a survey of valuation techniques). The current definition of value in ArchiMate has two main problems. The first one is related to its semantic overload. Value is now defined as the relative worth, utility, or importance of a business service or product. This coincides to a certain extent with the view expressed in the service science literature (Vargo and Lusch, 2004). However, Vargo and Lusch argue that value is not intrinsic to goods or services, but is established by the customer of that good or service as value-in-use; therefore, firms can only make value propositions. This is in line with the BMO (Osterwalder, 2004). ArchiMate does not make this distinction between value as "value-in-use" and value as "value proposition". For the sake of (models') simplicity, we choose to allow both these interpretation of value. The second problem is related to the fact that in ArchiMate 2.0, value is only associated to business services and products, and thus confined to the business layer of the architecture. We argue that value should not only be considered in relation with a firm's environment (its customers), but also internally. Thus, any architectural element (or project) has value (as value-in-use) for its users. For this reason, we choose to broaden its definition to cover a broader range of values. Thus, value is defined as the relative worth, utility, or importance of a core architectural element (business service, process, application component, etc.), or of a (IT) project.

For the concept of risk, we adopt the definition of The Open Group (2009): "the frequency and magnitude of loss that arises from a threat (whether human, animal, or natural event)." The most common risk calculation formula is that of the threat's probability multiplied with the size of its effect (that is, the size of the value loss).

The constraint concept has been proposed in the motivation extension and does not cover operational constraints (for example, control flow constraints). We use it in relation with value-related concepts as well.

The resource concept is present prominently in most valuation techniques, and especially in constraint optimization models, in which they are defined mathematically and constrained. We define a resource as a person, (information) asset, material, and/or capital owned or controlled by an organization. We relate the resource concept to the motivation extension, in particular to goals. Furthermore, we stress that a resource is realized by structure elements, and, as such, we can regard it as an abstraction of structure elements.

Similarly to resource, we introduce the capability concept as an abstraction of behaviour elements. More precisely, capability is defined as the ability of an entity (department, organization, person, system, etc.; a static structure element) to perform activities that would contribute to the achievement of its objectives, especially in relation to its overall mission. This definition suggests that capability can indeed be seen as an abstraction of the behaviour the entity is able to perform to achieve its goals.

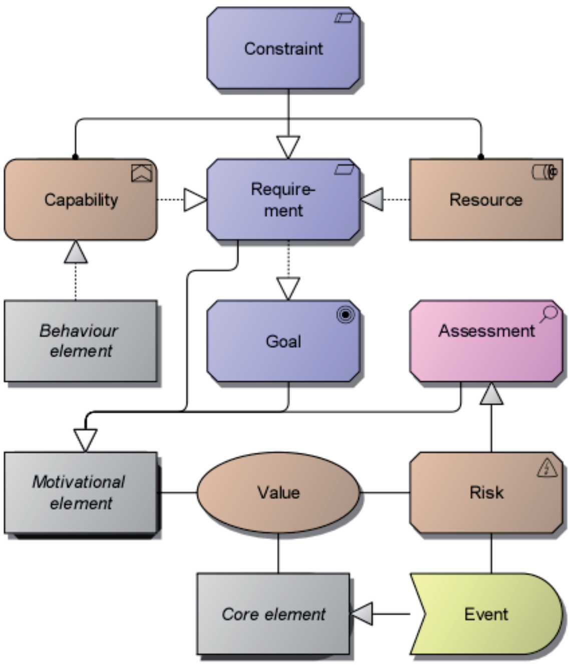

Figure 43: ArchiMate value-related concepts meta-model and notation

From the semantic point of view, the above concepts of resource and capability are similar to those of operand resources and operant resources respectively, as introduced by Constantin and Lusch (1994) in the marketing literature, and then incorporated in service science (Vargo and Lusch, 2004). Operant resources are employed to act

on other resources to create an effect, usually some benefit, while operand resources are resources on which an operation or act is performed to be beneficial (for example, natural resources, goods, data, or money). According to Vargo and Lusch (2004), operant resources are usually intangible (for example, core competencies, and organizational and business processes). They are dynamic and infinite as opposed to operand resources, which are static and finite. This agrees with our idea to introduce resource and capability in ArchiMate as abstractions of, respectively, structure and behaviour.
Figure 43 shows the meta-model and notation for the extension with value-related concepts and their alignment with the core meta-model. In Figure 44, we also give an example of model that uses concepts from this extension.

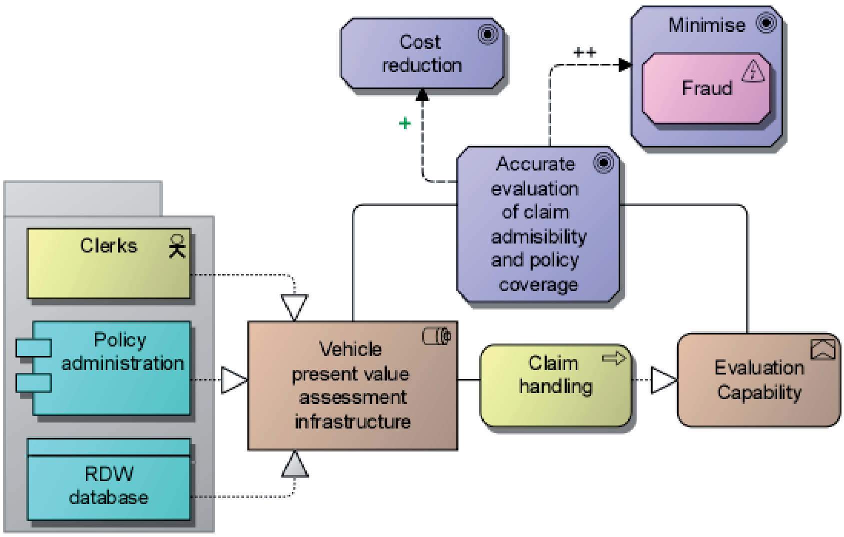

Figure 44: ArchiMate value-related model example, with resource and capability use (ArchiSurance)

6.2 Business modelling: business model canvas (BMC) as foundation

The previous chapters thoroughly describe our interpretation of business modelling. For this chapter, however, we need a meta-business model to link to enterprise architecture (EA). We choose for the business model canvas (BMC), as described by Osterwalder (2004) and Osterwalder and Pigneur (2010). It provides a framework (or canvas) for business modelling. Before getting into details of the BMC, first we motivate our choice for the BMC. Then we introduce its concepts and underlying meta-models.

6.2.1 Why the BMC?

Many business model frameworks exist that aim at facilitating and guiding business modelling. For example, Activity system by Zott and Amit (2010), e3-value by Gordijn (2002), RCOV by Demil and Lecocq (2010), the BM Concept by Hedman and Kalling (2003), Entrepreneur's BM by Morris, Schindehutte and Allen (2005), the Social BM by Yunus, Moingeon and Lehmann-Ortega (2010), The BM guide by Kim and Mauborgne (2000), 4C by Wirtz, Schilke and Ullrich (2010), Internet BM by Lumpkin and Dess (2004), and BMO by Osterwalder (2004). Some of them have a strong link to information systems, while others are closely related to strategic management or industrial organisation. Most business model frameworks mentioned above have been published in the top 25 MIS journals. However, a systematic literature review, which we carried out recently, resulted in an initial set of 171 journal articles and conference papers relevant for the topic of business modelling. After filtering this set of publications, we ended up with 76 articles presenting some 43 different business model frameworks. Furthermore, five articles in the reviewed literature present a review of business model literature and aim to compare some existing frameworks: Pateli and Giaglis (2004), Gordijn et al. (2005), Lambert (2008), Al-Debei and Avison (2010), and Zott et al. (2011). A common trait of most frameworks is the lack of formality, which is necessary to relate a business model to its supporting enterprise architecture at the model level. However, of the reviewed frameworks, two stand out as having a sufficient formal foundation from the modelling point of view: e3-value (Gordijn, 2002)and BMO (Osterwalder, 2004). Gordijn et al. (2005) present an extensive comparison of these two approaches. The two approaches are quite different. In terms of the scope covered, BMC focusses on a single element of a value chain and its direct relations, customers and suppliers, while e3-value takes a network perspective to provide more insight into value generation, outside the formal boundary of a single organization. At the conceptual level, they are quite different too: the BMC puts emphasis on resources needed to create a value proposition, while in e3-value, modelling value streams in a business network is central. Gordijn et al. (2005) propose a mapping between BMO and e3-value concepts, which reveals these differences. When considering the level of formality, although both e3-value and BMO have been found to be "light weight" ontologies (Gordijn et al., 2005), e3-value is more formal than BMO since it comes with a meta-model (Gordijn and Akkermans, 2003) and a graphical notation, for which reason it is a true modelling language. The fact that BMC is widely accepted is partly due to its simplicity and ease of use, which come at the cost of formality. Our decision to choose the BMO over e3-value is not only because its popularity but also due to the fact that the relationship between e3-value and ArchiMate has been addressed by Janssen, Buuren and Gordijn (2005) already.

6.2.2 Business Model Ontology

Osterwalder's PhD thesis provides the formal foundation for the BMC in the form of the Business Model Ontology (BMO) (Osterwalder and Pigneur, 2010; Osterwalder, 2004). The ontology is based on previous research as its key concepts come from the balanced score card (Kaplan and Norton, 1992), value chains (Porter, 1985), and stakeholder analysis (Freeman, 1984).

As we use Osterwalder's BMO, we adopt his definition of a business model (Osterwalder, 2004):

"A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams."

Osterwalder identifies nine elements. These elements map to four general areas, similar to the balanced score card (Kaplan and Norton, 1992): product (the value a company offers), customer interface (one or several segments of customers), infrastructure management (the architecture of the firm and its network of partners), and financial aspects (profitable and sustainable revenue streams). Each of the nine elements is decomposed into sub-elements. For example, a value proposition may consist of multiple offerings. Besides that, the elements may have attributes, for example, the sub-element "account" may take a name and a percentage of the total costs as attributes. Figure 45 shows all the elements included in the BMO and their relationships. For a precise description of each element (by means of tables), its attributes, and its relationships, we refer to Osterwalder (2004). Using this source, we have been able to "mine" the BMO meta-model shown in Figure 45.

While first the BMO consists of twenty concepts (Osterwalder, 2004), later versions include only nine concepts (Osterwalder and Pigneur, 2010). These form the Business Model Canvas (BMC) (Osterwalder and Pigneur, 2010), which' name gives a clear hint on the intended use and practical relevance of BMO, namely that of a tool to design and specify business models. The main reduction of concepts comes from combining the elements with their sub-elements, which has significantly contributed to BMC's parsimonious character, and most probably, to its quick success. For example, from the two pairs Value Proposition and Offering, and Capability and Resource, only Value Proposition and Resource remain.

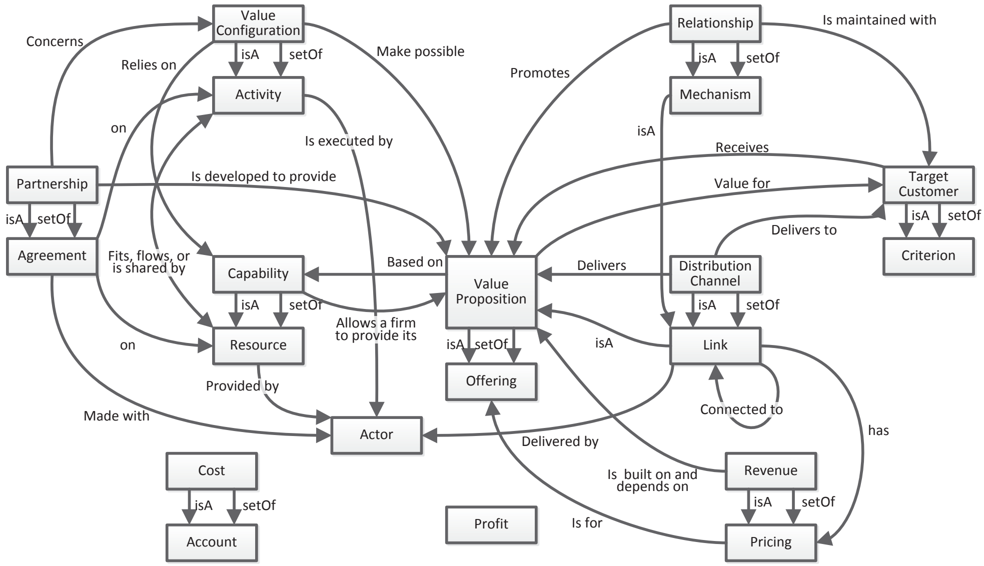

Figure 45: The BMO meta-model

The concepts Profit and Actor have been eliminated in the BMC. They were also the only two elements without a sub-element in the original BMO. Profit might have been considered as superfluous, as it is simply the difference between Revenue and Cost. In the meta-model, profit has no relationships to any other elements either. As far as the Actor concept is concerned, we assume that it was merged with Partnership and Agreement, to form Key Partners. Considering all of the above, we may assume that the BMC simplification of the BMO meta-model is as shown in Figure 46 (the dashed arrow

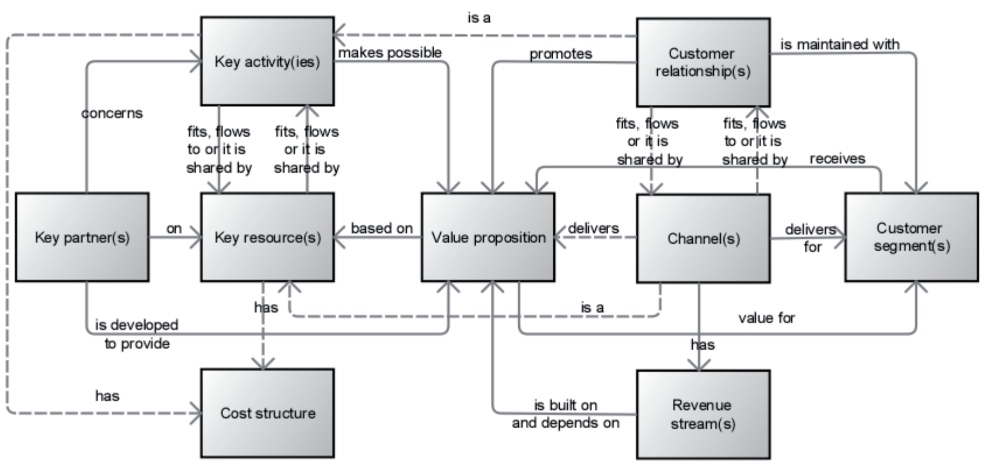

Figure 46: BMC meta-model and proposed extensions

do not belong to original definition of the BMO; they represent proposed extensions and are explained below).

In our opinion, the resulting BMC meta-model reveals a few issues with the meta-model definition of the BMC and of the BMO, from which we have derived it. For example, there is no explicit relationship defined between the cost structure building block and any other building block. To compensate this we propose the extension of the BMC meta-model with the following relationships:

- A "has" relationship from the key activities to the cost structure. Key activities require the usage/consumption of resources, which generates costs.
- A "has" relationship from key resources to cost structure. Key resources must be connected to costs, as the costs of all activities can be seen as resulting from the consumption/usage of resources during their execution.

Another problem (also related to costs) is that the creation and maintenance of customer relationships may also generate significant costs (for example, through creation and distribution of marketing materials), as they can be seen as a type of activity during which resources are used/consumed. However, no direct (or indirect) relationship in the BMO is defined between the customer relationship building block and cost structure. We solve this issue by adding an "is a" relationship from the customer relationship building block to the key activity building block. A similar situation occurs with the channels, which can be seen as resources that cost money. For example, take the portal application of a web shop, which is the channel through which the business is done, and, hence, a key resource. The solution is to add an "is a" relationship from channels to key resources. Additionally, we consider extending BMC with a bidirectional "fits, flows to, or is shared by" from the customer relationship building block to the channels building block to make explicit the resources (in this case channels) assigned to the customer relationships. Finally, we also miss a "delivers" relationship from channels to value proposition, since channels are the means through which the value proposition reaches the customers. The proposed additional relationships are shown in Figure 46 with dashed lines and they do not belong to the original BMO meta-model definition.

Another, more fundamental issue with the BMO definition is the inclusion of capabilities in the Key resources building block. Osterwalder's capability definition is that of "ability to execute a repeatable pattern of actions that is necessary in order to create value for the customer." (Osterwalder, 2004) On the other hand, Osterwalder defines the activity concept (which forms the core of the key activity building block) as "an action a company performs to do business and achieve its goals." As can be seen, not only are the two definitions semantically very much related, but also they suggest that capability (as ability of performing activities) and activity should better belong together to the same building block (the key activities building block) as they have the same nature: they both express behaviour. Instead, the key resources building block should only focus on the specification of the assets an organization owns or controls, such as tangible assets (for example, plants, equipment, information systems, and cash reserves), intangible assets (for example, patents, copyrights, reputation, brands, and trade secrets), and human assets (for example, the people a firm needs to create value with tangible and intangible resources). In the BMC, this problem disappears, since the capability concept has been eliminated, and the only remaining elements are, simply, key activities and key resources. Nevertheless, we stress that (contrary to the BMO meta-model definition) we follow our argument that capabilities belong to key activities, when relating the BMC's key activities building block with the architecture capability concept, as will be explained later.

6.3 Relating ArchiMate and BMC

We argue that the ArchiMate concepts suitable to be related to the BMC concepts are those from the motivation extension, the resource and capability concepts, and several of the business layer concepts. This statement rests on the observation that business models and architecture models aim to represent different abstraction levels of an organization. Thus, the former captures mostly the strategic aspects, while the latter is mostly concerned with operational aspects. Therefore, business models rarely concern other aspects of the enterprise than those mentioned, which are obviously closer to an organization's strategy than the deeper architecture layers. Furthermore, even if BMC elements would refer to operational entities described in the architecture, one can use more abstract architecture concepts instead, such as, capability and resource, to abstract from them. Such abstractions can then be further refined and operationalized in terms of business, application and infrastructure layer concepts. This idea is suggested in Figure 47, which also shows the correspondences between BMC and ArchiMate concepts. To define correspondences, we first compared concepts defined by BMC (also called "building blocks" by Osterwalder and Pigneur (2010)) to the concepts defined by ArchiMate. Table 39 shows and motivates the proposed correspondence that resulted from this comparison. As can be seen, often, concepts from Osterwalder's meta-model can be matched with multiple concepts in ArchiMate. This is logical, as ArchiMate is richer than the BMO.

After the most suitable matching between BMC and ArchiMate concepts have been found, we do the same for the relationships defined in the BMC meta-model (Figure 46) and ArchiMate relationships. Table 40 presents the result of our relationship matching is. It was obtained as follows: for each pair of BMC concepts among which a BMC relationship exists, we analysed the ArchiMate meta-model and selected the most suitable relationship that is allowed between the corresponding ArchiMate concepts.

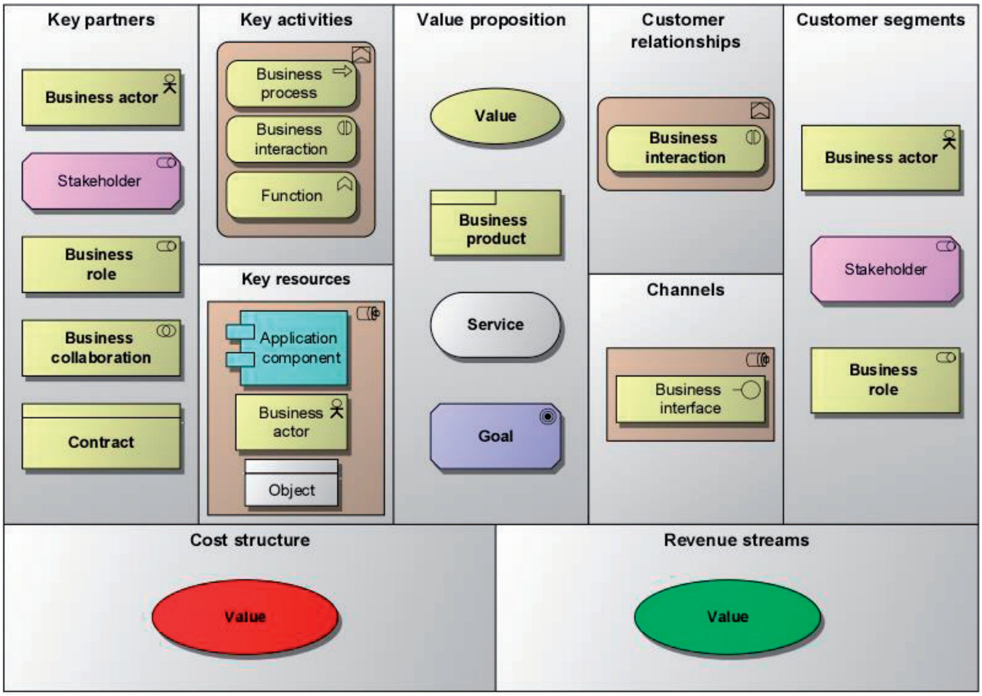

Figure 47: Relating ArchiMate and BMC

Table 39: Defining the correspondence between BMC and ArchiMate concepts

BMC	ArchiMate	Justification
Segments	Business actor, Business role, Stakeholder	"The Customer Segments Building Block [in the BMC] defines the different groups of people or organizations an enterprise aims to reach and serve". In ArchiMate such organizations, departments are modelled as actors, stakeholders or roles.
Proposi-tions	Business service Value, product Goal	"The Value Propositions Building Block [in the BMC] describes the bundle of products and services that create Value for a specific Customer Segment". A very simple lexical analysis of the definition above already gives a clear indication of the ArchiMate concepts that are suitable to model the value proposition. Besides products, business services and value, we also included the goal concept because most goals are formulated in terms of the aim of increasing some sort of value, and thus, they give a more accurate view on the value proposition by showing why the Product or Service is useful.
Channels	Business interface, Resource	"The Channels Building Block [in the BMC] describes how a company communicates with and reaches its Customer Segments to deliver a Value Proposition". Considering that, in the ArchiMate specification, "a business interface is defined as a point of access where a business service is made available to the environment", we may conclude that the channels building block contains a specification of all business interfaces. It should be noted that business interface is an active structure element that fits in the definition of resource and, as such, can be abstracted from by means of the resource concept.

BMC	ArchiMate	Justification
Customer relation-ships	Business interaction, Capability	"The Customer Relationships Building Block [in the BMC] describes the types of relationships a company establishes with specific Customer Segments. In ArchiMate, the most suitable choice to describe such relationships is the concept of business interaction defined as "a behaviour element that describes the behaviour of a business collaboration." It should be noted that business interaction is a behaviour element that fits in the definition of capability, and, as such, can be abstracted from by means of the capability concept.
Revenue streams	Value	"The Revenue Streams Building Block [in the BMC] represents the cash a company generates from each Customer Segment (costs must be subtracted from revenues to create earnings)". The only ArchiMate concept that can be used to model revenue is value. Another option is to specify the revenue as an attribute of the architectural element generating it (for example, a product or business service). However, in such case (as opposed to modelling revenue as value), the modelling of revenue sources is explicit, while that of revenues themselves is implicit.
Key re-sources	Resource	"The Key Resources Building Block [in the BMC] describes the most important assets required to make a business model work." This definition reproduces almost literally the definition of resource.
Key activ-ities	Capability	"The Key Activities Building Block [in the BMC] describes the most important things a company must do to make its business model work." As mentioned earlier, in the architecture domain, capability is defined as the ability of an entity (department, organization, person, system) to perform activities that would contribute to the achievement of its objectives, especially in relation to its overall mission, which is that of making its business model work.
Key Part-nerships	Business actor, business role, Stakeholder, business collaboration, Contract	"The Key Partnerships Building Block [in the BMC] describes the network of suppliers and partners that make the business model work". This definition suggests that this building block specifies both the nodes of the network, that is the parties invoked in partnerships (actors, roles, and stakeholders), and the relationships and interactions between them. Similar to the customer relationship building block, such relationships/ interactions can be described in ArchiMate by means of business collaborations, business interactions and contracts.
Cost Structure	Value	"The Cost Structure [in the BMC] describes all costs incurred to operate a business model". Similar to the case of the revenue streams building block, the only ArchiMate concept that can be used to model cost is value. Another option is to specify the costs as an attribute of the architectural elements generating them (for example, a human, technical, or informational resource). However, in such case (as opposed to modelling cost as value), the modelling of cost sources is explicit, while that of costs themselves is implicit.

Table 40: Relationship matching between BMC and ArchiMate

BMC relationship	ArchiMate relationship
Is a	Specialization
Fits, flows or it is shared by	Assignment access, used by
Concerns, is maintained with	Assignment
Make possible, promotes, deliver, based on	Realization
Is developed to provide, on, has, is built on and depends on, receives	Association
Delivers for	Used by

6.4 Chaining Architecture-based Cost Analysis technique with BM-based Cost/Revenue Analysis

Next to showing how a business works, an equally important goal of a business model is to demonstrate that the business indeed does work: that it generates profit. Often, this is done by a cost/revenue analysis, in which both costs and revenues are estimated based on the expected size of the market share. The accuracy of this type of analysis depends highly on the quality of the input estimations. These estimations can be significantly improved if they are the result of detailed architecture-based cost calculations that, in turn, are based on real resource costs, processing times, and processing volume (also known as throughput). For architecture models, such a technique is described by Jonkers and Iacob (2009).

The EA-based cost calculation technique of Jonkers and Iacob (2009) uses several cost measures and assigns them to the different model elements. Applying an algorithm (based on a recursive formula) results in calculated cost values for each behaviour element (including services). In a bottom-up fashion (from the technology infrastructure to the business layer), the algorithm collects all resource use costs caused by the completion of an instance of a behaviour element, where any structure element is seen as a resource.

Architectures can be described from different viewpoints, which result in multiple, different views on a single architectural model (ISO/IEC, 2007). These views aim at different stakeholders that have an interest in the modelled architecture. Also for the cost aspects of an enterprise, a number of viewpoints can be discerned, resulting in different (but related) cost measures:

- User/customer view (stakeholders: customer; user of the offered service or product): cost per use / price of a service or product. This type of costs can be seen as revenues for the providing enterprise.
- Resource view (stakeholder: resource manager; capacity planner): resource variable cost (or tariff), the cost per (time) unit for using or consuming the resource and a resource fixed cost (the cost per use). Recall that a resource is any type of asset used or consumed (e.g., human resources, information resources and systems, money, materials, buildings, etc.). In ArchiMate, resources are realized by active or passive structure elements (such as, actors, application components, interfaces, objects).
- Process view (stakeholders: process owner; operational manager): cost per completion of a process. This cost can be calculated as the sum of all costs incurred as result of all resources consumed/used during the execution of that process instance.

- Product/service view (stakeholders: product manager; operational manager): cost per completion of one product/service. This cost is the sum of all completion costs of all business processes that together realize the product or service.

In addition, all of these cost measures can be divided into fixed and variable cost components.

This technique leads to an objective and precise estimation of the cost structure in an architecture. In particular, the calculated costs of business services offered directly to the customer can be copied directly into the cost structure building block of an architecture's BMC. Already, these calculated service costs include the costs of resources and activities needed for their realization. Thus, realistic business cases and accurate cost/revenue calculations become possible. This idea, of chaining the two cost analysis techniques, will be demonstrated by means of the ArchiSurance case later.

6.5 A Method for Business Model Driven Architecture Change

As interesting as it may be, relating the BMC framework with ArchiMate has no immediate practical value by itself without a method to guide the migration from a current situation to a desired situation, in which a new or improved business model motivates the architecture change. In this section, we propose such a method. Before going into details, we set the applicability scope of our approach. Our method applies to architecture change projects. By an architecture change, we mean any change that may affect any of an enterprise architecture's layers (business, application, and technology infrastructure layers). Examples of such change projects are projects that involve change of one or more business processes, acquisition, outsourcing, or upgrading of information systems, replacing infrastructural components, such as computing equipment. Our method also assumes the existence of a baseline architecture, where the methods starts. In a green field situation, our method does not work since there is no architecture to relate to a business model.

In the enterprise architecture domain, we rely on the most widely accepted development method, The Open Group Architecture Framework (TOGAF) (The Open Group, 2011). However, we further elaborate on TOGAF, explain how business models can be incorporated in TOGAF, and show how they intervene in developing a target (business) architecture.

TOGAF originated as a framework and methodology for development of technical architectures, but has evolved into a generic EA framework and method. The core of TOGAF is formed by the Architecture Development Method (ADM), a step-wise iterative approach for the development and implementation of an enterprise architecture (see Figure 48). We focus on phases B, C, and D (the highlighted area of Figure 48), as they concern the development of the four architectures that TOGAF distinguishes: business architecture, application architecture, data architecture, and technology architecture, for both the current ("baseline") and desired ("target") situations. For these phases, ArchiMate 2.0 provides suitable modelling support and viewpoints. In addition, we explain the role of requirements management during these phases, because this is where the role of a business model becomes critical for justifying the EA change.

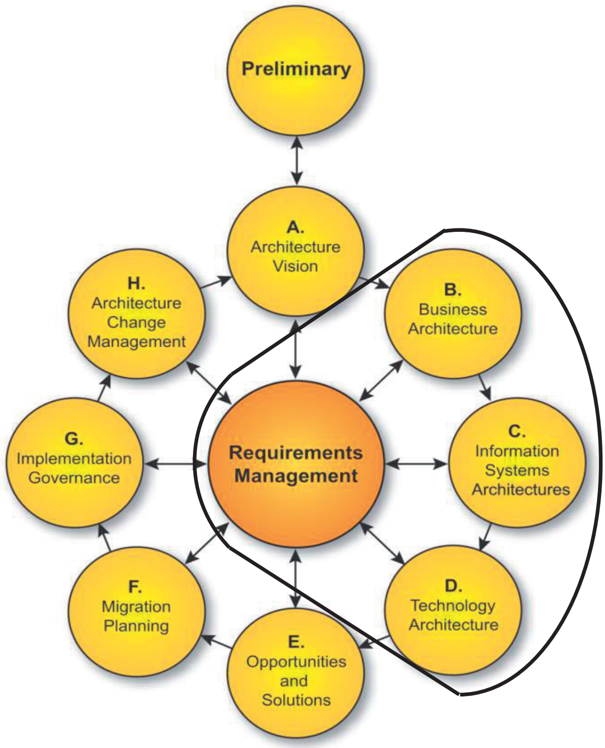

Figure 48: TOGAF Architecture Development Method (ADM)

TOGAF does not prescribe a particular sequence in which the Phases B, C, and D must be carried out, although the arrows in Figure 48 suggest otherwise. This is important for our method, which takes the complete set of baseline architectures as starting point. This assumption is justified by the fact that rarely the need for architecture change arises in a green field situation, and, thus, a baseline architecture indeed exists. Start-ups may constitute an exception, in which case the method starts with the design of a target architecture and its business model, and continues from there.

Phase B "Business Architecture" is particularly relevant because, as indicated in the ADM specification (The Open Group, 2011), this is the phase in which business principles, business goals, and business drivers are explicitly mentioned as inputs for the design of the target architecture (see the overview of overview of TOGAF's phase B given in Figure 49). Business principles, goals and drivers are the foundation on which business requirements rest and which lead the design of the target architecture. Therefore, before design of the target business architecture begins, a critical requirements management activity must take place, which results in the consolidation of business requirements to be included in the request for architecture work. Some of these business requirements can be incorporated in a target business model. Although this line of thinking is acknowledged in TOGAF as well, as proven by the bidirectional arrows linking the middle Requirements Management circle with each of the other phases, the meaning and methodical content of these double arrows are some of the most scarcely described and least understood areas of the TOGAF ADM. This is precisely where our method contributes and fits in. More accurately, it clarifies the meaning of the bidirectional arrow between Phase B and Requirements Management.

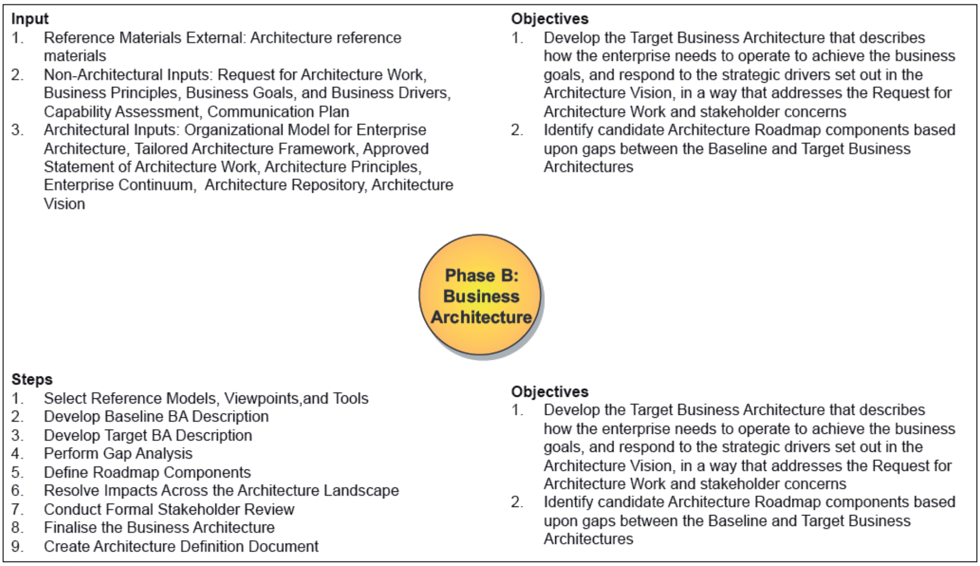

Figure 49: Overview of phase B in the TOGAF ADM

Of course, the question may be raised: why is the definition and communication of business requirements linked specifically to Phase B (and not so much to Phases C and D)? As we mentioned earlier (in section 6.3), it is unlikely that a business model concerns and directly drives the design of the application, data, and technology architectures, due to the abstraction level gap between business models and architecture models. Any business requirements built in the business model (including those that concern to some limited extent the application and infrastructure layers) can first be captured and traced back to the target business architecture by means of resources and capabilities (in the sense of ArchiMate). Afterwards, these can be linked to the target business, application, data and technology architecture descriptions, for which the usual steps prescribed by TOGAF ADM's phases B, C, and D should be followed. Therefore, in the case of Phase C and D, the bidirectional arrows in Figure 48 concern the elicitation of specific technical requirements for the respective architectures, and not that of business requirements (as indicated in the TOGAF ADM specifications (The Open Group, 2011)).

The main idea of the proposed method (worked out in detail in Figure 50, left) is that, once the baseline architecture has been specified (following the phases B, C, and D), its corresponding baseline business model can be derived from it, based on the relationships established between ArchiMate and BMC in section 6.3. Since the conceptual gap between EA and BM is significant, an intermediate step may be the synthesis (from the EA model) of a resource-capability model, which can be related easily to the baseline BM canvas. Then an EA-based cost analysis chained with a BM-based cost/revenue analysis of the baseline situation can be carried out. Such an analysis may reveal problems with the financial health of the current business model and may trigger the architecture change process. The process starts with the design of a motivation model that captures the goals and requirements of the architecture change. This model may indicate already which part of the baseline architecture is subject to change. However, the complete and detailed specification of the target architecture will be carried out by following, again, phases B, C, and D. Similar to the baseline situation, a target resource-capability model and a target business model must be devised from the target enterprise architecture. A second round of EA-based cost analysis chained with a BM-based cost/revenue analysis must be executed, this time for the target situation. Comparing the results of both cost/revenue analyses indicates whether the architecture change is justified from the business point of view. Furthermore, the comparison of the two business models reveals the impact of the architecture change on the baseline business model. Consequently, a decision can be made with respect to the implementation of the target architecture. If the decision is negative (the cost/revenue analysis of the target situation shows no significant profit increase), one may consider going back to the motivation model and reconsider the drivers and goals of the architecture change. A change of the motivation model may lead to an alternative target architecture and, thus, to a re-iteration of the right half of the method (Figure 50, left).

The baseline and target architectures developed during the phases B, C, and D can also be used to develop a series of Transition Architectures that show how to move gradually from the Baseline Architecture to the Target Architecture, in all the architectural domains (The Open Group, 2011). If the risk and impact of the envisaged change is small, it might be possible to move from the baseline to the target in one step. However, migration often requires considering a number of complex business and technical issues related to the change of operational systems. In such a case, the change is better carried out in an incremental fashion, and each step is described by a Transition Architecture. Of course, it may be necessary to devise and evaluate the intermediary business models of the Transition Architectures as well.

To summarize, in our method, models evolve on two orthogonal dimensions: a horizontal dimension (change from baseline to target), which concerns the change occurring within a modelling domain, and a vertical dimension (going from the EA domain to the BM domain), which consists of a two-step abstraction transformation and expresses the process of creating a BM for a given EA. The relationship between the models occurring in the vertical dimension (and also between their underlying modelling formalisms) is depicted in Figure 50, right. Once the baseline and target BMs have been created, analysed, and compared with each other, a decision can be made with respect to the actual implementation of the target EA (in case the costs/benefits balance is favourable).

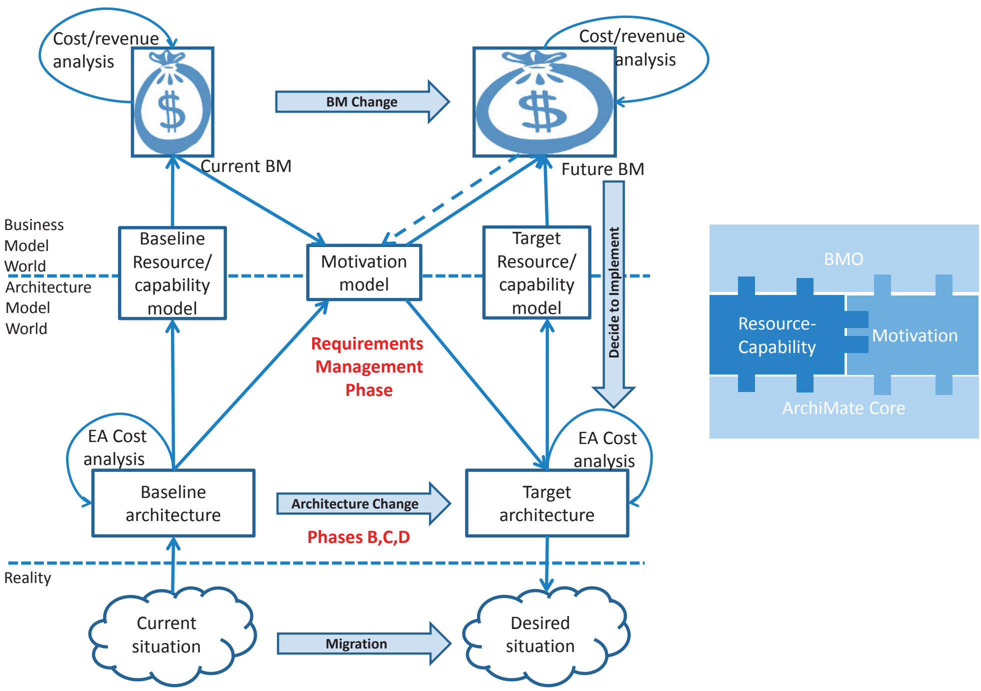

Figure 50: Going from enterprise architecture to business models and back

6.6 Method demonstration: A case study on ArchiSurance

To demonstrate the method described in the previous section, we use an example case often used in the enterprise architecture community: the ArchiSurance case (a case description for ArchiSurance is presented by Lankhorst (2004)). This case has the advantage of being realistic and of manageable size, without being overly simplistic.

ArchiSurance is a fictitious company that provides home, travel, and car insurances. It sells its services through a network of intermediaries. ArchiSurance's primary operations are (1) maintaining customer relationships and intermediary relationships,

(2) contracting, (3) claims handling, (4) financial handling, and (5) asset management. These operations are similar for most insurance companies. To support these operations, the company has several departments, and is running a collection of applications on various hardware platforms.

As for all insurance companies, ArchiSurance offers “security” in the form of risk reduction to its customers. In return for a premium, customers are covered in the case of incidents. The goal of the customers is to “be insured”. Insurance can be considered as a case of the upside-down freemium pattern (Osterwalder and Pigneur, 2010); many paying customers cover the costs of a few claimants. Next to the premiums paid, ArchiSurance also tries to make a profit on its assets by investing them in stocks and bonds. This is common practice for most financial companies. This aspect, however, will not be handled in the models presented next, as it falls outside the scope of the architecture change we address.

The problem ArchiSurance is facing is that lately the customer support at ArchiSurance was confronted with more complaints than usual. Customers complain about almost everything: lack of clarity of their claim status, the inconvenient manner for submitting claims, long waiting times when calling customer support, claims take forever to be processed and paid, etc. Moreover, as a result, they are leaving. ArchiSurance has seen the number of policies dropping with 8% over the past twelve months. Although the situation is not critical yet, management sees this trend as disturbing, considering that it coincides with turbulent developments on the stock market, where ArchiSurance’s investments also significantly dropped in value lately.

In the remainder of this section, we go step by step through the method described in the previous section and shown in Figure 50. During the process, we make use of the proposed approach for relating EA and business models, and of the combination of cost analysis techniques mentioned earlier.

6.6.1 Step 1: Document and specify the baseline enterprise architecture

ArchiSurance’s current enterprise architecture is documented and specified using ArchiMate (Figure 51).

To create insight in ArchiSurance’s primary operations, the company is described in terms of its main business processes, services, and products (together they form the business architecture), application services and components (the application architecture), and networks, devices and artefacts (the technology architecture). Since most reported problems relate to claim handling, the baseline EA specification focuses on the claim handling process and on the business services it supports.

Essentially, ArchiSurance offers three services to the customer: claim submission for which regular mail is used (incoming claims are first sorted by the mail room employee and then scanned and registered in the Document Management System), customer information service that is used to inform customers about the status of their

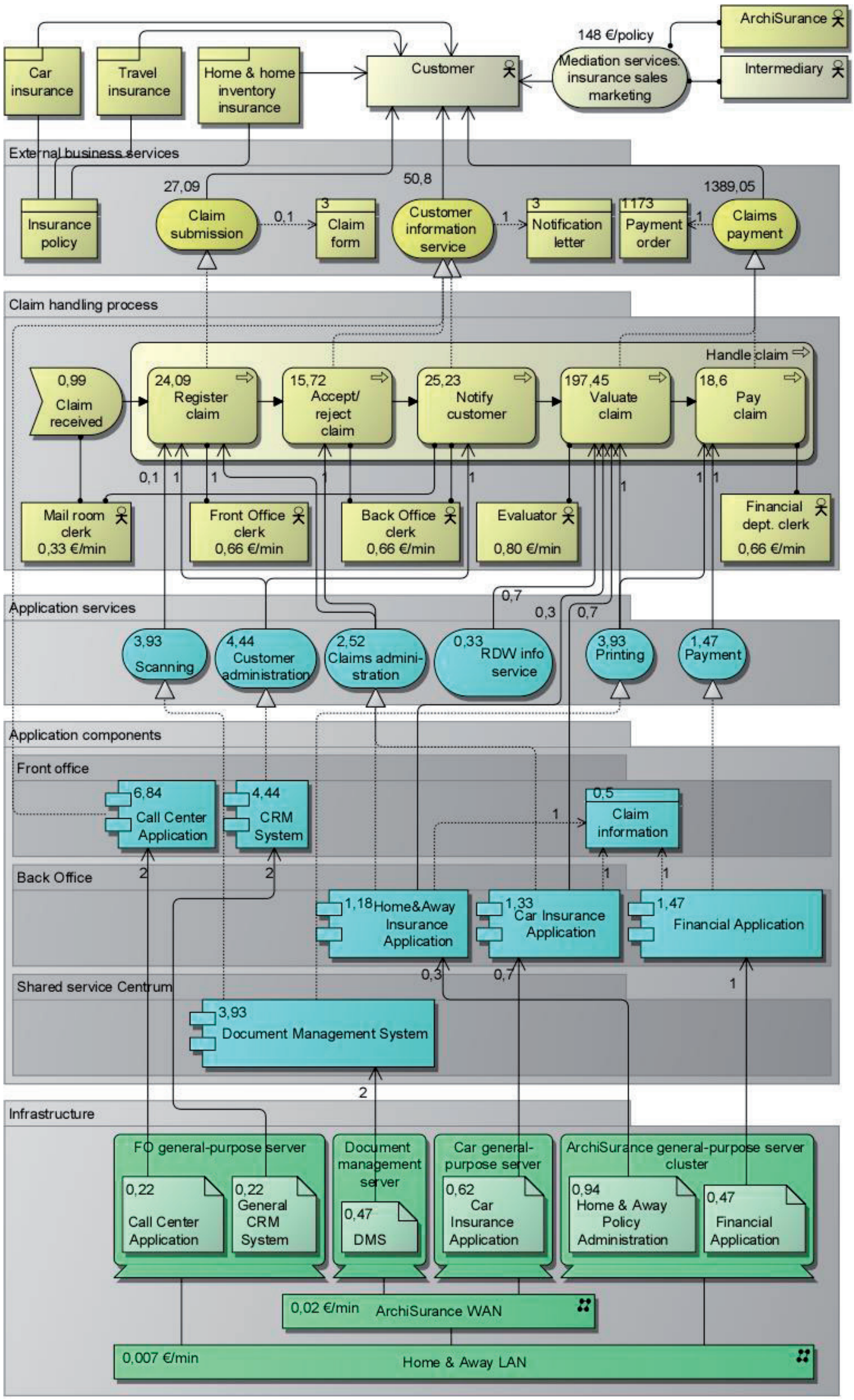

Figure 51: ArchiSurance baseline architecture

claims (again via regular mail, or by telephone via the call center), and claim payment to compensate damages suffered by customers whose claims have been accepted.

ArchiSurance has no control over the sales of insurance products. They work with intermediaries, who mediate the sales and marketing activities, on ArchiSurance's behalf, against a commission. The model in Figure 51 also shows the actors involved in the claim handling process. The numbers shown on the model represent either the cost associated with the execution of one instance of a behaviour element or the tariff/ time unit associated with the used resources. The former constitute the calculated cost values using the EA-based cost analysis technique from Jonkers and Iacob (2009), while the latter is given input data.

6.6.2 Step 2: Specify the current business model

To specify ArchiSurance's current business model, first we extract from the baseline EA the key activities, key resources, and main business services and products offered directly to the customer. All these elements are included in the resource-capability model shown in Figure 52.

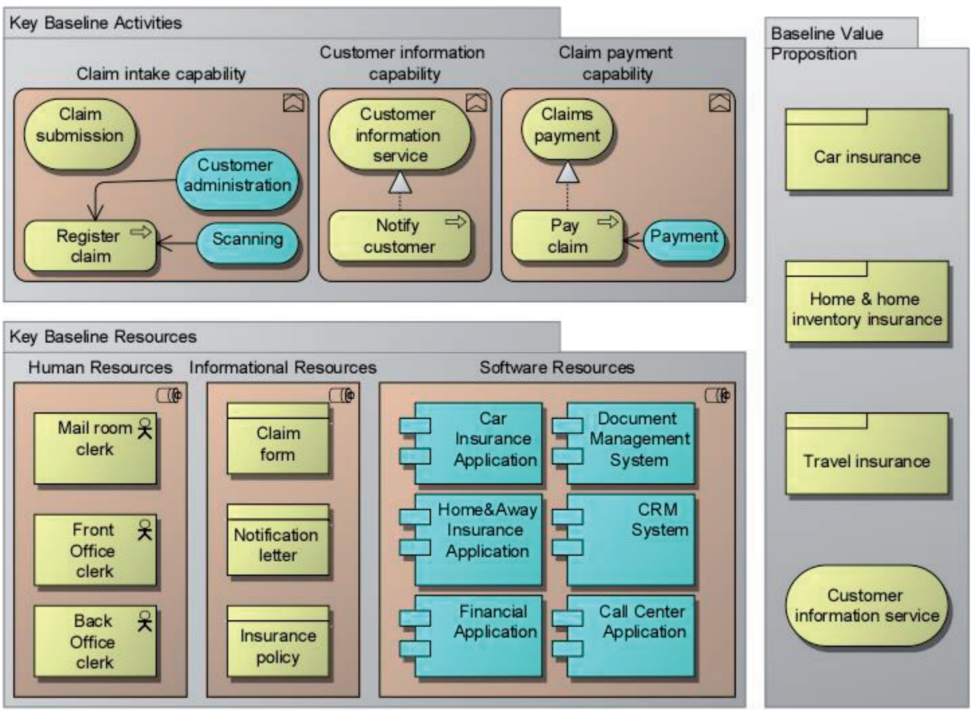

Figure 52: ArchiSurance baseline resource - capability model

Based on this model a baseline BMC can be created (Figure 53). In the cost structure building block, the cost values resulting from the EA-based cost analysis are the input.

Another necessary input is that related to the current transaction volumes (total number of claims/month; average number of new policies/month). Based on this quantitative input a total cost is calculated. ArchiSurance's monthly revenue is calculated as the average monthly premium multiplied with the average number of policies.

As said before, customers are complaining about the lack of insight in the status of their claims, and about inconvenience of the claim submission. The ArchiSurance management team is aware that a few competitors offer new Internet based solutions where customers can access all kinds of information about their insurance portfolios. Therefore, they believe that adopting this new technology may solve ArchiSurance's problems. They want to explore the possibility of developing an online ArchiSurance

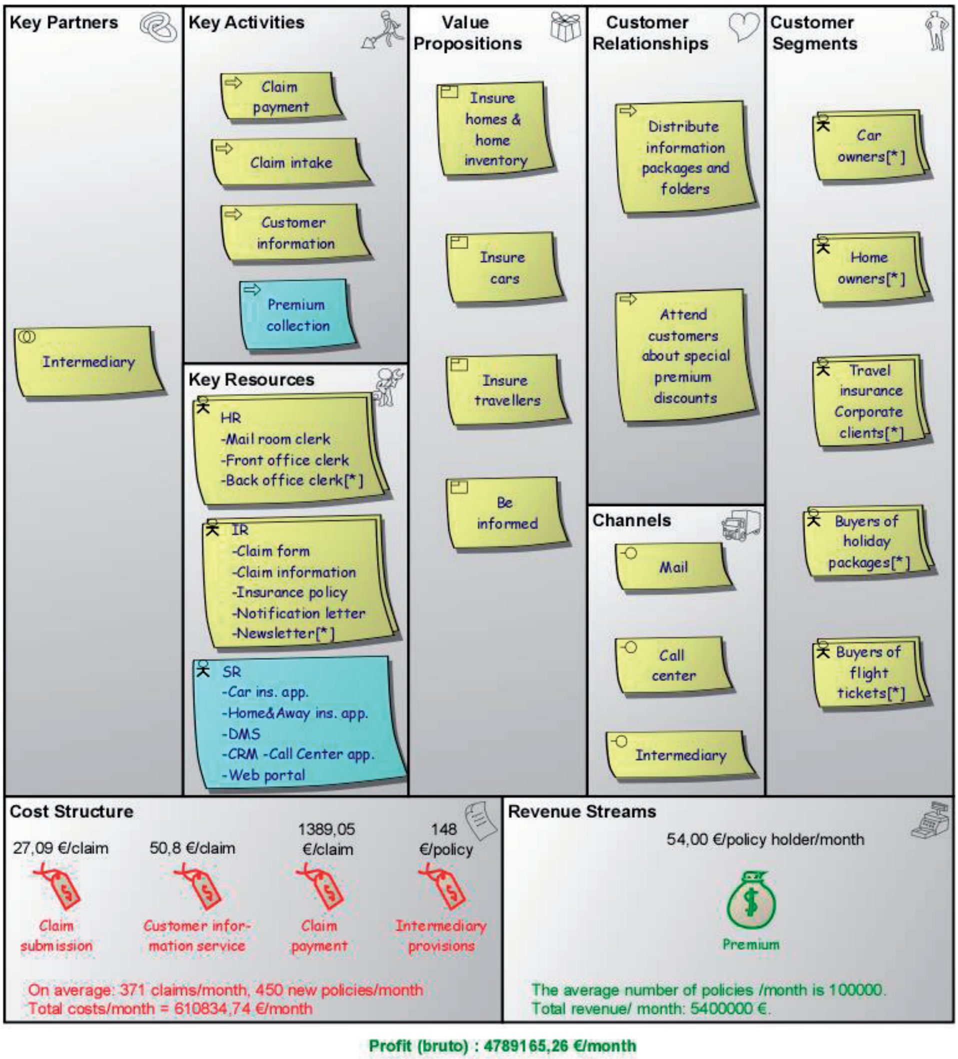

Figure 53: ArchiSurance baseline BM

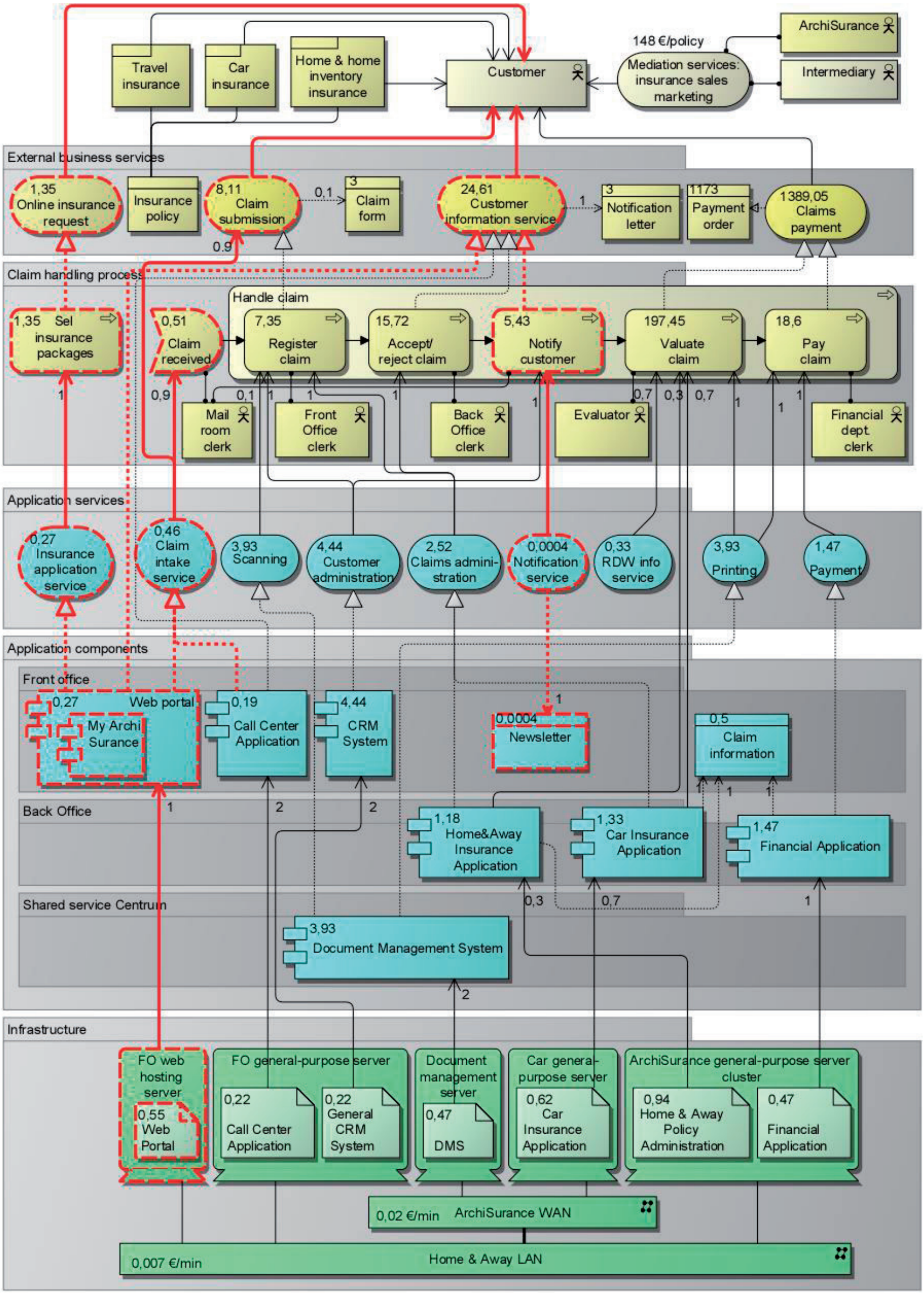

Figure 54: ArchiSurance target architecture

portal that should offer such services (information services, claim submission service, etc.) in the form of a customized "my ArchiSurance" web application (protected by the Id and Password). They have documented their business requirements with respect to this IT project (the architecture change) in a motivation model (Figure 42). The motivation model is the starting point for the specification of the target architecture shown in Figure 54. Red dashed borders highlight all new architecture elements.

As Figure 54 shows, the new web portal application and its corresponding infrastructure have been added to the EA. This results in several new services offered to customers (for example, the possibility to request insurance packages online, online marketing, and newsletters), and old services being offered through a new channel: the portal. This should reduce manual labour and handling costs. For example, in the case of handling of incoming claims, it is expected that 90% of the incoming claims be received online within a year. This assumption seems realistic to us considering the wide spread and ease-of-use of Internet. Consequently, the mailroom employee has to sort 90% less claims than in the current situation. Also scanning of paper forms is needed no longer, since for 90% of claims e-forms are stored directly into the system. The new portal can also automate the customer information service.

As indicated in the method, we run the EA-based cost analysis algorithm (Jonkers and Iacob, 2009) on the target architecture as well to calculate the costs associated with all business processes and services. The results of the cost calculations are indicated in the model.

6.6.3 Step 3: Design the target resource-capability model and business model

Similarly to the baseline situation, the next steps are the design of the target resource-capability model and target BM. They are shown in Figure 55 and Figure 56, respectively.

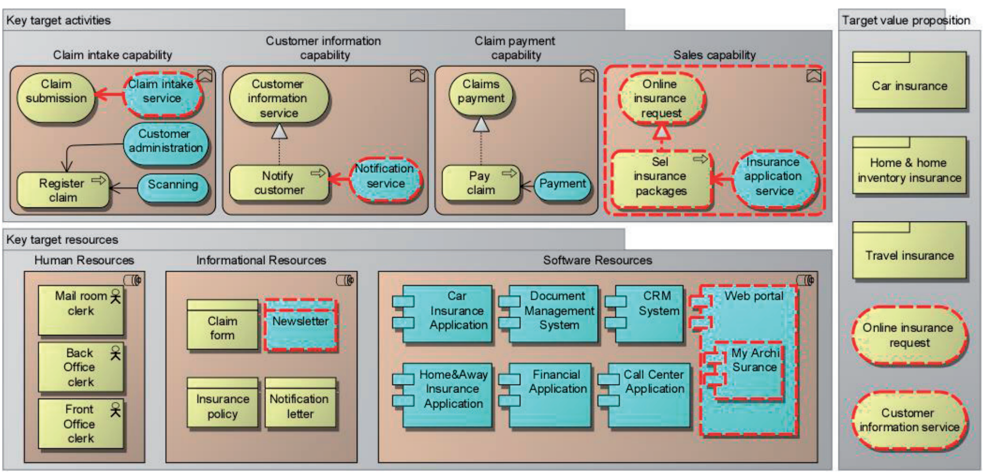

Figure 55: ArchiSurance target resource-capability model

As the figures show, a new sales capability, and new informational and software resources have been added. In addition, the cost/revenue analysis of the target BM has been done under the assumptions in Table 41.

Table 41: Assumptions for ArchiSurance's new portal

Volumes (Average per month)	Baseline	Target
Claims	371	371
New requests	450	1100 = 1000 new online requests + 100 via intermediaries. Not all of these requests will lead to new policies. We assume a growth of 10% on a yearly basis of the total number of policies.
Policy holders	100,000	105,500

This leads us to the following conclusions:

- the new portal leads to a significant decrease in costs for some old services (claim submission service and customer information service);
- the new on line policy sales service generates new costs, while the commission costs for intermediaries drop significantly;
- total costs remain approximately unchanged;
- an important gain is the increase in revenues due to the expected increase of the customer base.

Considering all of the above, the management decides that the investment in the new portal is beneficial with an estimated profit increase of 7.6% per month. Therefore, the management initiates the implementation of the target EA and BM.

6.7 Discussion

Although new, the idea of relating enterprise architectures and business models is quite powerful and seems justified, as it has emerged simultaneously in both the EA and BM communities. Recently, Fritscher and Pigneur (2011) published their view on the relation between business models, enterprise architecture, and IT services. They also used the BMC and ArchiMate, in addition to a classification and objectives of IT Services (Weill and Broadbent, 1998; Weill and Vitale, 2002). They focus on connecting business models to the IT infrastructure level and using ArchiMate as visualization. While their work also underscores the importance of relating business modelling to enterprise architecture, their paper does not go into technical details regarding concept and relationship mappings. It is a rather global mapping and comparison of the three frameworks. In contrast with Fritscher and Pigneur's work, we take the

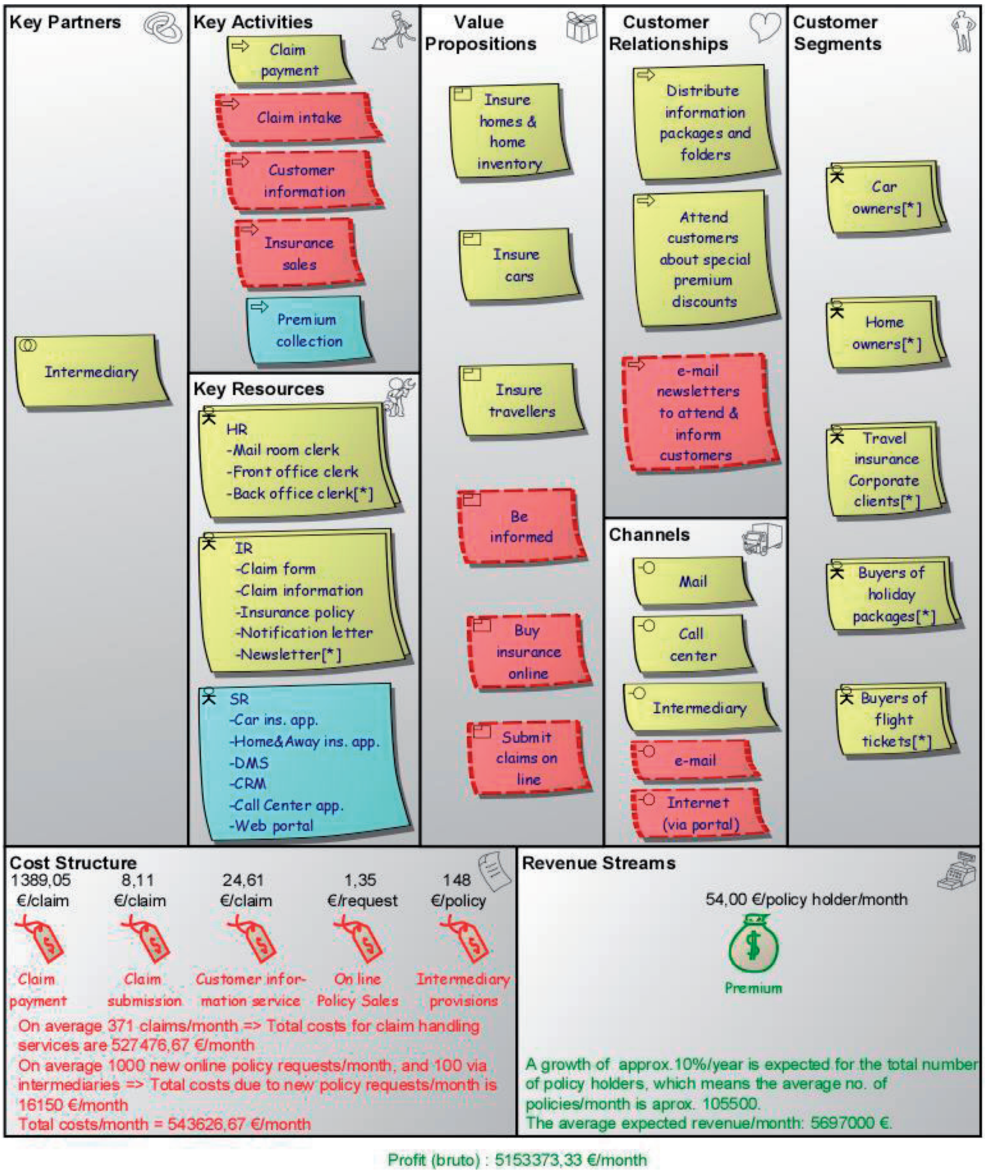

Figure 56: ArchiSurance target BM

enterprise architecture as starting point. Our motivation is that it is possible to extract the business model from the architecture model, by leaving out application, technology, and even business process details. BMs are about the key elements of the business: key business services, key resources and activities, distribution channels, customers and partners, and costs and revenues. Relating these generic and strategic elements of the BMC to the concrete and operational business, application, and infrastructure layers of ArchiMate directly is hard, if not impossible. Fritscher and Pigneur confirm this, as they have to add IT Services for it. By making use of the ArchiMate extensions, we ensure a smooth transition from operational architecture descriptions to strategic business models by using motivation and resource-capability models. In addition, we specify a method supporting this process, position it with respect to the TOGAF ADM, and show how to apply cost analysis to the combination of EA and BM. We agree with Fritscher and Pigneur that, in future work, the relation between BM patterns (Osterwalder and Pigneur, 2010) and EA design patterns (Buckl et al., 2009a, 2009b, 2007) should be investigated.

Other related work is presented in one of our earlier papers (Meertens et al., 2012). These early ideas have been extended and improved. Especially, the recently improved version of ArchiMate and its extensions, as well as new insights, have led to a better understanding and better justification of the relation between business modelling and enterprise architecture.

6.8 Conclusions

The main contribution of this chapter is threefold:

1. Relating the BMC building blocks to ArchiMate concepts.
2. Demonstrating the practical value of that relationship in a composite cost/benefit-analysis.
3. Clarifying the role of BMs in the TOGAF ADM, by providing methodological support.

First, we have related the BMO building blocks to ArchiMate concepts. Because the BMC is not an official standard, and no complete meta-model exists, we had to create one. We took Osterwalder's thesis (Osterwalder, 2004) as the main reference, as this is the most extensive work on the BMO. However, we used the concepts from the BMC, as this is the version most often used and allows for a more intuitive mapping. As the BMC does not provide relations, we took those from the BMO and included them in our derived version of the BMC meta-model. This meta-modelling exercise also resulted in a critical analysis of the definition of the BMO, which revealed some missing relationships. We also used ArchiMate, extended with motivation and value-related concepts. This was necessary to find good semantic correspondences for the BMC building blocks in ArchiMate, and to bridge the abstraction level gap between the two.

Second, we have demonstrated the practical value of the proposed BMO-ArchiMate relation by showing how cost analysis techniques defined for the two approaches can be composed, such that the output of one can be used as input for the other, having as result more accurate and realistic calculations.

Third and final, we have elaborated methodological support that complements the TOGAF ADM and clarifies the role of business models for business requirements management and for architecture change. Our approach facilitates the tracing of business requirements, captured by motivation and business models, down to the design specifications, expressed as enterprise architecture models. Furthermore, it may be used the other way around, to assess the impact of architectural change on the underlying business model.

7

A Business Model and Enterprise Architecture for U*Care

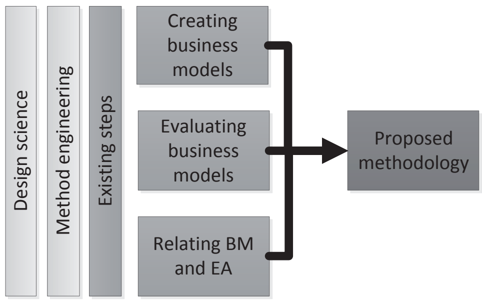

Figure 57: Did we reach the objective? Demonstrating the proposed methodology

In this chapter, we apply the languages, methods, and frameworks from the previous chapters to a case study: U*Care. This shows how the methods work together to create business models and an enterprise architecture. It demonstrates the previous work.

In the first section, we introduce the U*Care case. Then, we use the business modelling method (BMM, chapter 4) to build a business model for the current situation. We build both a qualitative and quantitative business model for the elderly care centre. In the third section, we look towards the future and create alternative business models for U*Care and build business cases for each alternative using the business case method (chapter 5). The last artefact that we build is an enterprise architecture for the best alternative (chapter 6). We also apply the chained cost/benefit-analysis demonstrated in the previous chapter.

7.1 Introduction to the case: Elderly care and the U*Care project

Similar to other (West-European) countries, the Netherlands has an increasingly ageing population. It is desirable, from an economical and a social point of view, to provide automated care support to people in their own homes whenever possible, to encourage, support, and maintain activities and participation of elderly in their familiar social context . The U*Care project aims at developing solutions that facilitate a prolonged active life and independent living of an ageing population.

7.1.1 Elderly care in general

In most developed countries, the population is aging. Over the coming years, this will take a leap due to the baby-boom generation reaching their retirement age. Currently, old-age dependency ratio in the Netherlands is at approximately 25%. This means that for every person of 65 or older (elderly), there are four people in the age range of 20-64 (potential money-earning employees). Predictions indicate that by 2040, this percentage will rise to 50%. This means every two people in the potential money earning range have to support an elderly person. For several other countries the predictions are even worse (The Economist, 2009).

The economic results of the aging population will have its toll on the (health) care systems. A (relatively) smaller group of potential money-earning employees has several effects. First, less potential taxpayers have to share the costs of care. Second, less care professionals are left to take care of elderly people. This leads to a possible third effect of higher prices for care, due to scarcity.

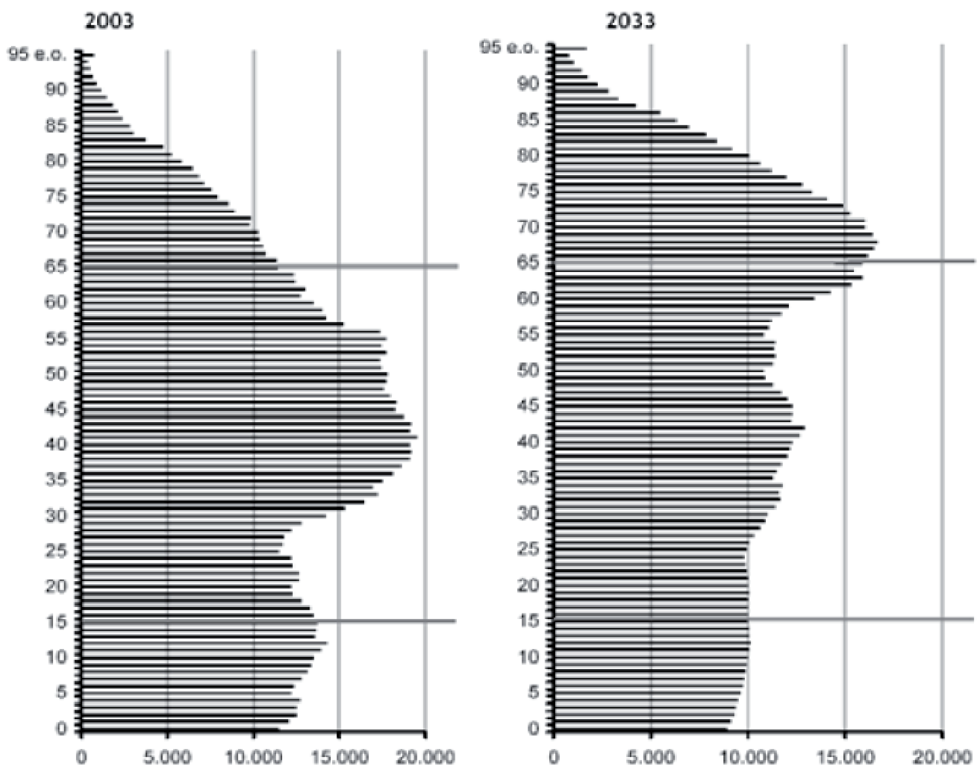

Figure 58: (Predicted) demographics of Limburg (province for U*Care) (CBS, 2013)

Not only will (relatively) more elderly people need support, these people will also be older. Current statistics show that the older elderly people become, the more care they need. This combination leads to a high volume of required care.

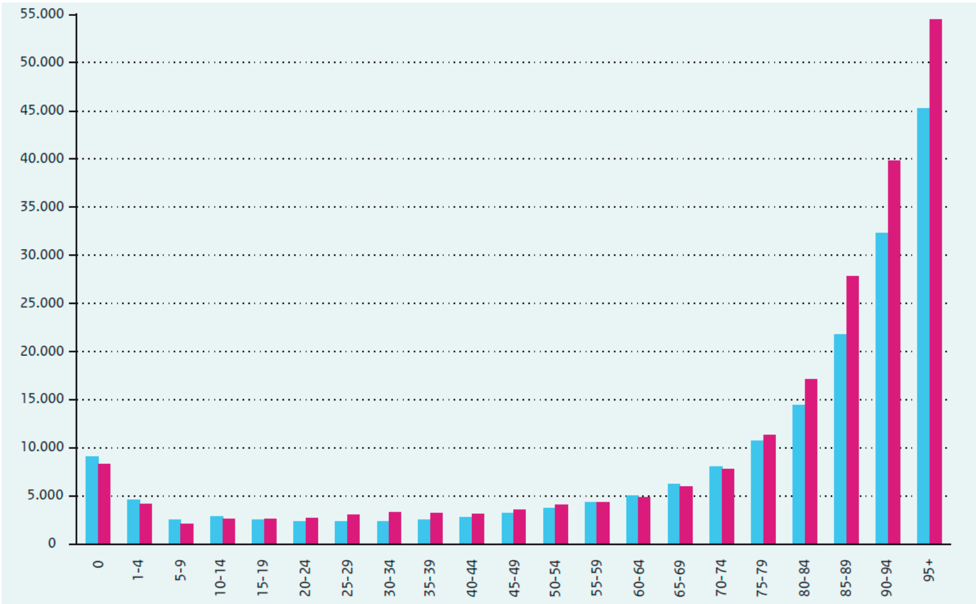

Figure 59: Average costs (in euros) for healthcare for Dutch inhabitants, according to age and gender

7.1.2 Healthcare in the Netherlands

As in most countries, the structure, in which we pay for healthcare in The Netherlands, is far from trivial. It is a combination of private payments, social insurance, (additional) insurance, (governmental) subsidies, and other sources, such as employers.

From a high-level perspective, we spend money in three areas; cure, care, and governance. Similar, four sources of income can be specified; Dutch people, employers (organization that employ people, including the government as an income provider), the government, and foreign contributors.

For this case, the Dutch population can be dissected into many smaller roles according to the money streams. An individual may belong to multiple roles at the same time or at different points in time. Social care insurance is obligatory for all Dutch people. Every person of at least 18 years of age has to pay for this basic insurance (ZVW, ZorgVerzekeringsWet: Care Insurance Law). The government pays for those under 18 years of age. Besides the people themselves, employers have to contribute to this social insurance, based on the salaries of the employees. A second solidarity measure is that the government reimburses part of the costs of the social insurance for poor people. Next to the basic social insurance, employees pay for a second social care insurance named AWBZ (Algemene Wet Bijzondere Ziektekosten: General Law Exceptional Care costs). This insurance covers care costs deemed as impossible to insure by individuals, including much of the elderly care. All Dutch people of at least 18 years of age can opt for additional care insurance (for example, dental care) with an insurance company.

For basic insurance, care consumers have a compulsory insurance excess (they have to pay the first € 220 of care costs themselves in 2012). To lower their premium, they can increase this by up to € 500 voluntarily. For AWBZ, care consumers are expected to contribute as well, depending on their income. Costs not covered by any of the policies have to be paid for by the consumer too.

The government can be dissected in a similar manner.

7.1.3 What is U*Care?

U*Care stands for User-tailored Care services platform. Goal of the project is to develop a services layer for integrated homecare systems, referred to as the U*Care platform, which provides tailorable, evolvable, and non-intrusive home care services. The U*Care platform provides technology-independence; it shields application developers from underlying software and network technologies. The U*Care platform differs from current platforms as it provides basic context-aware functions that can be used as service building blocks. Context-awareness is achieved by using information from sensors for bio-signs (activity level, heart rate, blood pressure, oximetry, weight, etc.) and sensors for physical context (location, temperature, humidity, etc.). The focus is on wellness and healthcare applications and services to assist people of 50 years and older in an integrated living environment. Typical applications are in emergency monitoring, lifestyle monitoring and advice, exercise monitoring and co-training, and enabling social interaction.

The results of the project are:

- scenarios for using wellness and healthcare services in an integrated living environment
- an as-is business model, identifying stakeholders and relationships within the relevant care-giving and care-receiving processes
- a to-be business model, considering the role of the U*Care platform in this environment
- a (service-oriented) architecture for the U*Care platform
- a set of wellness and healthcare services and a set of building block services, where the latter can be used in creating and composing end-user services.
- a prototype of the U*Care platform.

7.1.4 The consortium

The participants in the U*Care consortium have been chosen to cover the range of expertise and provide the facilities and environments needed to carry out the proposed research. The consortium consists of one research partner (UT-CTIT, represented by three research groups from different departments), two healthcare partners (Orbis and IZIT), and three (information) technology partners (IBM, TKH, and MobiHealth). The research groups of the research partner provide necessary expertise on relevant disciplines, such as information systems and services, mobile health systems, and business and governance aspects. The healthcare partners provide the application context and a test bed for the research. They also participate in the development of scenarios and the derivation of user requirements, as well as in evaluation of usability and usefulness of research results. The technology partners provide knowledge on IT solutions and industry standards. They also have experience with applying such solutions in practical settings, including healthcare.

University of Twente (UT) participates through CTIT (Centre for Telematics and Information Technology, www.ctit.utwente.nl) with three research groups, Information Systems (Computer Science department), Remote Monitoring and Treatment (Electrical Engineering department), Industrial Engineering & Business Information Systems (Management and Governance department). The research of these groups is jointly managed by CTIT.

Orbis Medical and Care group (www.orbisconcern.nl) is a chain organization for cure, care, residential facilities and services in Netherlands. It is made up of the Maasland Hospital, ten nursing and convalescent homes, eight care support centres, a large-scale home care organisation, and a mental health organisation. Orbis has a wide range of care activities and makes it one of the largest employers in South Limburg, The Netherlands with a staff of 5700 and a turnover of 250M€. Orbis has developed an innovative integrated elderly living village concept, Parc Hoogveld, in which housing, wellness, care, and services all go hand-in-hand. Together with other healthcare institutions, clients and third parties, ORBIS intends to extend its platforms, promoting sustainable cure, care and living in the Netherlands and abroad. Orbis brings expertise in elderly people care, needs and requirements. It also offers Parc Hoogveld, a 400-apartment complex for integrated living, as a test bed environment for the project.

IZIT (www.izit.nl) is an association of care providers, aiming at improving processes and working procedures in care in the Twente region through the application of ICT. IZIT collaborates with and coordinates relevant actors in the care chain. It has expertise concerning the use of technical solutions for care, interconnection of care systems, and optimization of care processes.

IBM (www.ibm.com/nl) is a world-wide leading company in computer hardware, software, technology, and ICT services. Relevant to this project, IBM is the leader in the development of SOA intellectual property, developed products and services that support service-oriented solutions, and applied such solutions in healthcare.

TKH Group (www.tkhgroup.com), based in Haaksbergen, is a company specialized in the development and installation of telecom, building, and industrial solutions. Relevant to this project, TKH developed systems for indoor telecommunication, intelligent living, and surveillance of home-based patients. Specifically, TKH developed an IP-TV system, Realive, which integrates telephony, internet, and television with new functions such as on-demand and community TV.

MobiHealth BV (www.mobihealth.com) is a spin-off company of the University of Twente. Relevant to the U*Care project, MobiHealth ™ is specialised in development and deployment of remote monitoring systems that monitor physiological and context data of people during their normal daily life activities.

7.1.5 Orbis, Park Hoogveld, and Hoogstaete

Together with many other parties, Orbis has created an innovative integrated elderly living village concept in Sittard, the Netherlands: Parc Hoogveld. Housing, wellness, care, and services all come together here. Parc Hoogveld includes a multifunctional centre, care centre, and several modern apartment complexes. Everything is situated around a beautiful, green and spacious, neighbourhood park. The integrated living village provides a solution to the increasing demand for high-quality living environment, where people can live on their own for a long time. The multifunctional centre, Orbis Hoogstaete, plays an important role in this (Orbis Medisch en Zorgconcern, 2013).

7.1.5.1 Living

Orbis Hoogstaete has 94 apartments, some of which are suitable for couples. These care apartments are spacious and have separate living, sleeping, and showering segments.

Eight units for “small-scale living” offer high-intensity care to forty eight dementing elderly. Each of the units houses six clients, which each have their own sleeping room, but spend most of the day together in the shared living room and kitchen. They cook and eat together, to the extent possible, and do household chores, watch television, receive visitors, etc. Just like they would have at home. Living and wellness come in first place here.

Next to the multifunctional centre, three apartment complexes have domotica systems for security and assistance. Elderly who have limited care needs live in these apartments, which can be accessed from the centre directly through a glass corridor. Inhabitants receive personalized care from the centre, and may make use of all the functionalities and services provided. Five other apartment complexes, not directly connected to the centre, can make use of the services too.

7.1.5.2 Facilities

Orbis Hoogstaete offers many facilities in the area of wellness, care, and exercise. Inhabitants, as well as people living in the neighbourhood, can make use of these. The facilities include service such as physiotherapy, dietician, midwife, but also a hairdresser. In addition, Hoogstaete has a restaurant, where inhabitants as well as neighbours are welcome every day of the week.

Much more on Parc Hoogveld can be found in "Please in my backyard: Parc Hoogveld en de opkomst van de integrated care community" (in Dutch) (Haarmann et al., 2009).

7.2 A business model for the current situation at U*Care

In this section, we apply the first part of the business modelling method introduced in chapter 4. The result of the first four steps is a quantitative business model of the current (baseline, as-is, IST) situation in Dutch health care. The first step identifies the roles. The second step recognizes the relations. The third step specifies the activities. The fourth step quantifies the model.

Step	Inputs	Deliverables
Identify Roles	Documentation, domain literature, interviews, experience, previous research	Role list
Recognize Relations	Role list, Stakeholder map, value exchanges	Role-relation matrix
Specify Activities	Role-relation matrix, Role list, business process specifications	List of activities
Quantify Model	Process specifications, accounting systems and annual reports	Total cost of the business "as-is"

In chapter 4, we used part of the U*Care case as an example already.

7.2.1 Step 1: Identify Roles

To identify the roles for the U*Care platform as systematically as possible, we carry out a stakeholder analysis according to the interpretive research method of Pouloudi and Whitley (1997). This method consists of four steps. In the first step, we identify obvious groups of stakeholders as a starting point. In the second step, we contact representatives of those groups, so we can interview them in the third step. In the fourth step, we revise the stakeholder map resulting from the first step according to the information gained from the interviews.

The first step of the stakeholder analysis, leads to the identification of several groups of obvious stakeholders. The groups include all the project partners, as their participation in the project indicates their stake. Another group includes the main users of the platform, both clients and employees of the elderly care centre.

After identifying the obvious stakeholders, we contacted and interviewed representatives from all the project partners and several people in the care centre. These interviews did not explicitly focus on stakeholder analysis, but served as a general step in requirements engineering.

The fourth step includes a search for stakeholders in the literature. Besides identifying the extra stakeholders, the literature mentions the important issue that some actors in the list are individual players, while other actors are organizations or other forms of aggregations (groups). Consequently, overlap can occur in the list of actors.

The final step is not a trivial one. Refining the stakeholder list requires interpretation from the researcher. Different stakeholder theories (for example, from E. J. Emanuel and L. L. Emanuel (1996), J. Robertson and S. Robertson (2000), and Wolper (2004)) act as tools to minimize subjectivity.

The long list of identified stakeholders is not practical to continue with and has much overlap. Therefore, we grouped the stakeholders into a limited set of roles, which Table 42 presents. This set of high-level roles is an interpretive choice. The small set helps to keep the rest of case clear instead of overcrowded. The larger set (see Appendix 10.1) is kept in mind for the to-be situation to find potential “snail darters”: stakeholders with only a small chance of upsetting a plan for the worse, but with huge results if they do (Mason and Mitroff, 1981). The small set of stakeholders was subject to prioritization based on Mitchell et al. (1997). While the prioritization is subjective, it shows that all roles in the list are important.

Table 42: Main Roles

Care consumers
Care providers
Technology providers
Government
Insurers

7.2.2 Step 2: Recognize Relations

The current situation consists of five categories of interacting roles. Table 43 shows them on both axes. The cells show relations between the roles. While the care provider has relations with all the other roles, it is not a clear hub-and-spoke pattern. Several of the other roles have relations outside the care provider.

The relations show that a main goal of the business is to provide care to the care consumer. The insurers and government handle much of the payment. Other (regulating) roles of the government remain out of scope, as the case is complex enough as it is.

The insurers handle most of the payments. The patient has to pay the care provider after receiving care. The patient can then declare the costs to the insurance company, which refunds the patient. The patient pays a premium to the insurance company.

According to the Dutch Healthcare Insurance Act (Zorgverzekeringswet, ZVW), every citizen has to have basic care insurance (ZVW). For "uninsurable care" (including most home healthcare, similar to USA Medicare), the Dutch government set up a social insurance fund, termed General Exceptional Medical Expenses Act (Algemene Wet Bijzondere Ziektekosten, AWBZ). All employees and their employers contribute towards this fund. The AWBZ is similar to the regular insurance companies, except for collecting the premium. The premium is paid through taxation by the government, which outsources most of the further actions to insurers. A similar system is set up for wellness homecare, such as cleaning. This is the Social Support Act (Wet Maatschappelijke Ondersteuning, WMO). In contrast to the AWBZ, the government takes care of all WMO actions itself, through its municipalities.

Figure 60 shows the roles and relations from Table 43 in diagram form. Several issues exist, which we do not handle in detail here. For example, it is inherent to insurance that not all people who pay premium are also (currently) care consumers.

Table 43: Role-relation matrix for elderly care

Consumer Provider	Care consumers	Care providers	Technology providers	Government	Insurers
Care consumers	X	Pay for care		Pay for AWBZ Pay for WMO	Pay for insurance
Care providers	Provide ZVW care Provide WMO care Provide AWBZ care	X	Pay for (use of) technology or service	Provide care to citizens	Provide care to insured
Technology providers		Provide technology or service	X		
Government	Provide AWBZ insurance Provide WMO insurance	Pay for WMO care to citizens		X	Pay for AWBZ care to citizens
Insurers	Provide insurance Refund AWBZ and ZVW care			Ensure AWBZ care for citizens	X

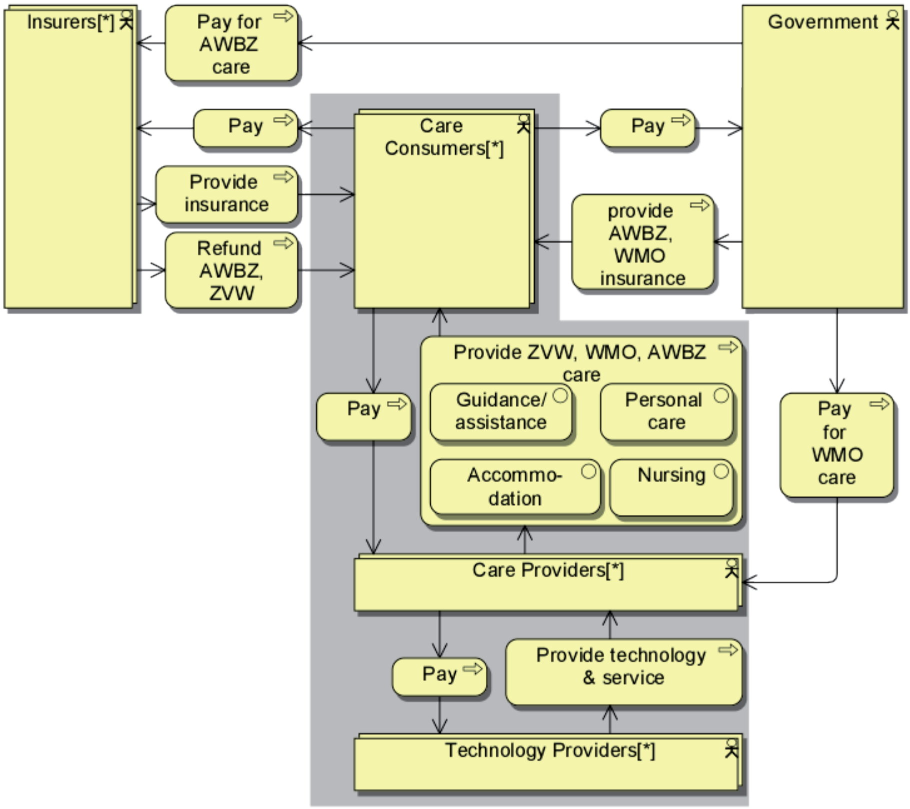

Figure 60: Visualization of roles and relations in elderly care

7.2.3 Step 3: Specify Activities

Most of the relations between the roles in Table 43 are described using verbs. This signals that they are (part of) behaviour. Any relation not beginning with a verb is a candidate for rephrasing or being split into smaller parts. As we are interested in isolated units of behaviour (activities), these relations are a suitable starting point. However, we are interested in a more detailed view than what Table 43 and Figure 60 offer. Therefore, we use the results of interviews, previous research, and documents made available by the government for reimbursement purposes (Ministry of Health, Welfare and Sport, 2008).

At the highest level, care providers provide care and the care consumer pays for it (either directly, via government, or via insurance). To get into more detail, we focus on a specific part of care, namely elderly care in the Netherlands. At this level, the financing still goes through several possible paths: WMO, AWBZ, ZVW, and direct payments. Care, cure, and residence are the three main categories of behaviour. While making business models at this level is possible, it does not yet show the changes that technological innovations bring about. To enable this, we have to focus further. We look at only at personal care activities provided in combination with residence. AWBZ pays for all activities at this level, and also defines demands to which activities must be provided.

Approaching the case at this level allows us to take the simpler high-level view. Starting from this simpler view, we can focus on the isolated activities performed for this form of care, instead of combining them into categories of behaviour. These isolated activities are the place where technological innovations have their influence. Most of them are activities done by a caregiver for or with a care receiver, such as washing, helping with getting in and out of bed, and presenting medication. Table 44 shows the activities that the AWBZ defines.

Next to the personal care activities, the AWBZ pays for residence. This includes living quarters and food-related costs. For this, they do not specify activities. Also most of the costs in these categories come from asset or material costs (buildings to live in, and food to eat). Care-related technological innovations have little influence on this. Therefore, we show them in the qualitative business model to be complete, but disregard them in further calculations. Section 5.5 presents a different case where the asset costs are interesting.

Table 44: Personal care activities according to the AWBZ purposes (Ministry of Health, Welfare and Sport, 2008).

Activity	Actions	Time in minutes	Frequency per day	Elderly in need	Hours per day
Washing	Whole body	20	1x	21	7
	Parts of body	10	1x	21	3.5
Dressing	(Un)dress completely	15	2x	21	10.5
	Undress partially	10	1x	21	3.5
	Dress partially	10	1x	21	3.5
	Put on compression stockings	10	1x	21	3.5
	Take off compression stockings	7	1x	21	2.45
Getting in and out of bed	Help getting out of bed	10	1x	21	3.5
	Help getting into bed	10	1x	21	3.5
	Help with afternoon rest (for example, get onto the couch)	10	1x	21	3.5
	Help with afternoon rest (for example, get off the couch)	10	1x	21	3.5
Eating and drinking	Help with eating cold meals (excluding drinking)	10	2x	10	3.33
	Help with eating warm meal (excluding drinking)	15	1x	21	5.25
	Help with drinking	10	6x	10	10
Change position sitting/lying		20	3x	6	6
Going to toilet or changing incontinence material		15	4x	10	10

Support excretion	Stoma	10-20	4x	10	10
	Catheter	10	4x	10	6.7
	CAPD/CCPD	30	4x	3	6
Tube feeding		20	2x	3	2
Medication	Present medicine	5	3x	48	12
	Administer medicine (oral)	5	3x	15	3.75
	Apply medical patch	5	2x	10	1.7
	Administer eye, ear, or nose drops. Administer medicine (non-oral)	10	2x	6	2
	Nebulise medicine	20	1x	3	1
Personal care for teeth, hair, nails, and skin	Care for teeth	5	2x	21	3.5
	Care for hair	5	1x	31	2.6
	Care for nails	5	1x (per week)	31	0.4
	Inspect skin	10	1x	10	1.7
	Care for skin	10	1x	6	1
Attaching and removing prosthetic limb	Attaching limb	15	1x	6	1.5
	Removing limb	15	1x	6	1.5
Teaching and supervising personal care activities	Teaching the above activities	30 per week	As above	10	0.7
	Supervise to ensure quality of self-care	30 per week	Spread over week	63	4.5

To conclude this section, Figure 61 shows a simplified business model for an elderly care centre. It is based on the previously given information. Living quarters and food-related items are included. The activities and resources are aggregated so that the figure gives an overview. The value proposition, living pleasantly, is aimed at the client living in the care centre.

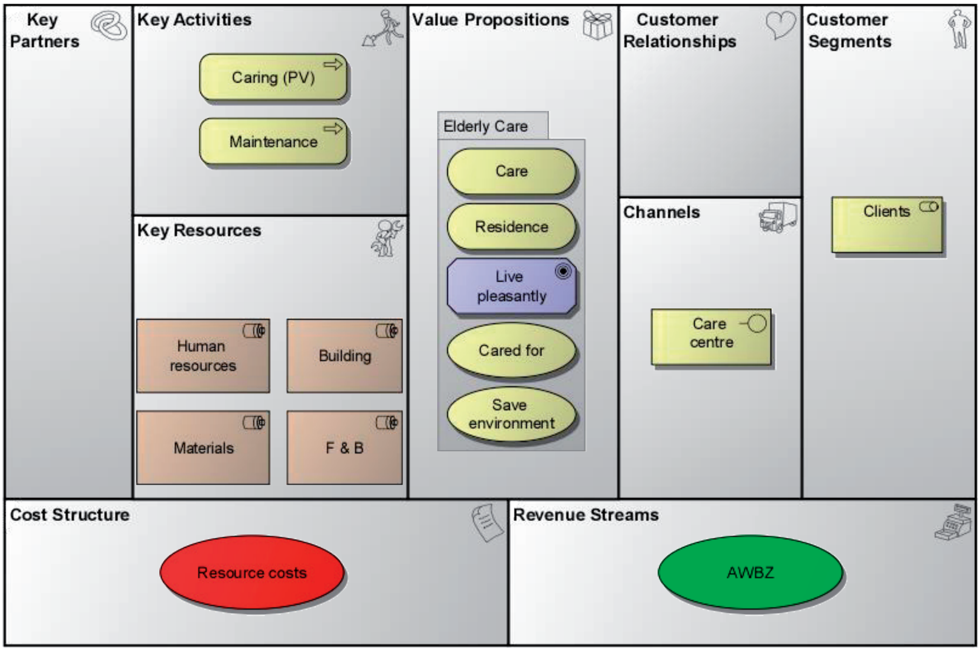

Figure 61: A simple business model for an elderly care centre

7.2.4 Step 4: Quantify Model

Quantifying the business model shows us what is happening in detail and helps us compare innovations to the baseline situation. While a qualitative business model shows what is being done, a quantitative business model also shows how often things happen and how much they cost. To achieve this, numbers are needed. The numbers are the volume of activities (how often they occur) and the costs per activity. Together, these numbers provide a complete view of the costs captured by the business model. Several sources of costs and volumes are possible. For this case, we access accounting systems, investigate annual reports (Orbis Medisch en Zorgconcern, 2012, 2011, 2010), review AWBZ documents (Ministry of Health, Welfare and Sport, 2008), look at national statistical data (Centraal Bureau voor de Statistiek, 2013), and interact with experts. The resulting quantitative business model shows the as-is situation.

For confidentiality reasons, we have manipulated some of the numbers. Especially those coming from sources that are not publicly available and may contain sensitive data, such as the accounting systems and patient-based data. However, the numbers we use are still representative for an elderly care centre in the Netherlands.

7.2.4.1 Revenue

In the revenue side of the business model, payments of the AWBZ care come in. Per elderly, this is based on an indication for a care-intensity package (zorg-zwaarte pakket, ZZP) for care and nursing (vezorging en verpleging, VV), which shows how much care an elderly should receive. The indications range from one to ten, increasing in intensity and reimbursement. Table 45 shows the expected amount of time caregivers should spent on each case, respectively for personal care (persoonlijke verzorging, PV) and nursing care (verpleging, VP).

Table 45: Expected time available per care-intensity package (Centrum Indicatiestelling Zorg, 2013)

Care-intensity package (ZZP)	Time for personal care (per week)	Time for nursing care (per week)
0		0-0.9
1	0-1.9	1-1.9
2	2-3.9	2-3.9
3	4-6.9	4-6.9
4	7-9.9	7-9.9
5	10-12.9	10-12.9
6	13-15.9	13-15.9
7	16-19.9	16-19.9
8	20-24.9	

Most of the elderly at the care centre have a care-intensity indication between two and five. Usually, intensity one and two are not given for elderly that live in an elderly care centre, but only for those still living at their own homes. It still occurs, as it may be given to somebody coming to live in an elderly care centre if they move in with their partner with a higher indication. Elderly with intensities of five to eight should go to a nursing home instead of an elderly care centre. However, these too occur at the elderly care centre, as the indication tends to increase (with age) after people have received it for the first time and it takes time or is not strictly necessary to move them. For these reasons, we include intensity one to eight.

Intensity nine is an indication for revalidation. Therefore, the care that belongs to it is (supposed to be only) temporary. For example, it may be given to an elderly who has had surgery for a hip replacement and is temporarily unable to take full care of themselves. It aims at recovery and (re)learning specific activities, for example relearning how to walk after a hip replacement. While this type of care is sometimes delivered at the elderly care centre, it is so incidental and for short periods that it is not significant for this case. Therefore, we do not include intensity nine.

Intensity ten is hospice care. It is meant for people in the terminal phase of their live, less than three months to live. This type of care may include special medical equipment, intense pain-killers, and specially trained staff. It is usually not provided at the elderly care centre, but at special hospices. Even if it is provided, it is only for a short period of time. Therefore, we do not include intensity ten.

The elderly care centre houses 100 people, with an average care indication of "four" for the AWBZ care. This means that the care provider gets approximately € 100 per person per day. Therefore, the annual revenues of this care centre are approximately € 3.65 million (= 100 people x 365 days x € 100).

7.2.4.2 Costs

The total costs, which can be related directly to this elderly care centre, are approximately € 2.8 million. This includes personal care, accommodation (both food-related and living quarters), as well as management. Table 46 shows these costs per component.

Table 46: Costs for an elderly care centre (x € 1,000)

Food-related	400
Living quarters	810
Management	150
Personal care	1,440
Total costs	2,800

Indications of volume (times a day, and minutes spend), which the government uses for reimbursement purposes, provide a further step to quantifying the model. With this information, we can assign costs to each of these activities, which the caregivers perform. We focus on this, as it is the largest part of the costs (95% of the personal care costs arise from human resources), and this is the area on which innovations can have the greatest influence.

The caregivers in this elderly care centre work for approximately 50 FTE (Full Time Equivalent, which is 36 hours per week in the Dutch healthcare). So a total of approximately 257 hours can be spent per day (= 50 FTE x 36 hours / 7 days per week). Table 47 indicates the amount of time that caregivers spend on each activity per day. The total hours spent is 236, so that leaves 21 hours for other tasks, such as administration and changing shifts.

The amount of time per activity is calculated by multiplying the frequency that activities have to be carried out for each client with the required time for each moment that it is carried out and the amount of elderly in need (frequency X time X amount of clients). The frequency and the time required come from the official AWBZ documentation, which in turn bases it on research by HHM (2007). The amounts of elderly in need are estimation, based on interviews with caregivers at the care centre, statistical data (Centraal Bureau voor de Statistiek, 2012), and checked with management.

An average hour of care costs €15.39. Together with the hours spent per day, we can now calculate the costs of each activity. For example, the most expensive activity is presenting medicines. A total of 12 hours is spend on this each day, therefore the costs per day are approximately €288 (= 18.75 hours x €15.39 per hour). The same calculations can be made for the other activities. Table 47 shows these costs.

Table 47: Personal care activities, the time spent on them, and their (human resource) costs

Activity	Actions	Frequency per day	Time in minutes	Elderly in need	Hours per day	Costs (hours x € 15,39)	Cost per user
Washing	Whole body	1	20	33	11	€ 169,33	€ 5,13
	Parts of body	1	10	33	5,5	€ 84,66	€ 2,57
Dressing	(Un)dress completely	2	15	33	16,5	€ 253,99	€ 7,70
	Undress partially	1	10	33	5,5	€ 84,66	€ 2,57
	Dress partially	1	10	33	5,5	€ 84,66	€ 2,57
	Put on compression stockings	1	10	33	5,5	€ 84,66	€ 2,57
	Take off compression stockings	1	7	33	3,85	€ 59,27	€ 1,80
Getting in and out of bed	Help getting out of bed	1	10	33	5,5	€ 84,66	€ 2,57
	Help getting into bed	1	10	33	5,5	€ 84,66	€ 2,57
	Help with afternoon rest (for example, get onto the couch)	1	10	33	5,5	€ 84,66	€ 2,57
	Help with afternoon rest (for example, get off the couch)	1	10	33	5,5	€ 84,66	€ 2,57
Eating and drinking	Help with eating cold meals (excluding drinking)	2	10	17	5,67	€ 87,23	€ 5,13
	Help with eating warm meal (excluding drinking)	1	15	33	8,25	€ 127,00	€ 3,85
	Help with drinking	6	10	17	17	€ 261,69	€ 15,39
Change position sitting/lying		3	20	6	10	10	€ 153,94
Going to toilet or changing incontinence material		4	15	10	17	17	€ 261,69
Support excretion	Stoma	4	15	17	17	€ 261,69	€ 15,39
	Katheter	4	10	17	11,3	€ 174,46	€ 10,26
	CAPD/CCPD	4	30	5	10	€ 153,94	€ 30,79
Tube feeding		2	20	3	5	3,33	€ 51,31
Medication	Present medicine	3	5	75	18,75	€ 288,63	€ 3,85
	Administer medicine (oral)	3	5	25	6,25	€ 96,21	€ 3,85
	Apply medical patch	2	5	17	2,8	€ 43,61	€ 2,57
	Administer eye, ear, or nose drops. Admisiter medicine (non-oral)	2	10	10	3,33	€ 51,31	€ 5,13
	Nebulise medicine	1	20	5	1,67	€ 25,66	€ 5,13

Personal care for teeth, hair, nails, and skin	Care for teeth	2	5	33	5,5	€ 84,66	€ 2,57
	Care for hair	1	5	50	4,2	€ 64,14	€ 1,28
	Care for nails	1/7	5	50	0,6	€ 9,16	€ 0,18
	Inspect skin	1	10	17	2,8	€ 43,61	€ 2,57
	Care for skin	1	10	10	1,67	€ 25,66	€ 2,57
Attaching and removing prosthetic limb	Attaching	1	15	10	2,5	€ 38,48	€ 3,85
	Removing	1	15	10	2,5	€ 38,48	€ 3,85
Teaching and supervising personal care activities	Teaching the above activities	1/7	30	17	1,2	€ 18,69	€ 1,10
	Supervise to ensure quality of self-care	1/7	30	100	7,14	€ 109,95	€ 1,10
Totals					235,89	€ 3.631,11	€ 1,04

7.2.4.3 Conclusion: A quantitative business model of the current situation

The numbers in Table 46 and Table 47 above, in combination with the qualitative business model in Figure 61 and the revenue calculations, form a complete quantitative business model of an elderly care centre in the current situation. It clearly shows where the money is earned and where it is spent.

The difference of € 0.85 million, between the revenues and the total costs, comes from costs that cannot be related directly to the care centre (as it is part of the larger Orbis Medical and Care group). It is not profit, as Orbis is a foundation, which may not make profit by law. It includes costs incurred by the overarching organization, such as cost of capital and other overhead costs (Orbis Medisch en Zorgconcern, 2011).

7.3 Alternative business models for U*Care

From here on, we aim to capture a future state of the business in a business model. To make predictions, the model may need further instantiations. Each instantiation is an alternative development that may happen (to-be). Using techniques such as brainstorming and generating scenarios, business modellers create alternative, qualitative, future business models. These alternatives are used to make predictions. Usually, such alternatives are built around a (technical) innovation. This may include allocating specific roles to various stakeholders. A base alternative, which only continues an existing trend without interventions, may help comparing the innovations. Next to the business model, ideas for innovations serve as input. The resulting alternative business models show future (to-be) possibilities.

While the previous section provides a quantitative business model of the current situation, this section attempts to look into the future. How can we improve compared to the current situation? To do this, we design several alternatives in section 7.3.1. These possible improvements are scenarios that include innovations, which we capture in a qualitative business model. We can use the alternative business models to make predictions. Section 7.3.2 analyses the alternatives by quantifying the business models. The steps for this are similar to those of the previous section.

7.3.1 Step 5: Design Alternatives

For the U*Care project, we focus on the application of ICT in healthcare, often called telemedicine or e-health. Telemedicine is referred to as providing medical services over geographical or time distance, and can be used for applications such as health maintenance, alleviation, cure and prevention of diseases. On the other hand, e-health can be considered more broadly as an emerging field in the intersection of medical informatics, public health and business. E-health refers to health services and information delivered or enhanced through the internet and related technologies. In a broader sense, e-health characterises not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve healthcare locally, regionally, and worldwide by using ICT (Eysenbach, 2001). In e-health, there is a great interest in the deployment of patient care information systems or personal health records to improve service and administration.

The combination of ICT and medicine offers new ways to deliver health maintenance and disease prevention, alleviation and cure, which were not possible before ICT was available. Especially with the advent of mobile communications, ICT allows health support anywhere, anytime.

All design alternatives facilitate care services through support for activities, participation, and information needs. Requirements are elicited using a method based on in-depth interview sessions with clients and caregivers in the care centre, a workshop with multiple stakeholders, and scenario-based user need analysis.

Our requirements elicitation process combines scenario-based user need analysis (SUNA), and interviewing techniques guided by a health model constructed from the International Classification of Diseases (ICD), the International Classification of Functioning, Disabilities and Health (ICF), and their relationship as defined by so called core sets (Stucki et al., 2004; World Health Organization, 2001, 1992). Figure 62 shows the requirements elicitation process that we followed. The boxes show the activities; the arrows denote the information used and produced for those activities. A health model and breakdown concepts were used for interviews with clients and care professionals. Analysis of the interviews was used for scenario development purposes, both directly and involving a stakeholder workshop. The process leads to end-user values and needs, which Table 48 lists. The workshop identified a collection of functional elements of future ICT technology use for the targeted elderly.

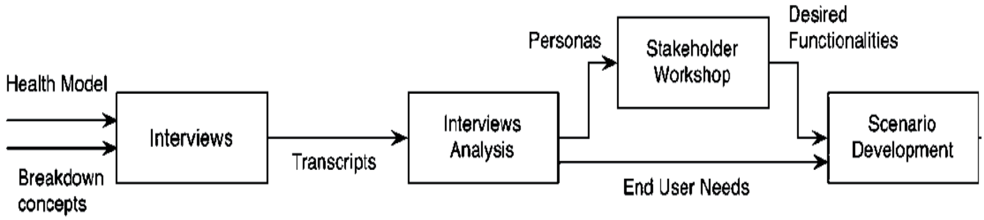

Figure 62: Requirements elicitation process

The end user needs, prioritised by the consortium, and the functional elements, formed the input to develop three scenarios. They were drafted to present the proposed novelties in a coherent story around the personas. Then, the project consortium reviewed the scenarios to achieve consensus. The proposed functionalities can be grouped under three service categories:

1. reminder and information services
2. social interaction and support services
3. remote monitoring and feedback services

Table 48: Values and needs important to clients and care professionals

Value/need	*Nr. clients reported (n = 7)*	*Nr. prof. reported (n = 4)*
Finding friends for activities	1	1
Providing daily structure	2	2
Information on events	3	3
Support for medication	4	2
Technology use for hobby	6	2
Contact with family	5	2
Memorising events	3	4
Contact with community	6	3
Aid in technology use	3	0
Monitoring for safety	0	4

For each of the three service categories, scenarios are developed. They contain the desired functionalities and the needs addressed by the interviewees. Together, they describe possibilities for the use of information and communication technology in home care. The scenarios centre on so-called personas, fictional persons that serve as a vehicle to illustrate the functionality (Cooper, 2004). Certain characteristics of some of the personas have been inspired by real persons who took part in the field study. However, the personas are not descriptions of really existing persons. Some are inspired by real persons, but personality traits and illness details from different persons have been blended and adapted to the purpose of the scenarios. The personas are:

- Sister Johanna leads an active life, despite the fact that she can only move in a wheelchair. She dependent on technology for communication – and for making sure she does not forget things. Functionalities that are naturally embedded in a scenario with her are visual reminders and social interaction, as well as home automation.
- Mr. Pieters has COPD. Telemonitoring, combined with measurements of body functions, help him to do exercises. Telecare and self-measurements fit well to Mr. Pieters, as his disease gives good options for monitoring body parameters and providing feedback remotely.
- Mrs. Stam finds her neighbour unconscious on the floor and contacts the emergency service. She is actively helped by Julie, the advanced information and communication system. The alarm functionality is the central element in this scenario.

There are three scenarios, each evolving around a different persona. A common element in the scenarios is Julie, a communication and information infrastructure. People in the scenarios speak about Julie as if it were a person. Julie is a system that comprises various kinds of functionalities. Basically, it is an audio-visual device that can display information and can be used for communication. Julie is a placeholder for (technological) innovations.

- Julie supports two-way video communication with a person at another Julie screen (for example, a caregiver) or a computer with a webcam (for example, a family member).
- Julie can present content and information, either requested by the client, or provided by another person. This can be passive content (for example, streaming video, photos that one can browse through) or interactive (for example, a choice of menus for dinner, a request that requires a response).

The full-blow scenarios can be found in Appendix 10.2. In the following sub-sections, we use parts of these scenarios to demonstrate the different alternatives.

7.3.1.1 Alternative 0: Keep things as they are

A base alternative, which only continues an existing trend without interventions, helps to compare the innovations in the scenarios. In this alternative, no explicit changes are made to the organization. For this alternative, the business model of the current situation is the main input. If alternatives score worse than this, they should not be implemented.

7.3.1.2 Alternative 1: Reminder and information services

The first category of services, derived through the requirements elicitation process, consists of functionalities similar to a combination of agenda/calendar and people actively reminding you. These may range from typical agenda items (for example, "Today, meeting with John at 4") and calendar items (for example, birthday reminders and events) to specific needs for elderly (for example, reminders for taking medicines or maintaining a daily structure). In the current situation, these reminders would be given by caregivers, a personal agenda/calendar, and posters or leaflets (for events). Below excerpts from the scenarios provide ideas and conception of the setting for this kind of services.

Sister Johanna:

[…] "Johanna, have you taken your medicine?" – a soft voice calls from the audio system, while, at the same time the question appears in big letters on her computer screen.

"Yes, Julie, I have," she answers, and the voice says: "Okay, thank you".

In fact she had taken her medicine, a number of pills for a variety of different physical problems, but forgotten to acknowledge that. A telephone call interrupted her normal routine, this morning at 8:04.

Christina, a colleague from the Catholic Youth Council, called her because there were some last-minute changes in a leaflet that Johanna would send to the printer today. Immediately after the call, she wheeled to her desk, opened the MS-Word document, and made the changes that Christina requested. The document covered the message on the screen and then she forgot the requested acknowledgement. So at 8:15 Julie reminds her again, increasing the intrusiveness level one step. […]

[…] Next, she asks Julie for "things to do today". She has become dependent on this service. Her short-term memory is failing more and more. It runs in the family. Her mother had no memory left at the age of 60. Writing things on scraps of paper worked at a certain level, but was not good enough. Often, she would not find back the right paper at the right moment. With the reminder system, it is all in one place – or, more accurately, in one system that can be accessed from different places.

Julie displays the "things to do today" page. It shows the following items:

- *Finish children's weekend leaflet*
- *Discuss Normandy trip with Maria*
- *Harry's birthday*
- *14:00 – Music at community centre*
- *19:30 – Meeting Catholic Youth Council*

Johanna ticks off the first one and asks Julie for a video connection to Maria. […]

[…] At 10:40 PM Johanna gets home. When she turns on the light, Julie switches the television screen on. It shows a single line of text:

- *Harry's birthday*

Oops, this had slipped her mind. On his birthday, he will be up late, so she will give him a quick call.

Mr. Pieters:

[…]Because this memory is getting worse, Julie sometimes needs to remind Mr. Pieters that he should do his exercises. If this happens, it is usually on days when he gets up late, and his schedule is disturbed. Julie also shows when the monthly check-ups by the doctor approach. Just in case he would forget the appointment otherwise.

While the above excerpts from the scenarios provide ideas, some of it is only be possible in a far future (or sci-fi movies). As we are looking for alternatives that can be implemented on short term, we take a more representative point of view. We focus on things that can be brought to a proof of concept within the duration of the U*Care project. These technical innovations include:

- Reminder service
- Acknowledgement service

These innovations on their own are not that new or exciting from a technological perspective. For example, most office software packages and smartphones have applications for this by default. However, placing these services in an elderly care centre provides several challenges, which still makes it innovative. In the elderly care setting, the calendar service not only provides a foundation for many other services, but also helps structuring an elderly's daily life. While this may sound trivial for many (younger) people, it is important and sometimes hard for many elderly.

From a business model view, the main changes are limited. The calendar functions mostly influence activities, which are not part of the caregivers' responsibility (officially). Yet keeping the calendars up to date may come down on them as an extra activity. The new technology is an extra resource. The calendar service may serve as an extra channel to communicate events to the elderly. Benefits for the elderly may also include a better daily structure, helping them to live more pleasantly.

7.3.1.3 Alternative 2: Social interaction and support services

The second category of services, derived through the requirements elicitation process, consists of functionalities for interacting with other people, be it peers or care professionals. This includes being able to contact, communicate with, and meet people. In the current situation, communication may happen through traditional ways such as

talking over the phone or face-to-face. Meeting people also happens through traditional ways, such as meeting people in the hallways or restaurant. However, many elderly hardly get out of their rooms and do not easily make new friends. Below excerpts from the scenarios provide ideas and conception of the setting for this kind of services.
Sister Johanna:

[…] Johanna ticks off the first one and asks Julie for a video connection to Maria. However, it does not open. Apparently, Maria is not online. Therefore, she calls Maria on the telephone and asks her to connect to her. A few minutes later, Julie announces a video call from Maria. They spend half an hour discussing the program for the next Normandy trip. […]

[…] The elderly sisters are somewhat lethargic now. When there are interesting activities, Johanna gently pushes them to participate. This afternoon in the community centre, there will be a singer with a small band, performing mostly Eddy Christiani songs from the 40s and 50s. Old people generally love that. This time Johanna has no difficulties getting the sisters interested.

After lunch, most of the sisters go to the music performance. However, Johanna does not go. With the meeting this evening, it will be a long day today. She cannot sit in a wheelchair for twelve hours or more, so she takes some rest and lies down. She switches Julie from the computer to her television screen that she can watch from her bed. For some time she watches the singing performance (available through Julie, real-time or later on demand), but then she dozes off. She isn't really interested; Eddy Christiani is really something for people over 75, she is only 64. […]

Mr Pieters:

[…] When asked whether he desires other contacts, Mr. Pieters says he is not keen to become intimate with the Hogerheide population. He dislikes people who complain about their health, and the truth is that most of the Hogerheide inhabitants talk a lot about their major and minor complaints. Yes, perhaps it would be nice to have a mate for going out, but then it should be the right person: someone with whom you can have a proper conversation. Not one of those old sods. He says he counts his blessings and is quite happy. Yet the Hogerheide staff members feel somewhat sorry for him – as for so many others who spend most of their lives locked in their rooms. […]

Mrs. Stam:

[...] "Beep, Beep."

Julie speeds-up the sound. This indicates Mrs. Stam should react immediately. She swiftly goes to see what Julie has to say. As Julie detects that Mrs. Stam approaches the screen, the beeping stops and the cause for the distress appears on the screen. The messages *alarms Mrs. Stam; her next-door neighbour, Mrs. Meier, made an unexpected movement, and has not moved since, nor has she reacted to the signals from Julie's counterpart (i.e. Mrs. Meiers version of Julie).*

Mrs. Meier is not only a neighbour but also a good friend of Mrs. Stam. In addition to this, Mrs. Stam serves as a voluntary caregiver for her. They were not aware of each other's presence in the building until they met online. The matchmaking site Carey, run by the local home-healthcare organization, brought them together almost a year ago. Carey aims to bring people in the neighbourhood together. While it focuses on the elderly in the nursing home and the accompanying protected housing, the whole neighbourhood may use it. Carey can make use of the two-way video screen when trust has been established.

Mrs. Meier found Mrs. Stam when she was looking for voluntary aid. Her son had taken care of her until then, but immigrated to South Africa. They now have regular contact through the two-way video. Mrs. Stam had placed her name on the list with possible volunteer caregivers in the neighbourhood. She once again had time on her hands, now that her last child moved out to live on his own. Carey's match was successful. They have grown to be good friends over the past year. […]

[…] While she enters her own flat, Julie signals that she has an incoming video conversation. It is the nurse from the nursing home. "They are taking her to the stroke unit in the hospital." she announces, "Can I do anything for you? Arrange transport there for example?" "No, thank you," Mrs. Stam answers, "I'll be just fine." "Goodbye then." "Goodbye."

After this dialogue, she asks Julie to contact her daughter for a two-way video conversation. Right now, she really needs somebody close to talk to.

While the above excerpts from the scenarios provide ideas, some of it is only be possible in a far future (or sci-fi movies). As we are looking for alternatives that can be implemented on short term, we take a more representative point of view. We focus on things that can be brought to a proof of concept within the duration of the U*care project. These technical innovations include:

- Two-way audio-visual communication service
- Virtual community support (match-making) service
- Alarm / emergency service

Virtual communities can be used to support many processes in the elderly care sector. For example, they support the social interaction between clients and (informal) caregivers. ICT-based synchronous and asynchronous communication may expand client and (in)formal caregiver communication methods. Virtual communities allow for the exchange of public and private information between involved parties and services. Profile-based or context-based matchmaking allows for suggestions to find friends, activities and services. Reminder and agenda services can be moderated by and tailored to community members to increase and to organise socialisation.

According to these examples, virtual communities have the potential to improve the community building process and care services through support for activities, participation and information needs. Moreover, such virtual communities need to be tailorable and composable, because the elderly is not one homogenous group and needs vary from individual to individual.

From the business model view, two types of changes occur. The largest change is offering extra services to the elderly in the form of an extra communication option and a virtual community. A smaller change is the channel through which existing support is delivered. Neither of the changes has a large impact on the activities currently performed by caregivers. Although hopefully, people require less professional care if they are part of a strong community. Virtual communities may require new activities, such as moderating and content/member management. The new technology is an extra resource. The care centre could receive monetary benefits by charging an extra fee for use of the community. The communication service may be set up together with a partner, such as a telecommunication provider. As an option, people outside the care centre may become users of the virtual community and communication services.

7.3.1.4 Alternative 3: Remote monitoring and feedback services

The third category of services, derived through the requirements elicitation process, consists of functionalities for monitoring and providing feedback based on the monitoring. This includes monitoring vital signs, showing them to the elderly, and providing feedback on how to improve. In the current situation, caregivers have to make many measurements. On the one hand, this takes a lot of time. On the other hand, elderly often have to wait for the caregivers to come for their measurements. Measurements are also influenced by "white coat syndrome", a response of the body to fear of medical personnel, which especially influences blood pressure (Pickering, 1991). Below excerpts from the scenarios provide ideas and conception of the setting for this kind of services.

Sister Johanna:

"Johanna, have you taken your medicine?" – a soft voice calls from the audio system, while, at the same time the question appears in big letters on her computer screen.

"Yes, Julie, I have," she answers, and the voice says: "Okay, thank you".

In fact she had taken her medicine, a number of pills for a variety of different physical problems, but forgotten to acknowledge that. […]

Mr. Pieters:

[...] Out of habit, he tries to maintain a strict daily schedule. Nevertheless, sometimes he does not sleep well and gets up late. In addition, his memory is getting worse. Three times a day a nurse comes along to give him his medicine. It is stored in a locker in his room, but he does not have a key himself. Besides medicines, the doctor told him to do a series of exercises each day. In addition to those, he should try to maintain his stamina by going out; walking in the park. [...]

[...]No cure exists for COPD. Therefore, the treatment of Mr. Pieters' disease focuses on reducing symptoms and avoiding further deterioration of his condition. Some of his medicines work for the symptoms, but physical exercise is the key treatment. The original series of exercises was explained once at the doctor's office. Since then, Mr. Pieters does them at his home in Hogerheide. During the exercises, he uses a wristband, which measures the oxygen level in his blood and his heartbeat. Through the wall mounted screen, Julie provides feedback on how long he should do each exercise, based on those measurements. Thanks to this feedback, Mr. Pieters dares to continue the exercise for longer than he would otherwise. This little bit extra is exactly what improves his condition.

If the measurements exceed limits set by the doctor, Julie notifies the nurse who is on duty. The nurse can then use the two-way video options to check on Mr. Pieters, without having to walk to his room first. If something appears to be seriously wrong, the nurse can notify an emergency response team and go to the room. Fortunately, this functionality was needed only once. This occurred when Mr. Pieters attempted to ignore the screen, and continued his exercises for a little too long. When the nurse appeared on the screen, she told him to stop the exercise and use his inhaler to avoid acute exacerbation. All worked out well.

As a routine, at the start of the daily exercise, Julie asks Mr. Pieters to measure some blood pressure and haemoglobin level. This is used to monitor is progress over time. The positive feedback that Julie provides encourages Mr. Pieters to keep up the exercises. He notes that his condition no longer deteriorates. He hopes that Julie will soon be available in the park as well. It would reassure him when taking a walk there. One thing Julie already helps him with when he wants to take a walk is an update on the outside temperature. As people with COPD have extra difficulty breathing when it is cold, the screen gives the advice to dress warm in those cases.

The doctor uses the two-way video to check-up on Mr. Pieters once a month. Coached by the doctor, he has to blow into a tube; Julie sends the results to the doctor. On those occasions, the doctor may adjust the exercise levels and medicines, based on to the acquired measures and progress of the disease. The doctor also adds the next check-up to Mr. Pieters' calendar. If needed, an appointment with the physiotherapist is made. When there is a change in the exercise level, the physiotherapist can guide Mr Pieters through the *new exercises. When Mr. Pieters understands what to do, and the physiotherapist sees that Mr. Pieters does it right, supervision of the exercises can be taken over by Julie. […]*

Mrs. Stam:

[…] Two years ago, she was very exhausted. She had to have her daughter cancel some of the visitors. From that moment on, she started working on her stamina. The home trainer serves as a platform for exercise, three days a week. On the other days, she takes a walk in the nearby park. Sometimes with friends, but also on her own if she feels like it. The exercise on the home trainer provides good results. While on the home trainer, Julie automatically monitors her heartbeat and body-mass index. Feedback from Julie, based on the heartbeat, encourages Mrs. Stam to push further, but stops her from going too far. The bmi-graph shows improvement over time, helping her to continue. […]

[…]She swiftly goes to see what Julie has to say. As Julie detects that Mrs. Stam approaches the screen, the beeping stops and the cause for the distress appears on the screen. The messages alarms Mrs. Stam; her next-door neighbour, Mrs. Meier, made an unexpected movement, and has not moved since, nor has she reacted to the signals from Julie's counterpart (i.e. Mrs. Meier's version of Julie). […]

[…]"Can you apply the FAST-approach?" asks the nurse, as she quickly assesses the situation over the two-way video.

"No. She is unconscious." responds Mrs. Stam. On hearing that, the nurse immediately contacts the emergency service. They are able to get to Mrs. Meier faster than she can. This at least conforms to the last aspect of the FAST-approach (Face, Arms, Speech, Time), used in case of possible stroke (CVA).

While Mrs. Stam attends to her friend, Julie reacts to the signal that the emergency response team is on their way here. She brings the elevator down to the ground floor, and sends Mrs. Meier's medical history to the incoming team members to see. In addition to this, they take over the two-way video from the nurse.

"Hi, my name is Stephan. Is she usually so pale?" one of the team members asks Mrs. Stam. "No," she replies, "usually she has more colour in her face." A couple of questions follow. With this information, they can make a preliminary diagnosis. […]

[…]While she enters her own flat, Julie signals that she has an incoming video conversation. It is the nurse from the nursing home. "They are taking her to the stroke unit in the hospital." she announces, "Can I do anything for you? Arrange transport there for example?" "No, thank you," Mrs. Stam answers, "I'll be just fine." "Goodbye then." "Goodbye." […]

While the above excerpts from the scenarios provide ideas, some of it is only be possible in a far future (or sci-fi movies). As we are looking for alternatives that can be implemented on short term, we take a more representative point of view. We focus on things that can be brought to a proof of concept within the duration of the U*care project. These technical innovations include:

- Medication service
    - Reminders
    - Dispenser
    - Acknowledgement / Registration
- (Tele)monitoring service
    - Feedback over time
    - Notify caregiver
    - Measure
        - Oxygen saturation
        - Heartbeat
        - Blood pressure
        - Weight (+length => BMI)

Real-time measurement is not considered. Therefore, no measurement or feedback during exercise is possible. Neither is an alarm based on real-time measurements.

Interestingly, the clients did not talk spontaneously about monitoring or being monitored, but all the caregivers addressed monitoring functions as important for the clients' safety. We think that this comes from the fact that for the caregivers monitoring of safety is an important aspect of the job (for example, because of the possibly large impact after dangerous events such as a fall). In contrast, for clients it is something they rather not think or talk about freely when it concerns their own situation.

From a business model view, several changes occur. First off, the medication service directly impacts one of the activities that caregivers spent most time on, dispensing medicines. If done right, the service reduces time spent on it. Of course, new activities turn up: fill the dispensers, configure and maintain them, and train the elderly to use them. For the elderly themselves, it means that they do not have to wait for caregivers to give them their medicines. It may also improve medicine compliance by reducing human errors, providing the medicine at the right time, and improving registration.

Second, (tele)monitoring impacts the caregiver activities that involve measuring vital signs of elderly. The elderly may now measure these themselves, reducing the time caregivers spend on it. Of course, new activities turn up, such as training the elderly to use devices, but more importantly respond to those cases where the measurement exceeds set limits. The elderly no longer have to wait for the caregivers to do the measurements. Besides that they can better follow their progress over time. Telemonitoring can be seen as a change in channel too. This innovation requires quite some new technological resources and expertise. This may be acquired in-house, or done together with a partner, such as a technology provider.

7.3.1.5 Alternative N: Alternatives combined

Although the alternatives above may be individual innovations, they can be developed together. This may lead to synergy. If several alternatives require a similar infrastructure, it is possible to save costs by providing a shared platform, similar to Julie (though probably less sophisticated). For example, the medication service and telemonitoring service from the third category may build on top of the calendar service from the first category. As the scenarios demonstrate, alarm services and feedback benefit from two-way audio-visual communication, even though it is not strictly necessary.

From a business model view, a shared platform is interesting yet complex. It changes more on the business level than most of the individual innovations do. The shared platform is a new key resource and channel, which enables many other possibilities (probably even currently unperceived ones). A partner may be let in to ownership and responsibility for such a platform.

7.3.2 Step 6: Analyse alternatives (building business cases)

The final step for a business modeller is to analyse the alternative business models. While the business model of the current situation can be made very accurate (in theory), quantifying future business models inherently involves estimation. Besides the qualitative business models, several sources of input are possible to quantify the alternatives. For analysing the alternatives, we make use of predictions (Centraal Planbureau, 2013; Sociaal en Cultureel Planbureau, 2013), statistical data (Centraal Bureau voor de Statistiek, 2013), expert opinion, and a pilot project, as well as the data already collected for the current business model. By using this combination of sources, we aim to reduce subjectivity and bias in the estimations, and increase accuracy and precision.

When quantifying the alternatives, the main goal is to select the best one(s) to implement. The best one in this case is the one with the highest gains in financial terms. This measure is found when deducting the costs from the benefits in the business model. To do this systematically, we use the business case method developed in chapter 5 (see Table 28 for an overview). It starts with determining the business drivers and objectives for the project. These two are the same for all alternatives. When this is clear, each of the alternatives is evaluated on effects, risks, and costs. We handle these three aspects per alternative. Finally, the best alternative is selected, and an implementation plan is made for it. In this case, the implementation plan is part of section 7.4, where we build an enterprise architecture for U*Care.

7.3.2.1 Business driver

The business drivers stand for a statement of the current issues facing the organization that need to be addressed. For the elderly care centre, and society in general, the current issue is the increase in elderly, leading to an increased need in elderly care. While on the other side, the amount of money and people available for elderly care is decreasing. Therefore, we have to look for innovation opportunities.

7.3.2.2 Business objectives

The goal of this innovation is to reduce costs, while maintaining quality. The increased amount of care needed and reduction of resources available in the future must be handled this way. This objective focusses on the costs aspects of the business model. Since we have little direct influence on society as a whole, we focus on a single care centre. If innovations can reduce costs here, it may also be possible in other centres, leading to an overall reduction of costs.

As Figure 63 shows, within Europe, the Netherlands scores highest both on the quality and on the costs of care. In addition to this, the costs of care are expected to rise due to the increased aging of the population (see section 7.1.1). Due to this, goals of the alternatives do not focus on improving quality (as it is high already), but on decreasing costs (while maintaining quality). Therefore, we do not quantify increased quality (of live) for the purpose of cost-benefit analysis.

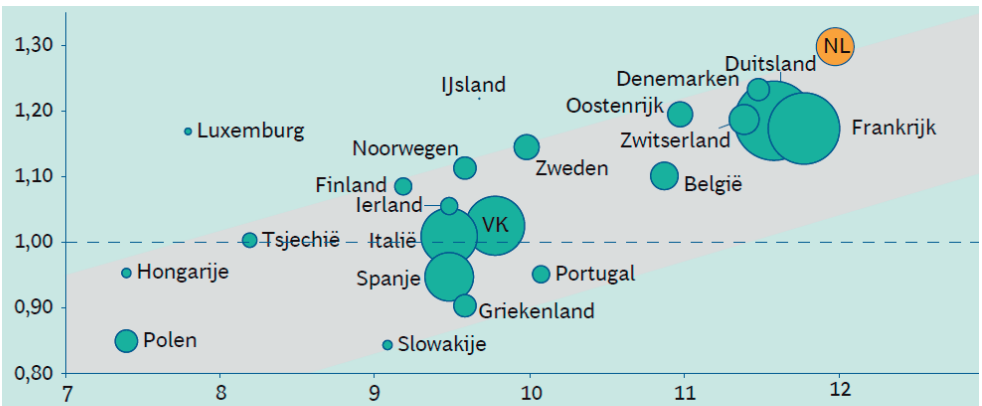

Figure 63: Costs and quality of care in Europe. The Netherlands scores highest on both. (Kuenen et al., 2011)

An often-heard benefit from telemedicine and home automation is that people can live at home longer (Wild et al., 2008). Living at home longer is usually a desire from the elderly themselves. Staying in your own, familiar surroundings feels better and more secure, especially if you have been living there for a very long time. In the Netherlands, people are living at home with care longer than they did in the past (Centraal Bureau voor de Statistiek, 2012), as Figure 64 shows. While the costs for care and quality of life for elderly living at home seems to be better intuitively, we have not found any research substantiating these benefits. Besides that, it may not be in the best interest of the care centre. Therefore, we do not include benefits of living at home longer in the analysis.

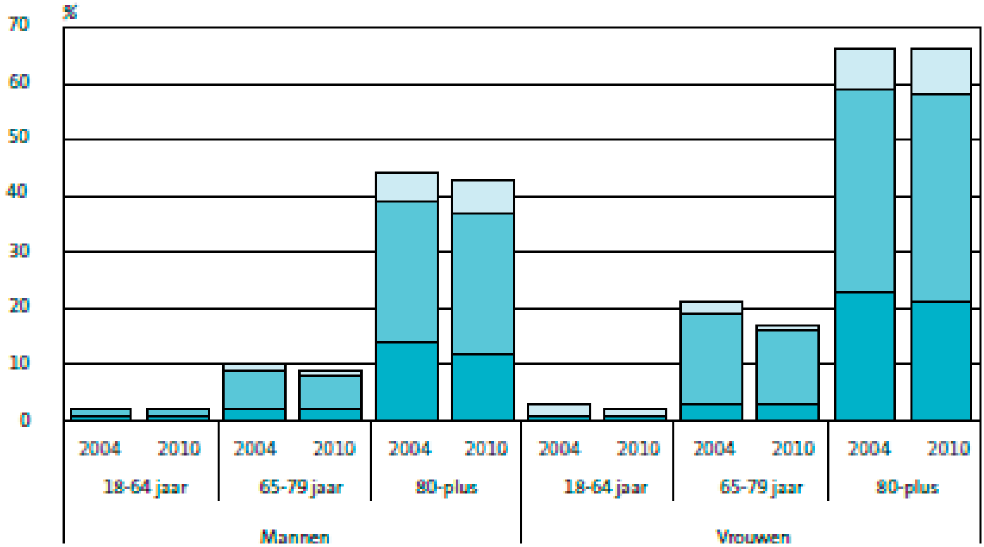

Figure 64: Government-financed care with (dark), without (medium), and mixed (light) accommodation (CBS, 2013).

Especially health labour productivity is a key performance indicator, as a high percentage of the care costs come from labour. Next to that, predictions indicate that the amount of care labour available decreases in the (near) future (Clark et al., 2006).

7.3.2.3 Alternative 0: Keep things as they are

As mentioned before, costs for elderly care are expected to increase in the near future, while the amount of people paying for care and the amount of caregivers drops (Simoens et al., 2005). Therefore, the current situation is not viable in the long term. Already, consulted experts see a drift away from having a care centre altogether. Elderly with low indications have to remain at home, while elderly with high indications go to nursing homes. The current care centres slowly turn into nursing homes providing a higher level of care than in the past. Yet care also has to be provided to elderly living at home.

In short, keeping things as they are is not sufficient. Things have to change. Especially, costs of care have to decrease compared to the current situation. For this alternative, the numbers are already in the section 7.2.4, so we elaborate them no further.

7.3.2.4 Alternative 1: Reminder and information services

Following the first two steps of the business modelling methodology does not change anything compared to the current situation. The roles and relations for this alternative remain the same, as the calendar functions mostly influence things outside the caregivers' responsibility. In the third step, specify activities, the caregivers may get the extra activity of keeping the calendars up to date. Besides this, activities normally associated with introducing new technology appear, such as maintain the system, and training the users. Introducing the technology in the business means that it also gets a place in the business model. The technology is both a resource and a potential channel in the Business Model Canvas (BMC). Both the technology and the required extra human resources (for updating calendars, training users, and maintain the technology) lead to extra costs. An added value for the elderly may include a better daily structure, helping them to live more pleasantly. Figure 65 shows the elements in a BMC that differ between alternative 0, keeping things as they are, and alternative 1, introducing reminder and information services.

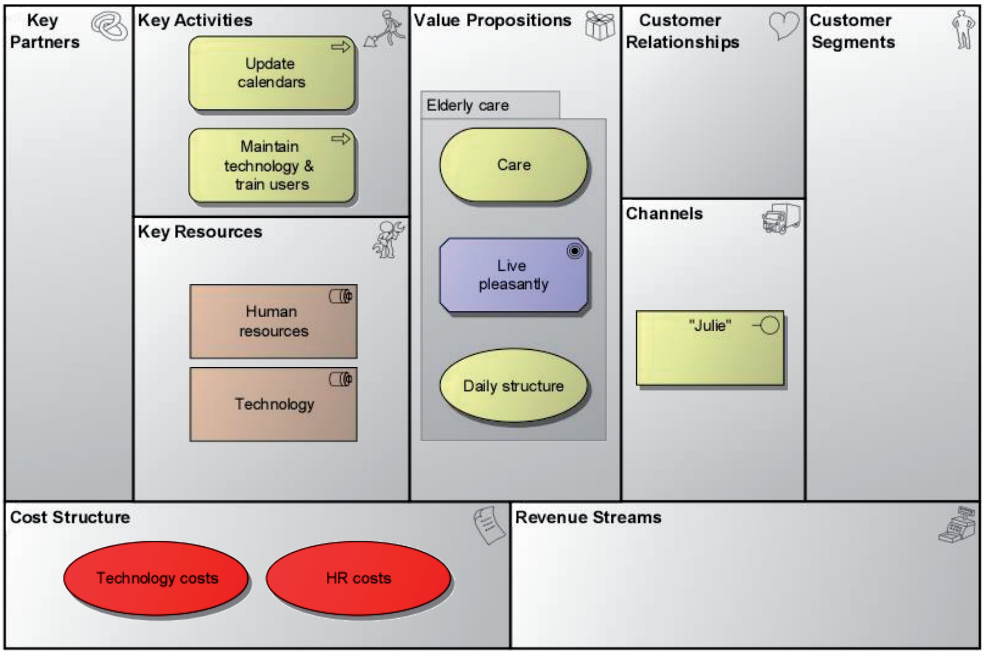

Figure 65: Differences in the business model between alternative 0 and 1.

The right side of Figure 65 shows that alternative 1 has no quantifiable benefits to be taken into account. On the left side, it shows an increase in costs for human resources and for the new technology.

Assuming standard technology (for example, Microsoft Exchange or Google Apps), software costs for a hosted solution are approximately € 5 per user per month (Google, 2013; Microsoft, 2013). A hosted solution allows us to take maintenance out of the picture, as well as hardware costs for central servers. This amounts to approximately € 6,000 a year for technology costs (€ 5 x 12 months x 100 users), excluding setup costs. For the human resource costs, training users and updating calendars, we estimate that approximately 15 minutes are needed on average per user each week. This has a peak at the start for training and gets lower on the long run. This amounts to approximately

€ 20,000 a year for human resource costs (€ 15 per hour x 52 weeks x 15 minutes x 100 users). Hardware costs for user devices start at approximately € 300 for a 10-inch Android tablet with 3G (Tweakers, 2013). Purchase costs for hardware are estimated to be € 30,000 (€ 300 x 100 users). In general, electronic devices can be used for 3 years. Therefore, the hardware costs are approximately € 10,000 per year. Therefore, total running costs are approximately € 36,000 a year. Setup costs, tailoring, and infrastructure are disregarded for now.

As no monetary benefits are taken into account, the net result of this alternative, compared to alternative 0, is a loss of € 36,000 a year.

7.3.2.5 Alternative 2: Social interaction and support services

This alternative has three different, yet closely related innovations. First, we introduce the two-way audio-visual communication service. Second, it includes virtual community support. Third and final, a new form of alarm / emergency service is incorporated. Each of these can be seen as an individual alternative too. Therefore, we analyse them separately. Figure 66 shows the elements in a BMC that differ between alternative 0, keeping things as they are, and alternative 2, introducing social interaction and support services.

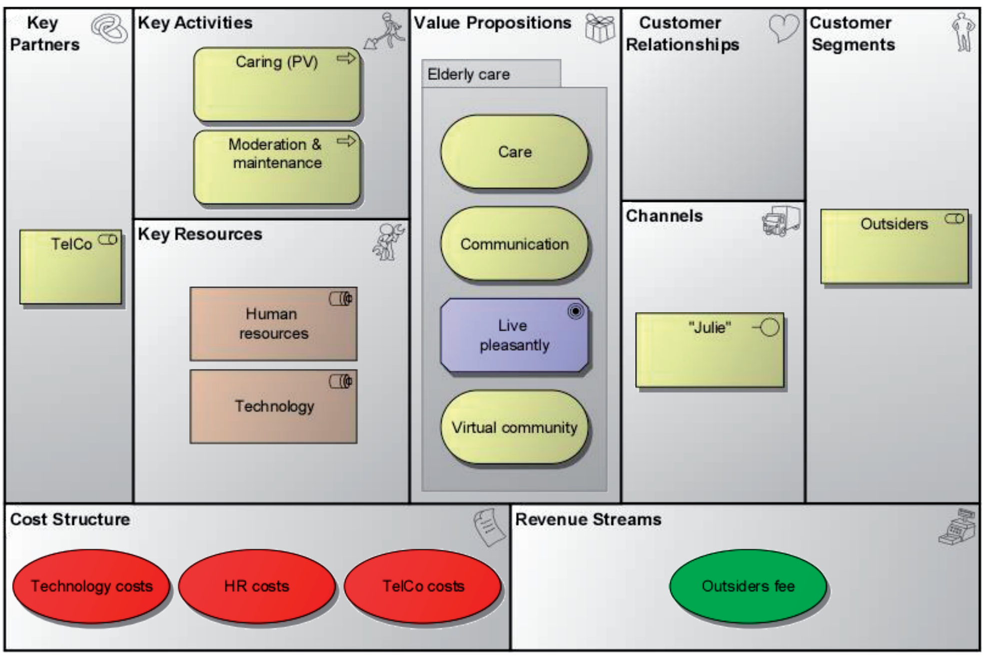

Figure 66: Differences in the business model between alternative 0 and 2.

7.3.2.5.1 Alternative 2a: Two-way audio-visual communication service

The communication service is both a new service to offer to the elderly and a new channel for caregivers to communicate with the elderly. The communication service may also be offered to outsiders, such as family of the elderly or people in the neighbourhood. As an extra service, a fee may be charged for use of the service. However, if the aim is to use it a communication channel between caregivers and elderly, it should be free of charge for the elderly.

While the communication service is a new channel for the caregivers, it is a substitute for their current channel (face-to-face). The potential benefit is that the caregivers would have to travel less time. However, as nearly all of their activities require physical presence and the travel distance is limited, this benefit is not significant in the care centre setting. Of the activities in Table 47, only teaching and supervising personal care activities may be done without being physically present. Yet especially this is done together with the actual activities usually.

The right side of Figure 66 shows that alternative 2 has outsiders fee as benefits. We do not take these into account, as it is not the core business of the care centre to offer this kind of services to outsiders. In future, this may be considered.

On the left side, Figure 66 shows an increase in costs for human resources, for the new technology, and optionally a telecom provider. Assuming standard technology, software costs for a hosted solution are minimal. For example, Skype offers this service for free. A hosted solution allows us to take maintenance out of the picture, as well as hardware costs for central servers. For the human resource costs, training users, we estimate that approximately 5 minutes are needed on average per user each week. This has a peak at the start for training and gets lower on the long run. This amounts to approximately € 6,500 a year for human resource costs (€ 15 per hour x 52 weeks x 5 minutes x 100 users). Hardware costs for user devices start at approximately € 300 for a 10-inch Android tablet with 3G (Tweakers, 2013). For two-way communication, both the elderly and the caregivers (30 FTE, sharing devices among part-timers) need devices. Purchase costs for hardware are estimated to be € 39,000 (€ 300 x 130 users). In general, electronic devices can be used for 3 years. Therefore, the hardware costs are approximately € 13,000 per year. Therefore, total running costs are approximately € 20,000 a year. Setup costs, tailoring, infrastructure, and a telecom provider are disregarded for now.

As no monetary benefits are taken into account, the net result of this alternative, compared to alternative 0, is a loss of € 20,000 a year.

7.3.2.5.2 Alternative 2b: Virtual community support

A virtual community (VC) is an ICT-mediated social network: it is defined as a group of people who have regular social interaction, independent of time and space, because of a common goal such as a problem, task, or feeling exchange (Eysenbach et al., 2004;

Rheingold, 1993). Virtual communities for elderly healthcare have a potential to improve the community building process and to facilitate care services through support for activities, participation and information needs. Profile- or context-based matchmaking allows for suggestions to find friends, activities, and services.

Potential benefits may exist in the quality of life for the elderly. This may result in less required care. However, several scientific trials have been performed, but there is no solid scientific evidence of the advantages of VCs. One reason of this lack of evidence is that most of these trials are combined with quite complex interventions. Promising is the fact that no negative findings have been recorded either (Demiris, 2006). In short, we do not include any benefits in quantifying the business model.

As Van ‘t Klooster et al. (2011) demonstrate, a virtual community for an elderly care centre is quite complex, and has major requirements. No standard technology is available to fulfil these requirements. This makes it harder to estimate costs. Therefore, we use the costs of the pilot project and assume the systems are run in-house. For the human resource costs, training users, moderating, and maintaining the system, we estimate that approximately 15 minutes are needed on average per user each week. This has a peak at the start for training and gets lower on the long run. This amounts to approximately € 20,000 a year for human resource costs (€ 15 per hour x 52 weeks x 5 minutes x 100 users). Hardware costs for user devices start at approximately € 300 for a 10-inch Android tablet with 3G (Tweakers, 2013). As the caregivers should be included in the community, both the elderly and the caregivers (30 FTE, sharing devices among part-timers) need devices. Purchase costs for hardware are estimated to be € 39,000 (€ 300 x 130 users). In general, electronic devices can be used for 3 years. Therefore, the hardware costs are approximately € 13,000 per year. Therefore, total running costs are approximately € 33,000 a year. Setup costs and infrastructure are disregarded for now.

As no monetary benefits are taken into account, the net result of this alternative, compared to alternative 0, is a loss of € 33,000 a year.

7.3.2.5.3 Alternative 2c: Alarm / emergency service

In the current situation, elderly have an alarm button in their room, which notifies a caregiver. The caregiver has to rush to the room instantly if this button is pressed to see if it is an emergency. If the above two innovations are implemented, they may also serve for this purpose. Advantages would be that misuse (for example, “testing” whether the button works) can be detected more easily, and that for minor happenings the community could provide the support instead of the caregiver. Besides that, the current system for alarm could be phased out.

However, we do not quantify this alternative. It is only applicable if both the above innovations are implemented. Without them, the current situation is sufficient, reliable, and simple. Besides that, the current alarm system has certification, which a new system may also require, increasing the costs greatly. As an example, Skype avoids certification costs as it explicitly says that it does not serve for emergency purposes.

7.3.2.6 Alternative 3: Remote monitoring and feedback services

Similar to the previous alternative, this alternative has two different innovations. First, we introduce the medicine dispenser service. Second, it includes remote monitoring. Each of these can be seen as an individual alternative too. Therefore, we analyse them separately. Figure 67 shows the elements in a BMC that differ between alternative 0, keeping things as they are, and alternative 3, introducing remote monitoring and feedback services.

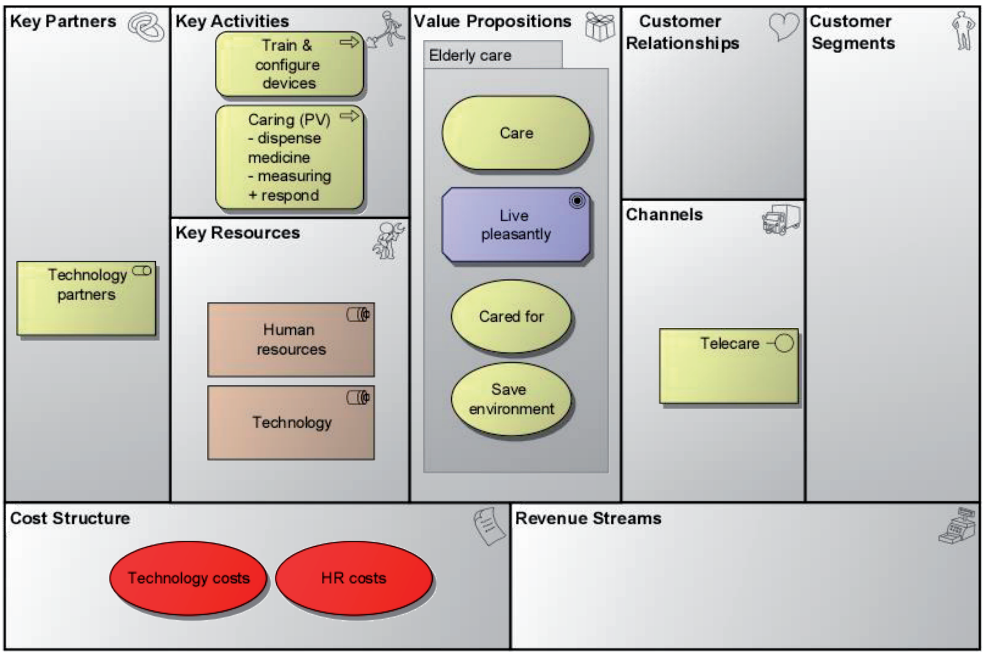

Figure 67: Differences in the business model between alternative 0 and 3.

7.3.2.6.1 Alternative 3a: Medicine dispenser

As Table 47 shows, presenting medicines is one of the activities that caregivers spend most time on. An electronic medicine dispenser makes it possible for a substantial part of the elderly living at a care centre to take their medication on their own for a longer period. This is done by placing pre-packed medicines in the dispenser and set it according to the current week programme. The dispenser sends a signal to the user when it is time to take the medication. When the user responds to the signal by confirming it, the pre-packed medication becomes available and the package is opened.

The display informs the patient to take the medication. If they do not confirm within the set period of time, a message is sent to the caregiver (Innospense, 2013).

For the elderly themselves, it means that they do not have to wait for caregivers to give them their medicines. Besides that, it may also improve medicine compliance by reducing human errors, providing the medicine at the right time, and improving registration. While these two things may improve elderlies' quality of life, no financial benefit can be captured directly for the care centre. Therefore, we do not include these benefits in quantifying the business model.

On the left side, Figure 67 shows a change in costs for human resources and costs for the new technology. To keep things simple for the care centre, medicine dispensers can be leased, so that maintenance can be disregarded. The costs for leasing are approximately € 750 per dispenser per year. Approximately 75% of the elderly in a care centre need medicines to be presented. Of these, caregivers at the care centre expect that 75% are able to use the electronic medicine dispenser. Costs for technology are estimated to be € 56,250 a year (€ 750 x 75 users).

The medication service directly impacts one of the activities that caregivers spent most time on, presenting medicines. If done right, the service reduces time spent on it. Of course, new activities turn up: fill the dispensers, configure and maintain them, and train the elderly to use them. For the human resource costs, we estimate that the new activities take 80% less time than the current situation, saving approximately 12 hours a day for all users. This amounts to a reduction in costs of approximately € 65,700 a year for human resource costs (€ 15 per hour x 12 hours a day x 365 days). Setup costs and infrastructure are disregarded for now.

As no other monetary benefits are taken into account, the net result of this alternative, compared to alternative 0, is a yield of € 9,450 a year.

7.3.2.6.2 Alternative 3b: Remote monitoring

Remote monitoring impacts the caregiver activities that involve measuring vital signs of elderly. The elderly may now measure these themselves, reducing the time caregivers spend on it. Several vital signs may be measured. We focus on oxygen saturation, heartbeat, blood pressure, and weight. Next to being captured on the measurement device, the data can be viewed in a (personalized, web-based) portal. Besides viewing monitoring data form their clients, caregivers can also communicate back to them (for example, adjust treatment advice). The elderly have their own personal account, giving them a secure way to provide their caregivers with information, monitor their own health status, and receive feedback in the comfort of their own environment (MobiHealth, 2013).

According to the AWBZ, measuring vital signs does not belong to personal care (PV) but to nursing care (verpleging, VP). Each measurement takes 10 minutes of a caregiver's time on average (Ministry of Health, Welfare and Sport, 2011).

For the elderly themselves, it means that they do not have to wait for caregivers to measure their vital signs. Besides that, it may also improve measurements by reducing human errors and avoiding white coat syndrome. While these two things may improve elderlies' quality of life, no financial benefit can be captured directly for the care centre. Therefore, we do not include these benefits in quantifying the business model.

On the left side, Figure 67 shows a change in costs for human resources and costs for the new technology. Approximately 75% of the elderly in a care centre need some form of vital signs measurements. Of these, caregivers at the care centre expect that 75% are able to use remote monitoring. For now, we assume every elderly needs only one type of measurement, and each measurement costs the same.

Assuming available technology, costs for a technology provider are approximately € 40 per user per year (BP@Home, 2013). This amounts to approximately € 3,000 a year for technology costs (€ 40 per year x 75 users), excluding setup and infrastructure costs. Hardware costs for user devices start at approximately € 110 for a measurement device (BP@Home, 2013). Purchase costs for hardware are estimated to be € 8,250 (€ 110 x 75 users). In general, electronic devices can be used for 3 years. Therefore, the hardware costs are approximately € 2,750 per year. For the human resource costs, training users and responding to measurements, we estimate that 15 minutes are needed on average per user each week. This has a peak at the start for training and gets lower on the long run. This amounts to approximately € 14,625 a year for human resource costs (€ 15 per hour x 52 weeks x 15 minutes x 75 users). Therefore, total running costs are approximately € 20,375 a year. Setup costs, tailoring, and infrastructure are disregarded for now.

For monetary benefits, we take into account the reduction in time for caregivers to measure the vital signs. According to the AWBZ, 10 minutes are available from the caregivers for each measurement (Ministry of Health, Welfare and Sport, 2011). Most measurements are taken daily. Therefore, approximately 4,500 hours can be saved each year (10 minutes x 365 days x 75 users). This amounts to a yield of approximately € 67,500 a year (4,500 hours x € 15 per hour).

Taking into account both the total costs and the monetary benefits, the net result of this alternative, compared to alternative 0, is a yield of € 47,125 a year.

7.3.2.7 Alternative N: Alternatives combined

In the U*Care project, the services described in the previous sections are envisioned to run on a shared platform, the U*Care platform, which provides tailorable, evolvable, and non-intrusive home care services. The platform provides technology-independence, in the sense that it shields application developers from underlying software and network technologies. It offers basic context-aware functions that can be used as service building blocks. The platform focusses on wellness and healthcare applications and services to assist elderly in an "integrated living" environment.

The shared platform is a new key resource and channel, which enables many other possibilities (value propositions or services). A partner may be let in to ownership and responsibility for such a platform. Figure 68 shows a business model canvas for such a shared platform. The platform is a technological innovation, and as such an investment. The technology comes with its costs. On its own, the platform has no direct value proposition for the elderly or caregivers, who are the end-users. It only provides a new channel for services to the care centre. Due to this, no direct benefits exist. In Figure 68, the empty fields for value proposition and benefits express this. However, benefits may arise when other innovations are included. The shared platform allows those services to be provided at a lower cost, as the infrastructure is shared between the services. Having the platform may also make several services viable that would not be viable on their own. Besides that, several services may work very well together. In the future, new service may be added on top of the existing platform.

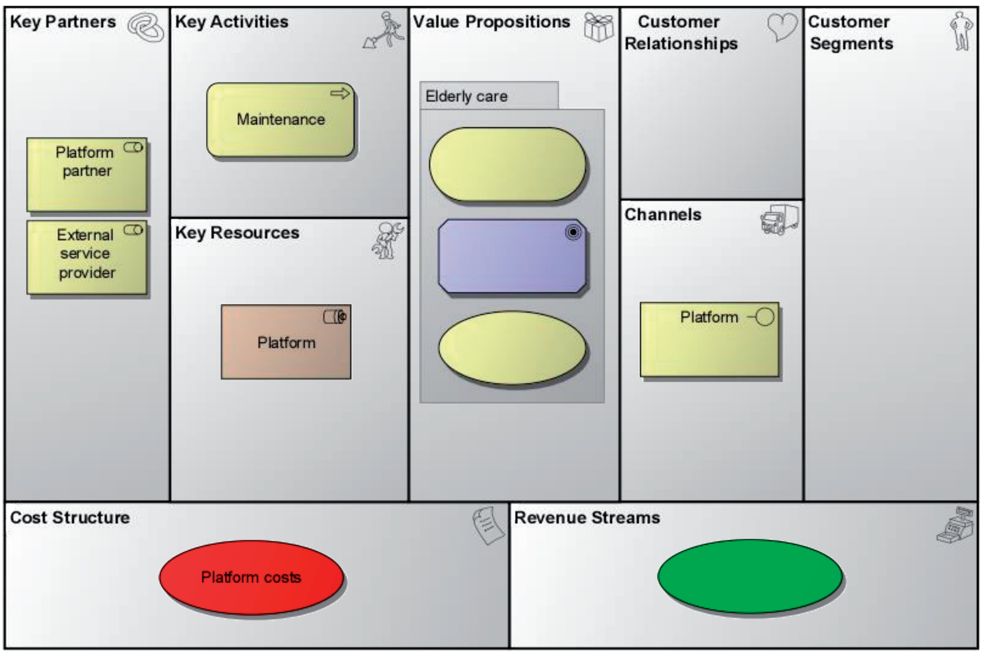

Figure 68: A business model canvas for alternative N: a shared platform

For quantifying the business model for the shared platform in Figure 68, we use two stages. First we look at the costs of the platform on its own, as it has no direct benefits. Second, we consider where having a shared platform reduces costs for the other alternatives.

7.3.2.7.1 Costs for a shared platform

The costs for a shared platform arise from several items, such as maintenance, configuration, hardware (devices and servers), software (development and licences), and training the users. Some of these costs can be found for general items in the public domain. Other costs are very hard to estimate. Therefore, we base the estimations on the costs from the pilot in the U*Care project.

Configuration and development of the software has been done for this project already. Therefore, these costs are minimal. The developed platform uses IBM Websphere as a base, which requires a license. License fees for the platform are approximately € 15,000 a year. The platform runs on two servers. Purchase of these two servers costs approximately € 12,000. In general, electronic devices can be used for 3 years. Therefore, the server costs are € 4,000 per year. The platform requires every user to have a device. Hardware costs for user devices start at approximately € 300 for a 10-inch Android tablet with 3G (Tweakers, 2013). Both the elderly and the caregivers (30 FTE, sharing devices among part-timers) need devices. Purchase costs for devices are estimated to be € 39,000 (€ 300 x 130 users). In general, electronic devices can be used for 3 years. Therefore, the device costs are approximately € 13,000 per year. Maintenance, configuration, and training the caregivers are estimated to require 9 hours each week from an IT professional. The costs for this are approximately € 7,000 a year (9 hours x 52 weeks x € 15 per hour). We estimate that caregivers require approximately 5 minutes on average per elderly each week for training. This has a peak at the start and gets lower on the long run. This amounts to approximately € 6,500 a year for human resource costs (€ 15 per hour x 52 weeks x 5 minutes x 100 users).

Taking the above into account, total running costs are € 45,500 a year.

7.3.2.7.2 Reduction in costs for other alternatives

Combining alternative 1, reminder and information services, with the shared platform results in very high synergy. The platform already has all functionality from the alternative. Therefore, the software and hardware costs of the alternative can be dismissed, as well as some of the training costs. The only extra costs remaining, compared to having only the platform, are human resource costs for updating calendars. We estimate that this takes 5 minutes on average per user per week. This amounts to approximately € 6,500 a year for human resource costs (€ 15 per hour x 52 weeks x 5 minutes x 100 users). However, as this alternative has no explicit benefits, this still means an extra loss. The total costs of this alternative combined with the platform are € 52,000 a year.

Combining alternative 2a, two-way audio-visual communication service, with the shared platform results in high synergy. The platform already has all functionality from the alternative. Therefore, the software and hardware costs of the alternative can be dismissed. As the platform offers these services natively, they are also included in the training for the platform. Therefore, this combination is no more expensive than the platform on its own, € 45,500 a year.

Combining alternative 2b, virtual community support, with the shared platform results in high synergy. The platform already has all functionality from the alternative. Therefore, the software and hardware costs of the alternative can be dismissed, as well as some of the training costs. The only extra costs remaining, compared to having only the platform, are human resource costs for moderating the system. We estimate that this takes 5 minutes on average per user per week. This amounts to approximately € 6,500 a year for human resource costs (€ 15 per hour x 52 weeks x 5 minutes x 100 users). However, as this alternative has no explicit benefits, this still means an extra loss. The total costs of this alternative combined with the platform are € 52,000 a year.

Combining alternative 2c, alarm service, with the shared platform results in high synergy. The platform already has all functionality from the alternative. Therefore, the software and hardware costs of the alternative can be dismissed. As the platform offers these services natively, they are also included in the training for the platform. Therefore, this combination is no more expensive than the platform on its own, € 45,500 a year. However, the current situation is still sufficient, reliable, and simple. Besides that, the current alarm system has certification, which the platform may also require, increasing the costs greatly.

Combining alternative 3a, medication services, with the shared platform results in limited synergy. The platform has some of the functionality from the alternative. Therefore, some of the training costs can be dismissed. Extra costs remaining, compared to having only the platform, are technology costs for leasing the dispensers. Costs for technology are estimated to be € 56,250 a year (€ 750 x 75 users). Human resource costs are reduced. This amounts to a reduction in costs of approximately € 65,700 a year for human resource costs (€ 15 per hour x 12 hours a day x 365 days). However, this still means a loss. The total costs of this alternative combined with the platform are € 36,050 a year.

Combining alternative 3b, remote monitoring services, with the shared platform results in some synergy. The platform has some of the functionality from the alternative. Therefore, some of the training costs can be dismissed. Extra costs remaining, compared to having only the platform, are technology costs for buying the hardware and subscribing with the technology provider. Extra costs for technology are estimated to be € 5,750 a year (equal to the alternative on its own). Human resource costs are reduced compared to not having the platform, as the training is included with the platform already. For the human resource costs, responding to measurements, we estimate that 10 minutes are needed on average per user each week. This amounts to approximately € 9,750 a year for human resource costs (€ 15 per hour x 52 weeks x 10 minutes x 75 users). Therefore, total running costs are approximately € 15,500 a year. The monetary benefits are the same as alternative 3b on its own, € 67,500 a year. The total yield of this alternative combined with the platform is € 6,500 a year.

Right now, implementing all the alternatives with the platform, results in a profit of € 2,950. Implementing all alternatives without the platform results in a loss of € 32,425. Implementing only the profit making alternatives (3a and 3b) results in a profit of € 56,575. Implementing the platform with only the profit making alternatives, results in a profit of € 15,950.

Table 49: Influence of a shared platform on alternatives.

Alternatives	Without platform	With platform (N)
0	0	-45.500
1	-36,000	-52,000
2a	-20,000	-45.500
2b	-33,000	-52,000
2c	--	-45.500
3a	9,450	-36,050
3b	47,125	+6,500
3a+3b	56,575	+15,950
N	--	-45,500

7.4 An enterprise architecture for U*Care

Although the previous section points out that, from a business perspective, only alternatives 3a and 3b without a platform should be implemented, we continue with a shared platform for care services, the U*Care platform. In this section, we build an enterprise architecture for the U*Care platform. We use the approach from chapter 6 (see Figure 50 for the overview). We start from a baseline architecture in the current situation, and deliver a target architecture for the desired situation. As opposed to the process in chapter 6 (Figure 50), we already have the business models of the current situation (Figure 61) and target situation (Figure 68) available from the previous sections. Therefore, we do not have to develop them the way we did for the ArchiSurance case.

7.4.1 Current situation

In the current situation at the care centre, a baseline enterprise architecture is not established yet. The IT infrastructure within the care centre is limited to a, mainly wired, network. With a few exceptions, the elderly do not have any network-connected devices. The care givers have basic mobile phones for alarm services and a single computer at each department. Besides this, the administrative departments have many computers and some servers, but these are strictly outside the scope of this project.

All rooms have a domotica system for security and assistance already. It consists of a base station, with a red button for alarm, and a green button for requesting assistance. These signals are sent to the care givers' station, and the mobile phone of the care giver on duty. The elderly may also have personal (pendant) alarms that connect to this system when they are in their rooms. The base station offers an audio connection. This domotica system works in isolation. Using or connecting to it falls outside the scope of the U*Care project.

While the baseline architecture in Figure 69 shows the security and assistance domotica system, the most important thing is the care delivered to the care receiver from the care giver. In the current, situation no information technology is used for this. This matches the business model in Figure 61, except for two changes. The first is that, compared to that business model, the living components (residence, building, care centre, F&B) are left out, as the alternatives do not influence it. The second is that the alarm part of care has been detailed to at least show the little IT that is in use already. The resource-capability model in Figure 70 makes the link more explicit. Quantitative details for caring can be found in the quantitative business model in section 7.2.4.

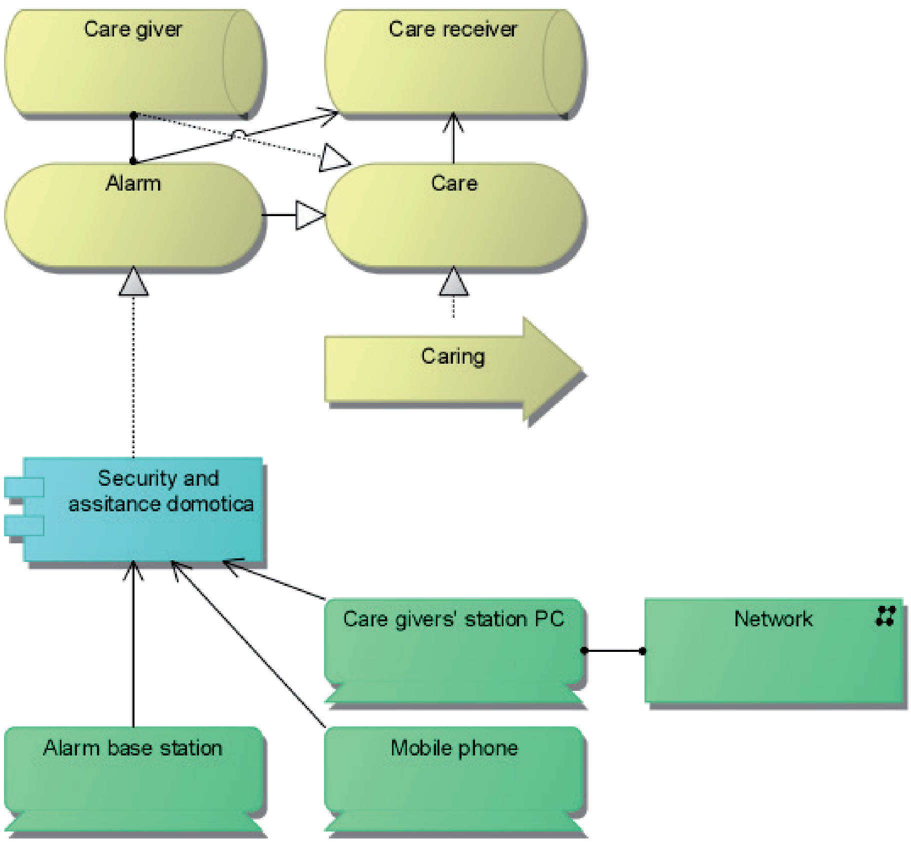

Figure 69: U*Care baseline architecture

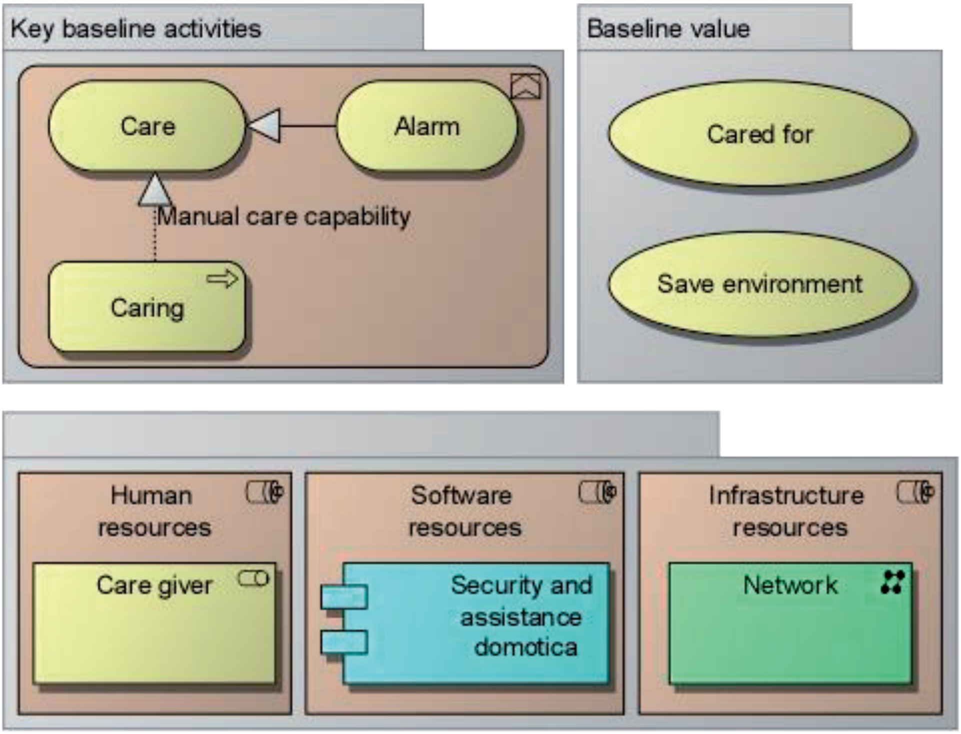

Figure 70: U*Care baseline resource-capability model

7.4.2 Motivation model

The motivation model in Figure 71 shows the drivers and objectives from section 7.3.2. As the increasing cost of care is the main driver, we focus on trying to reduce the costs. The figure reflects that most of the costs in elderly care are human resource costs. The available time of the care givers for each care receiver is decreasing, and becoming more expensive. Reducing the time they spend on manual work (especially not spend with the care receiver) should increase their productivity and thus lower overall costs. This may be achieved by facilitating self-service for the care receivers. Next to decreasing costs, this also allows them more independence and perhaps to live at home longer. At the bottom of the motivation model are the possible alternatives from the previous sections, which may help achieving the objectives.

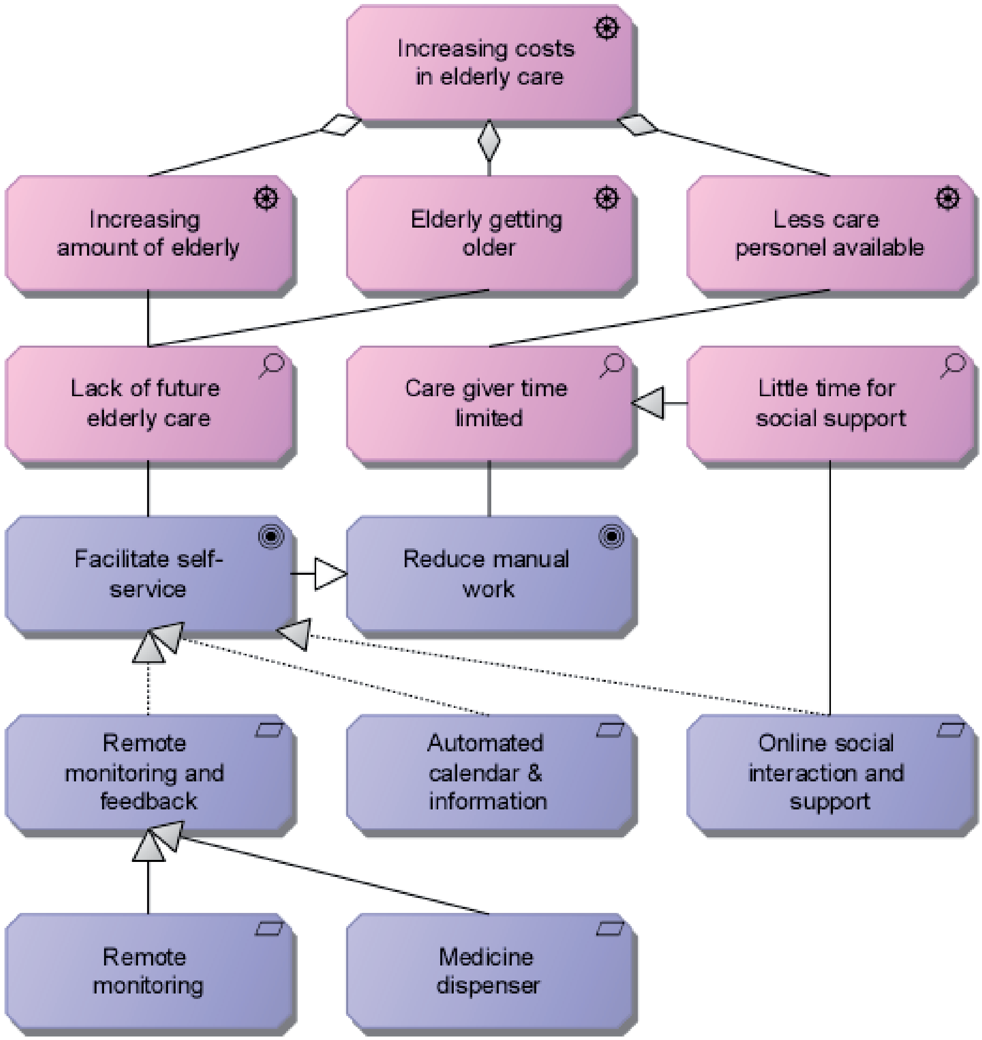

Figure 71: U*Care motivation model

7.4.3 Target situation

Based on the assesment of the alternative business models in section 7.3.2, a shared service platform forms the most interesting case to build an enterprise architecture for. Figure 72 shows the combined business model for the shared platform and the services running on it. Based on this, Figure 73 shows the provisioning architecture for the pilot project. Most of the online social interaction and support is not visible in this architecture, as it is mainly covered by the user interface, and the reminder and notification services. Two-way audio-visual communication is excluded, as this can be covered by independent applications on the care receiver tablets, such as Skype.

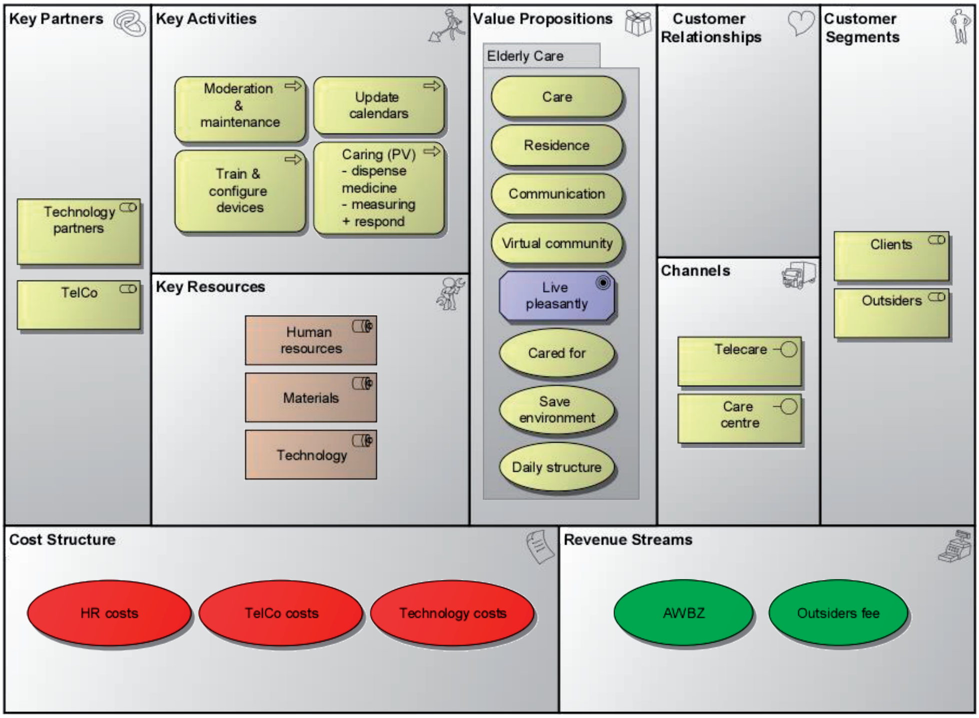

Figure 72: U*Care target business model

Parts of this architecture are published in several scientific publications (Klooster et al., 2011; Mohammad Zarifi Eslami, 2013; Mohammad Zarifi Eslami et al., 2010; Zarghami et al., 2012, 2011, 2011), where more details on each of the components can be found. In short, each of the services is provided by a combination of the technologies at the bottom of the picture. The rule and process engine take care that the right service building blocks are called according to the service plans. However, this requires tailoring the system to the users' needs. The provisioning architecture in Figure 73 does not show this, therefore, a second, tailoring architecture is needed, shown in Figure 74. This shows how a care giver can tailor the system in three steps to the needs of the care receivers.

As opposed to the ArchiSurance case, where we introduced a new web portal within the existing architecture, the U*Care case has a near green field situation. Therefore, instead of highlighting the parts of the architecture that changed (nearly everything), we point out the two things that have not changed. The first is the existing emergency alarm system. The second is the care givers and the fact that much of the care is still taken care of by them manually. The only manual care activities that are substituted by technology are medicine dispensing and (remote) monitoring of vital signs.

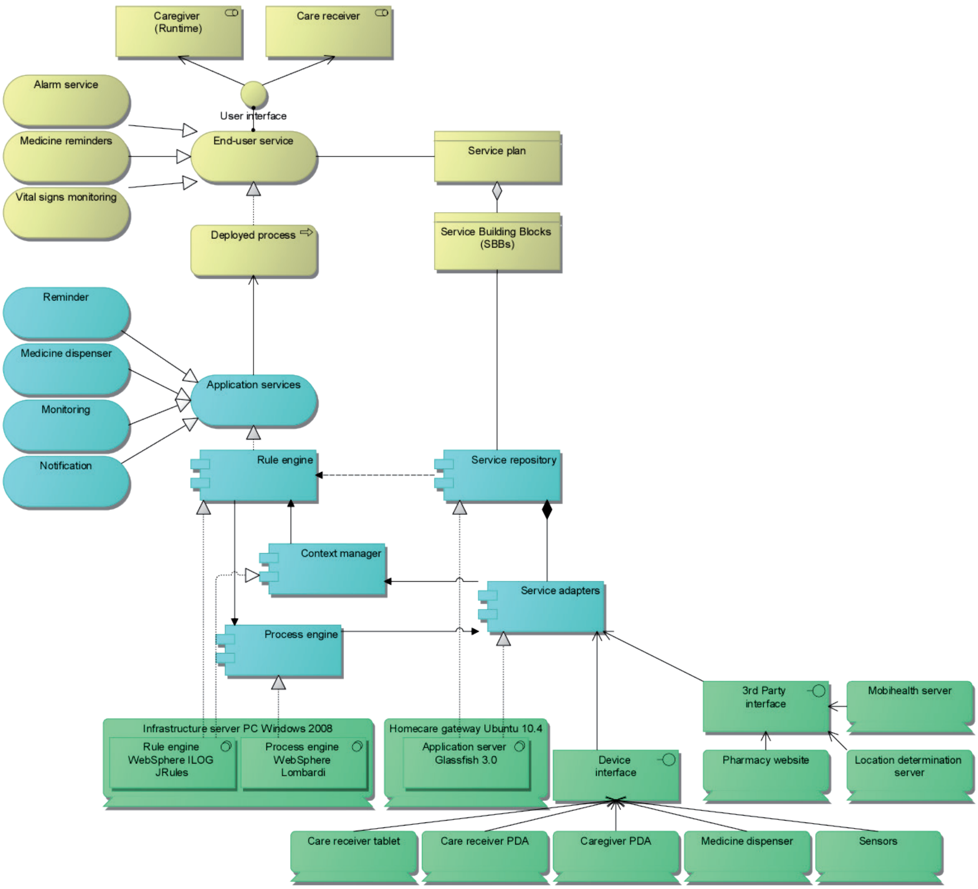

Figure 73: U*Care Provisioning Architecture

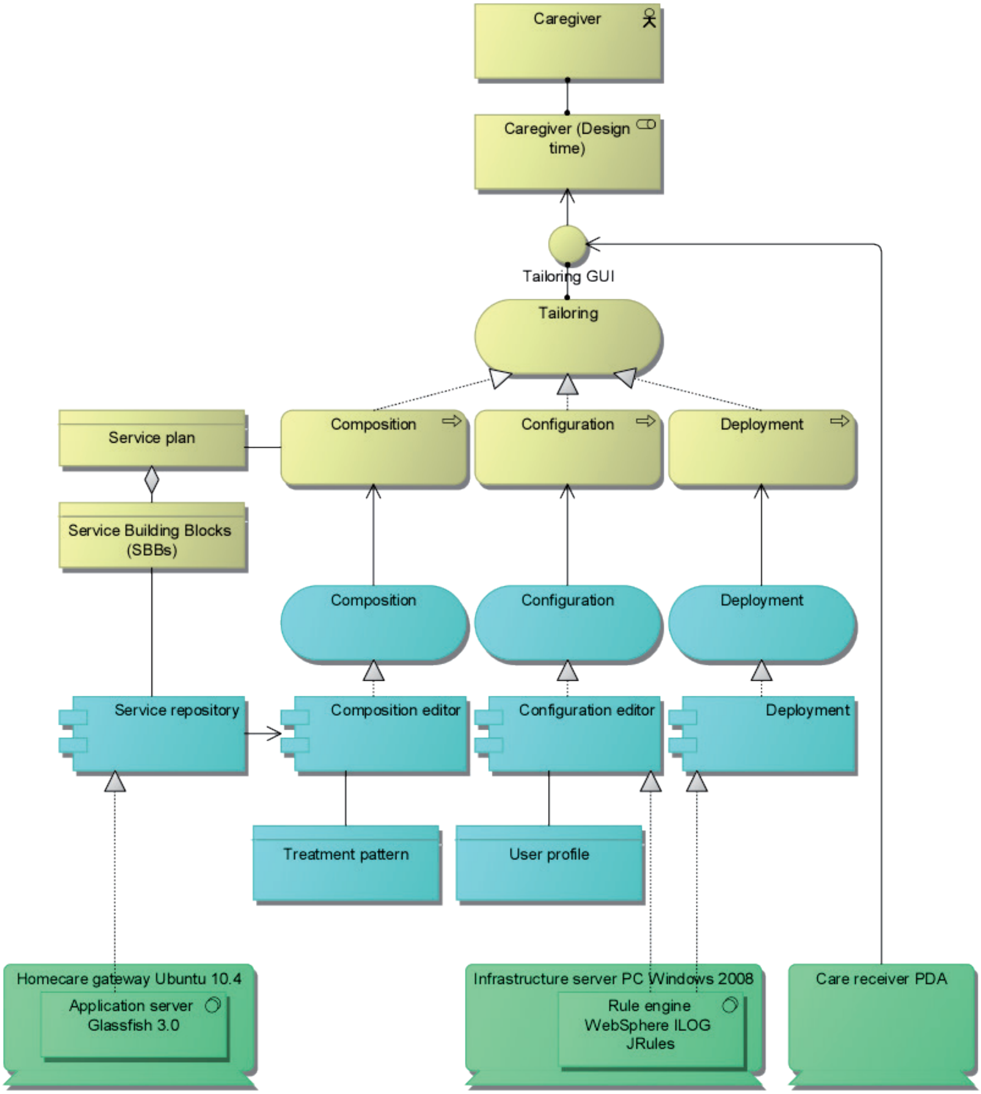

Figure 74: U*Care Tailoring Architecture

7.5 Chaining EA-based and BM-based cost/benefit-analysis

Similar to the ArchiSurance case in the previous chapter, we use can chain BM-based cost/revenue analysis in the above sections to architecture-based cost analysis, as described in section 6.4 and shown in Figure 75. To do this, first we take another view on the architecture in Figure 73 and Figure 74. Figure 77 shows a view on the same architecture, which better shows the division between manual labour by the care givers and work taken over from them by the U*Care platform. In parallel with Figure 54, we show the costs per year. The volume can be found in Table 47, as the frequency, time spend, and amount of elderly in need. The costs of manual care are approximately € 15 per hour.

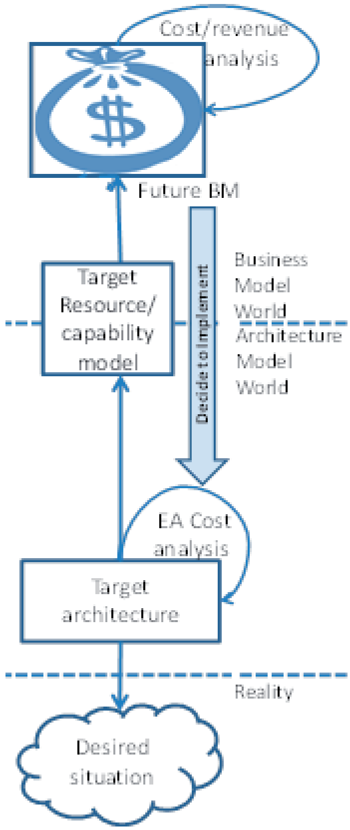

Figure 75: Chaining EA-based and BM-base cost/benefit-analysis

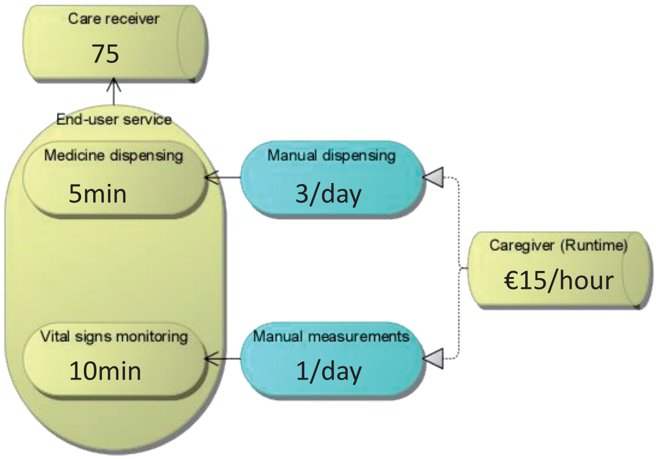

Figure 76: Medicine dispensing and vital signs monitoring in the baseline situation, including volume and cost

Figure 76 visualizes the care activities that the new technology substitutes for, including their volumes and costs. Figure 77 expands this view by adding the components of the new technology to the image. Besides the new components, the figure includes the annual costs and benefits (x € 1,000) for each of the components. The benefits are found in a decrease in manually dispensing medicines (€ 65,700 per year) and manually measuring vital signs (€ 67,500 per year). The costs are spread over the platform (a total of € 45,500 per year), hardware costs for leasing the dispensers (€ 56,250 per year) and sensors (€ 5,750 per year, including MobiHealth service), and new manual activities (€ 16,250 per year).

Several details are hard to show in the figure, while still keeping an overview. The main three are: 1. The costs for the IBM WebSphere licenses are for both the process engine and the rule engine. 2. The Glassfish application server is open source; therefore it has no license costs. 3. The cost for the sensors also includes the costs for the service provided by MobiHealth.

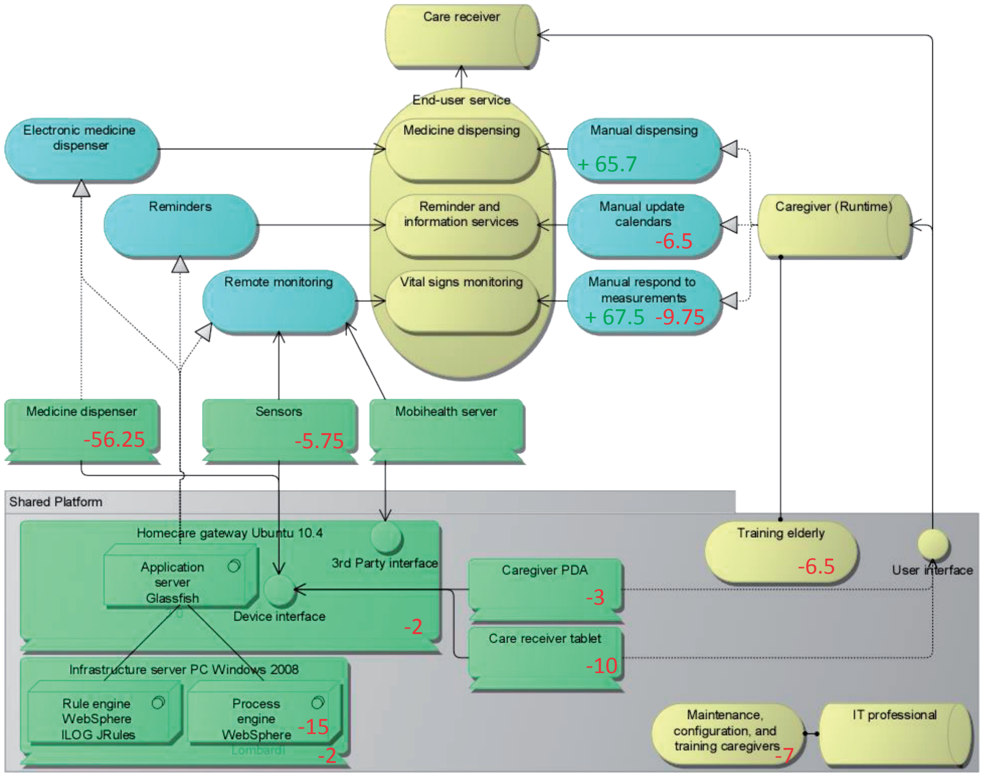

Figure 77: Architecture of the target situation, including costs and benefits (x € 1,000) per year

Now that the costs and benefits are made explicit in the architecture, the next step is the redesign of the target business model. Figure 78 shows this combination of the business model in Figure 72 and the quantified architecture in Figure 77. The left side of the figure is most noteworthy, as this shows the infrastructure, which is where the changes have been made. Subtracting the costs (in red, total -€ 123,750) from the benefits (in green, total € 133,200), leads to an improvement of € 9,450 per year. Based on this, the U*Care platform should be implemented. In future, more services may be offered over the platform, leading to an even better case for it.

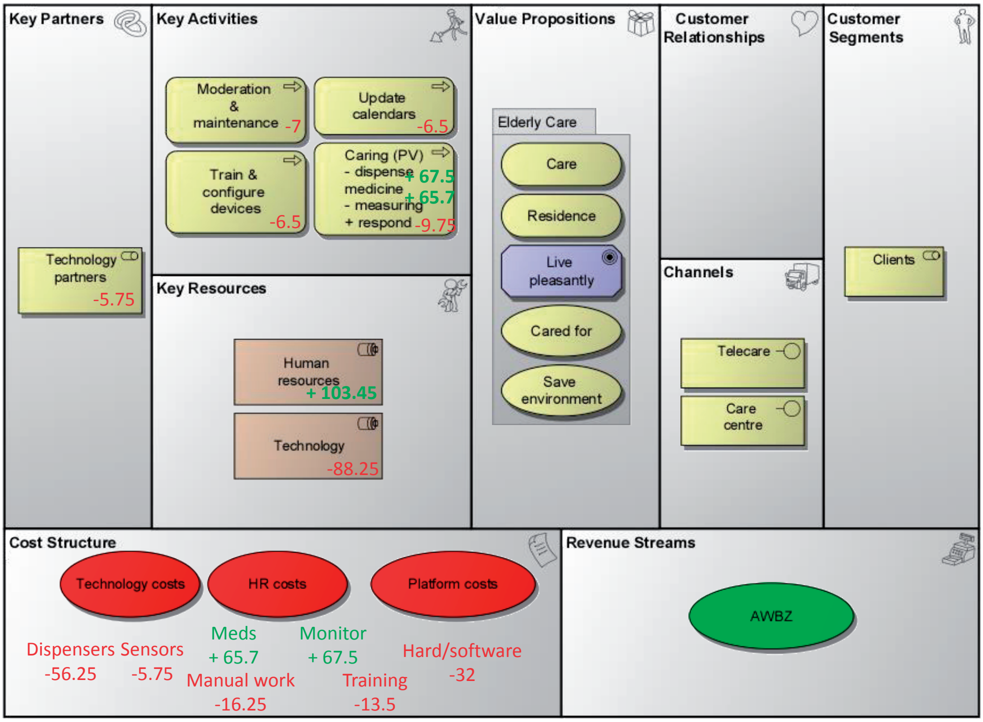

Figure 78: Business model of the target situation, including quantification of the costs

7.6 Summary

In this chapter, we applied the languages, methods, and frameworks from the previous chapters to the U*Care case. This shows how the methods work together to create business models and an enterprise architecture. In doing so, it demonstrates the previous work.

First, we introduced the U*Care case. It is a project conducted in elderly care in the Netherlands, which aims to develop a services layer for integrated homecare systems, which provides tailorable, evolvable and non-intrusive home care services. One of the project partners provided the test bed for this case, an elderly care centre, where the innovations could be tested in a pilot project.

Second, we used the business modelling method (BMM, chapter 4) to build a business model for the current situation at the elderly care centre. We built both a qualitative and quantitative business model for the elderly care centre.

Third, we looked towards the future and created alternative business models for U*Care and built business cases for each alternative using the business case method (chapter 5). For coming up with the alternatives, a sophisticated method for scenario generation was used. This lead to several alternatives, for each of which we could built a business model. These business models were assessed using the business case method.

This shows how the business modelling method and the business case method fit together.

The last artefact that we built is an enterprise architecture (chapter 6), based on one of the business model alternatives. While we assessed a combination of alternatives 3a and 3b without a platform as the best choice form a business perspective, we chose to build an enterprise architecture for the more complex alternative with a platform. This allowed for better explanation and demonstration of our method for business model-driven architecture change (BM2Arch). Using the method and the chosen business model, we were able to build an enterprise architecture for the future U*Care platform.

8

Discussion and Conclusion: What did we (not) do?

This last chapter revisits the research objective and questions, as formulated in the first chapter, to draw conclusions. We summarize and discuss the contributions, both practical and academic. Furthermore, we look back at the research and identify limitations and suggest possible directions for future research. At then end, we come with some final thoughts on what (else) we have learned.

8.1 Answer to the (research) question. Did we reach our objective?

This thesis provides a way to deal with issues from business-IT alignment, by developing a design science *methodology* for creating *business models*, evaluating them, and relating them to *enterprise architecture*. That was the research objective, and we have achieved it (taking into account the limitations), as the demonstration in chapter 7 shows.

The main research questions for this research were:

1. "How to create business models?"
2. "How to evaluate business models?"
3. "How to relate business models and enterprise architecture?

The short answer to all of them is "Use method X", where X stands for the methods developed in chapters 4, 5, and 6, respectively. The business modelling method (BMM), developed in chapter 4, creates business models. In doing this, it answers the first research question. The business case method for business models, developed in chapter 5, evaluates business models. In doing so, it answers the second research question. The mapping between the BMC and ArchiMate, and its methodological support, developed in chapter 6 and shown in Figure 50, shows how to relate business models to enterprise architecture. In doing so, it answers the third research question.

For a longer answer, we summarize the main points from the previous chapters.

8.1.1 How to create business models?

To create business models, follow the business modelling method (BMM) developed in chapter 4. It is a six-step method to create business models. The first four steps start with building a business model for the current situation. The final two steps repeat the first four to design and analyse business models for the alternative target situations.
The first step is to Identify Roles. Identifying the relevant parties (which we refer to as roles) involved in a business model should be done as systematically as possible. The aim is completeness in this case. The business modeller must carry out a stakeholder analysis, to identify all roles. The input to this step includes for example, documentation, domain literature, interviews, experience, and previous research. The output is a list of roles.

The second step is to Recognize Relations. The nature of these relations may vary substantially, but it always involves some interaction between two roles, and may assume some exchange of value of some kind. Much of the work and results from the previous step can be reused for this as input. The output of this step is a set of relations.

The third step is to Specify Activities. These activities originate from the relations identified in the previous step. Each of the relations consists of at least one interaction between two roles, requiring activities by both roles. Besides work and results from the previous steps, existing process descriptions can be valuable input. The output of the first three steps is a first qualitative business model, including roles, relations, and activities.

The fourth step is to Quantify the Model. Quantifying the business model helps us to see what is happening in more detail and compare innovations to the current situation. Numbers needed as input are cost and volume of activities (how often they occur). The resulting quantitative business model shows the as-is situation.

The fifth step is to Design Alternatives. We aim to capture a future state of the business in alternative business models. Next to the original business model, ideas for innovations serve as input. The resulting alternative business models show future (to-be) possibilities.

The sixth and final step is to Analyse Alternatives. Besides the qualitative business models, several sources of input are possible to quantify the alternatives. We can use the models to predict the impact. This step and the previous one can be repeated several times to achieve the best results. The final output is a business case for each alternative. This is the focus of the next chapter.

Innovators can apply the steps to create business cases for their ideas systematically. This helps them to show the viability and get things implemented. We provide a new design-science artefact to use and study for the academic world. As business modelling has several goals, conducting only the first few steps may be enough. For example, if your goal is to achieve insight in the current state only, the last two steps are not useful.

8.1.2 How to evaluate business models?

To evaluate business models, follow the business case method for business models (BM2BC) developed in chapter 5. It is an eight-step method to build business cases for evaluating business models. The design of the business case method is based on the two approaches identified by the literature review in chapter 2. Ward et al. (2007) and the Harvard Business Review Press (2010) both have a list of components. These lists partly overlap, yet each has distinct advantages and disadvantages. Based on the comparison of these two approaches, eight main components can be identified. Table 50 (=Table 28) lists the outputs created at each step and explains them. The input for each of the steps often is information coming from the business model, as Figure 33 shows. During step three till eight, alternative business models should be compared to the current business model to assess the changes and effects that it causes.

Table 50: Components of the business case method

1.	Business driver	The cause, problem, or opportunity that needs to be addressed
2.	Business objectives	The goal of the business case stating which objectives are aimed for
3.	Alternatives	Representing the options to reach the objectives
4.	Effects	Positive and negative effects that come with the pursued alternative
5.	Risks	Risks that come with the pursued alternative
6.	Costs	Costs that come with the pursued alternative
7.	Alternative selection	Based on gathered data the best alternative is chosen
8.	Implementation plan	Plan which explains when and how the alternative is implemented

8.1.3 How to relate business models and enterprise architecture?

To relate business models and enterprise architecture, use the mapping between the BMC and ArchiMate, and its methodological support (BM2Arch), developed in chapter 6. It is a method for business model-driven architecture change. Next to mapping Business Model Canvas building blocks to ArchiMate, we provide methodological support, clarifying the role of business models in TOGAF's Architecture Development Method (ADM). While Figure 50 suggests a certain path through the different models, similar to the ADM, we do not strictly prescribe a particular sequence. However, similar to the BMM, BM2Arch starts with the current (baseline) situation and moves forward, via a motivation model, to the target situation from there.

In our method, models evolve on two orthogonal dimensions: a horizontal dimension (change from baseline to target), which concerns the change occurring within a modelling domain, and a vertical dimension (going from the EA domain to the BM domain and back), which consists of a two-step abstraction transformation, and expresses the process of creating a BM for a given EA. The relationship between the models occurring in the vertical dimension (and also between their underlying modelling formalisms) is depicted in Figure 50, right. Once the baseline and target BMs have been created, analysed, and compared with each other, a decision can be made with respect to the actual implementation of the target EA (in case the costs/benefits balance is favourable).

8.2 Our research contributes to:

In several ways, our research contributes to the fields of enterprise architecture and business modelling. Of course, our main contribution is in reaching our objective, providing a way to deal with issues from business-IT alignment, by developing a design science methodology for creating business models, evaluating them, and relating them to enterprise architecture. However, to reach this objective, we had to overcome many smaller hurdles, which each hold their own contribution.

Chapter 2 provides a systematic review of the literature in both of the areas of business modelling and business cases. Besides showing what has been done, it also reveals some gaps that need to be filled. These literature reviews can be reused in academia and practice alike to get an overview of the fields.

The meta-meta-business model (Me2BM), in chapter 3, contributes to positioning business modelling. We improve the theoretical foundations of the discipline by introducing design theory and meta-modelling to the field. These two concepts are used to structure existing review literature and create the Me2BM: a conceptual framework to support business model theory development. The Me2BM is validated by checking it against existing meta-BMs. The Me2BM attends the need for a common language amongst practitioners and strengthens the internal consistency of the business model discipline. This allows for researchers to build more on each others' work, but also to compare meta-BMs, analyse shared and distinctive features and create links to other fields of research. The Me2BM is a conceptual framework that supports further theory development and improves the shared vocabulary used in business modelling.

The business modelling method (BMM), developed in chapter 4, was a missing part for both practitioners and researchers in the area of business modelling. To exemplify this, when work on this PhD research project started, we assumed it would mainly consist of going from business models to enterprise architecture. However, when we wanted to make the link, we had no way to consistently create and evaluate business models. Therefore, any method going from business models to enterprise architecture was hard to test: It was all "garbage in, garbage out". The BMM, especially when coupled to the business case method for business models, allows to create and evaluate business models systematically, thus avoiding "garbage" as input.

The business case method for business models (BM2BC), developed in chapter 5, contributes to evaluating business models. While the literature reviews for chapter 2 point out that some research has been conducted in this area, the review in chapter

3 shows that it is seen as important. By developing the BM2BC, we ensure that the business models we build can be evaluated systematically.

The main point in reaching our objective, and therefore our main contribution, lies in relating business models and enterprise architecture. The method for business model-driven architecture change (BM2Arch), developed in chapter 6, does exactly this. By coupling the BM to the enterprise architecture, a better architecture is made. Business models change. The architecture is often hard to change, making changes at this level expensive. Using the connection established in chapter 6, allows for assessing the costs bottom-up. This shows where the architecture can be changed easier. On the other hand, by using this method to design the architecture with the future (BMs) in mind, the architecture can allow for more degrees of freedom when changing the BM.

The final contribution of this thesis lies in the last stages of the design science research methodology (DSRM): demonstration, evaluation, and communication. The individual case studies in each of the design science chapters (4 through 6), as well as the elaborate case study in chapter 7, demonstrate the use of the methodology. In writing and visualizing them in this thesis, we hope to communicate them clearly.

8.3 Limitations and future research: What we did not do…

As most research, this research is biased. The background of the researcher on the cutting edge of (or gap between) business and IT calls for a way to bring the two closer to each other. As this is hard in real life, the focus has been on the abstract models for both business and IT. While in our view, models are the best way to connect the two worlds, it also adds two extra steps. Because, while models attempt to reduce complexity, the steps of first making models and then translating them back to practice may be too complex, and introduce errors or unwanted estimations.

The literature reviews on business modelling and business cases in chapter 2 were conducted systematically, with a proven research method. However, while this seems to work out perfectly in the business modelling area, the business case area showed very meagre results. In academic literature, only three articles with relevant content were found. Although we have some explanations for this, it shows the difficulty, and perhaps unsuitability, of such systematic literature review in some areas. On the other hand, we use other ways of acquiring knowledge in various areas which we build upon. However, this leads to the risk that things may have been missed in those areas, as it is not systematic.

Related to the above, business modelling is very much a practitioner area. Therefore, much work on business modelling is not published in journals and conferences, let alone academic ones. On the internet, much is written on business modelling on blogs and (consultancy) websites. Off the internet, things are written in (management) books. However, these books, blogs, websites, and other work mostly regarded as unpublished by the academic world (Vermolen, 2010), were not included. Due to this, interesting developments may have been missed, such as the Enterpise Canvas (Graves, 2011).

Usually, business modelling is done for a single organization. However, the definition of business model also provides the perspective of business in a networked sense. As opposed to the BMC (Osterwalder and Pigneur, 2010), which focusses on a single organization, e3-value (Gordijn, 2002) attempts to make explicit the network in which organizations operate. Taking this perspective of business modelling and relating it to enterprise architecture was not part of this research, but gives an interesting opportunity for future research.

In accordance with the above, the U*Care case study mainly focusses on a single care organisation. This makes it hard to have significant benefits, especially as the time saved by care providers would probably be put into other work, and not lead to any financial savings in the end (but may positively influence quality of care and life: aspects which were touched by others in the U*Care project). Viewing the healthcare domain in a larger perspective, may allow for a better business case. For example, if e-health would allow elderly to live at their own homes longer, instead of in a nursing home, this would not cut time spend by care providers by minutes per day, but by whole days at a time. The financial impacts would be far bigger. Sadly, this is outside the scope of this research.

Evaluation of the individual methods (BMM, BM2BC, BM2Arch), as well as of the whole methodology, is built on case studies. The case study approach is a flexible method of research, and because the design emphasizes exploration, we are comparatively freer to discover and address issues as they arise. However, it is inherently subjective. Validity and reliability are always issues with case studies (Becker et al., 1994). We have taken measures to avoid some of these issues, for example, by using multiple different cases, collecting both quantitative and qualitative data, using various sources, and involving multiple researchers. Most of these measures come down to some form of triangulation (Wijnhoven et al., 2010). As an extra form of validation, most of the work in this thesis was published in peer-reviewed academic outlets previously. However, in the end our conclusions are contextualized, and may not be generalizable.

Several steps in the methodology to create the Me2BM are interpretive. While we have made our best effort to limit subjectivity, some remains due to the nature of this type of research nevertheless. Therefore, the presented Me2BM is not definitive but may be modified. In addition, if the Me2BM is used to select the most suitable meta-business model, it should be tailored to the specific situation. We have not researched the tailoring in any detail.

Stelzer (2010) focusses on enterprise architecture design principles. He mentions that it is difficult to distinguish between IT, business, and enterprise architecture. We offer no solution to distinguishing them, however, using the relation between business modelling and enterprise architecture may ensure that the enterprise architecture fulfils the business principles as well.

We foresee several possibilities to extend this research. One interesting aspect to be investigated is the extent to which automated transformations are possible for a model-driven generation of business models and enterprise architectures. In an early publication (Meertens et al., 2010), we made a first attempt to do this.

In light of design theory, addressing a meta-business model as design artefact, several things are apparent. Several authors mention implementation/design and testable hypotheses in review literature. However, both are underdeveloped in business model literature. In addition, artefact mutability gets very limited attention in business model literature and is not mentioned explicit at all in review literature. This can mean one of two things: either these areas need further research, or they have no role in business modelling. The Me2BM was validated against existing meta-business models. The result may be interpreted in such a way that these elements have no role in the business model domain. However, from a top-down perspective, these three elements (artefact mutability, testable hypotheses, and implementation/design) are underdeveloped and require more attention from researchers. Especially, since the business model domain is a young and emerging discipline, gaps in the literature are expected to be present. Thus, future research should aim to improve artefact mutability, testable hypotheses, and principles of implementation and design.

Additional types of financial analysis are conceivable at the BMC level. For example, break-even analysis. On the other hand, at the architectural level, several other quantitative and qualitative modelling techniques exist. For example, performance analysis, portfolio management, and valuation techniques (Buckl et al., 2009a; Iacob and Jonkers, 2007). Similar to the composition of cost analysis techniques, other combinations may be realized. For the U*Care case study, we used a simple analysis as demonstration.

Although we have addressed the (mapping of) relationships between the concepts of the enterprise architecture and business modelling, the focus was rather on relating the ArchiMate and business model canvas (BMC) concepts, not their relationships. This is because in the BMC relationships are not explicitly modelled and do not play a role in current practice. A more extensive investigation and discussion of possible benefits of relationship mapping between the two languages may be carried out still, for instance for analysis techniques or for BM generation.

We use an extension of ArchiMate with value related concepts (Iacob et al., 2012b) to bridge the semantic gap between ArchiMate and the BMO. This extension and its underlying meta-model have been motivated in Iacob et al. (2012b) in relation with portfolio management approaches. Furthermore, this new language fragment has been aligned with the ArchiMate 2.0 meta-model. Part of on-going research is an ontological analysis of the new concepts, which further ensures their semantic interoperability with ArchiMate concepts, and strengthens their validation.

Finally, as it can be seen, many of the models presented have been realized using an existing modelling tool, that supports both the BMC and the ArchiMate 2.0 meta-model extended with the newly-proposed value-related concepts, thus providing an integrated modelling environment. However, integrating and chaining the used analysis techniques (and possibly other techniques) in this modelling tool is work in progress still.

8.4 Final thoughts: What (else) did we learn?

While we managed to relate business models to enterprise architecture, the manual effort that this process needs is not a triviality. Business modelling and enterprise architecture are human intensive endeavours on their own. This seems to be intrinsic, as the process of building the models may be just as important as having the final models. The hope is that in connecting the two, time and effort can be saved, and errors can be reduced (the models are "in synch").

The proposed method costs time and effort, which has to be compensated, either by being less than other methods used for business modelling and enterprise architecture on their own, or by enterprise architecture being so much easier with a starting point.

9

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10 Appendixes

10.1 Stakeholder analysis full tables (Chapter 7)

	Power	Urgency	Legitimacy	Type
Care providers	1	1	1	Definitive
Care consumers		1	1	Dependent
Technology providers	1		1	Dominant
Government	1	1	1	Definitive
Insurers	1			Dormant
Negative stakeholders/hackers	1			Dormant
Political beneficiaries				Non-stakeholder
Competitors				Non-stakeholder

	Power	Urgency	Legitimacy	Type
End Users				
- Clients				
Patient		1	1	Dependent
Family		1		Demanding
Representative			1	Discretionary
Volunteer aid			1	Discretionary
- Employees				
Administrative	1			Dormant
Care			1	Discretionary
- Clinical		1	1	Dependent
- Wellness		1	1	Dependent
Insurance companies	1			Dormant
Care (& wellness) providers	1		1	Dominant
- Homecare				Non-stakeholder
- General practitioners				Non-stakeholder
- Specialists				Non-stakeholder
- Hospitals				Non-stakeholder
- Homes for the elderly				Non-stakeholder
Technology providers	1			Dormant
Building sector				Non-stakeholder
Society				Non-stakeholder
Branch organizations				Non-stakeholder

	Power	Urgency	Legitimacy	Type
Government	1	1	1	Definitive
- European/international				Non-stakeholder
- Federal				Non-stakeholder
- Local				Non-stakeholder
GGD				Non-stakeholder
GGZ				Non-stakeholder
Inspection				Non-stakeholder
User organizations				Non-stakeholder
Competitors				Non-stakeholder
CIZ: "indicatiestelling"				Non-stakeholder

Care providers	Care consumers	Technology providers	Insurers	Government	Other	Surrogates (for)
End users	End users					
	Clients					
	Patients					
						Family (end users, patients, volunteer aid)
						Representatives (end users, patients)
Volunteer aid	Volunteer aid					
Employees		Employees	Employees			
Administrative employees		Administrative employees	Administrative employees			
Care employees						
Nurses						
Clinical employees						
Doctors						
Wellness employees						
			Insurance companies			
	Care consumer					
Care providers						
Homecare						
General practitioners						
Physicians						
Specialists						
Hospitals						
Homes for the elderly						

Care providers	Care consumers	Technology providers	Insurers	Government	Other	Surrogates (for)
		Technology providers				
		Building sector				
					Society	(patients)
						Branch organizations (care providers, employees, tech providers, insurers)
				Government		(all)
				European government		
				Federal government		
				State government		
				Local government		(community)
Community health departments						
Psychiatric healthcare						
				Inspection		
						User organizations (patients, employees)
					Competitors	
				Indicatiestelling		
		Additional service providers				
	Payers		Payers			
Managers		Managers	Managers			(organizations)
					Investors	(insurer?)
				Lawyers and courts		

Care providers	Care consumers	Technology providers	Insurers	Government	Other	Surrogates (for)
						Professional associations (=branch organizations)
						Community (patient, society, employees)
						Managed care plans (employers, insurers, patients)
Health care professionals						
					Employers	(investors, employers)
		Suppliers			Suppliers	
						Unions (healthcare professionals, employees, end users, employers)
Pharmacies						
Nursing homes						
Private clinics						
	Insured patients					
	Private pay patients					
						Media (all)
			Zorgkantoren			
		Infrastructure providers				
		Hardware providers				
		Technology maintainers				
It departments		IT departments	IT departments			
					Training providers	(tech providers)

Care providers	Care consumers	Technology providers	Insurers	Government	Other	Surrogates (for)
		Technology installers				
		Bio-sensor providers				
					Academic organizations	(tech providers)
						Political parties (all)
						Lobbyists (all)
					Hackers	(negative stakeholders)
Safety and security providers		Safety and security providers			Safety and security providers	Safety and security providers
					Political beneficiaries	
					Negative stakeholders	

10.3 Scenarios as design alternatives (Chapter 7)

10.3.1 Sister Johanna

"Johanna, have you taken your medicine?" – a soft voice calls from the audio system, while, at the same time the question appears in big letters on her computer screen.

"Yes, Julie, I have," she answers, and the voice says: "Okay, thank you".

In fact she had taken her medicine, a number of pills for a variety of different physical problems, but forgotten to acknowledge that. A telephone call interrupted her normal routine was, this morning at 8:04. Christina, a colleague from the Catholic Youth Council, called her because there were some last-minute changes in a leaflet that Johanna would send to the printer today. Immediately after the call, she wheeled to her desk, opened the MS-Word document, and made the changes that Christina requested. The document covered the message on the screen and then she forgot the requested acknowledgement. So at 8:15 Julie reminds her again, increasing the intrusiveness level one step.

Sister Johanna is a nun, member of a congregation that has only few members left in this part of Europe. She is 64 years old. She has been in a wheelchair for seven years now. Most medical problems are due to the condition of her bones, they are too weak. In addition, she has some problems that she perceives as "minor". She cannot lift her right arm beyond a certain point. If she sits in the same position for a long time, she gets spastic movements in her legs. Furthermore, she has skin allergy and she suffers from spells of dizziness. She can manage chronic pain with painkillers and an adjustable bed.

She was trained as a nurse, but with her physical condition, that was not the right profession. At the age of 34, she gave it up and started to do youth work. Among other things, the Catholic Youth Council organizes youth camps and weekends in the countryside. Sister Johanna still helps running these. If texts need to be written, they ask Johanna to do that.

After breakfast, Johanna reviews the leaflet that Christina called about once more. It is an announcement for a weekend activity for children, to be distributed to the local schools. She finds it correct and e-mails it to the print shop.

Next, she asks Julie for "things to do today". She has become dependent on this service. Her short-term memory is failing more and more. It runs in the family. Her mother had no memory left at the age of 60. Writing things on scraps of paper worked at a certain level, but was not good enough. Often, she would not find back the right paper at the right moment. With the reminder system, it is all in one place – or, more accurately, in one system that can be accessed from different places.

Julie displays the "things to do today" page. It shows the following items:

- Finish children's weekend leaflet
- Discuss Normandy trip with Maria
- Harry's birthday
- 14:00 – Music at community center
- 19:30 – Meeting Catholic Youth Council

Johanna ticks off the first one and asks Julie for a video connection to Maria. However, it does not open. Apparently, Maria is not online. Therefore, she calls Maria on the telephone and asks her to connect to her. A few minutes later, Julie announces a video call from Maria. They spend half an hour discussing the program for the next Normandy trip. The Catholic Youth Council owns a house in Normandy, and many activities take place there. Maria and Johanna wanted to discuss some ideas for a next trip. They will present it at the Council meeting tonight.

At 12:30, it is dinnertime. The sisters get dinner delivered by the Hogerheide restaurant.

Johanna shares a house with six sisters of her congregation. Each has a room for herself and they share a couple of common rooms. Johanna is the youngest. The other sisters are between 73 and 94. The congregation ran a home for the elderly themselves, but some years ago it was closed down and the remaining sisters went to live in Hogerheide.

The elderly sisters are somewhat lethargic now. When there are interesting activities, Johanna gently pushes them to participate. This afternoon in the community centre, there will be a singer with a small band, performing mostly Eddy Christiani songs from the 40's and 50's. Old people generally love that. This time Johanna has no difficulties getting the sisters interested.

After lunch, most of the sisters go to the music performance. However, Johanna does not go. With the meeting this evening, it will be a long day today. She cannot sit in a wheelchair for twelve hours or more, so she takes some rest and lays down. She switches Julie from the computer to her television screen that she can watch from her bed. For some time she watches the singing performance (available through Julie, real-time or later on demand), but then she dozes off. She isn't really interested; Eddy Christiani is really something for people over 75, she is only 64.

After the shared evening bread with the other sisters, Johanna goes out to the meeting. She drives a special car, for which you do not need to use your feet, you do everything with your hands. Getting into the car is difficult; she first has to drive the wheelchair in through the back of the car, and then get into the driver seat. This is hard, but her mobility if very important to her. She can go to meetings and even drives all the way to Normandy to the youth camps. Every two weeks she drives to Maastricht to visit a friend with whom she plays scrabble. They tried it online once, but it is not the same thing as sitting together at a table.

Only once has Johanna used Julie for telepresence at a Council meeting. This was not long after the equipment had been installed, and she was feeling a bit ill. She hated it. Julie is fine for a conversation with another person, as she had this morning with Maria, but a poor substitute for being at a meeting yourself. Therefore, she drives to these meetings and enjoys here mobility.

At 10:40 PM Johanna gets home. When she turns on the light, Julie switches the television screen on. It shows a single line of text:

- Harry's birthday

Oops, this had slipped her mind. On his birthday, he will be up late, so she will give him a quick call.

10.3.2 Mr. Pieters

Frans Pieters is 78 years old. Most of his life he worked for a large international petroleum company as a welder. Probably due to inhaling the toxic fumes resulting from welding, Mr. Pieters developed chronic obstructive pulmonary disease (COPD). Smoking tobacco, which is the greatest risk factor for the disease, is not the cause, as he insists to never having smoked a single cigarette in his life. By and by, his friends moved out of sight. It is 10 years ago since Mr. Pieters had been on a holiday.

Mr. Pieters has two children, living in different parts of the country, five grandchildren, and two great-grandchildren. One son and daughter-in-law come to visit him every month, the other children only at special occasions.

Mr. Pieters would prefer to do most of the household by himself; however, the COPD leads to exhaustion very fast. Therefore, a housekeeper takes care of most things twice a week.

Out of habit, he tries to maintain a strict daily schedule. Nevertheless, sometimes he does not sleep well and gets up late. In addition, his memory is getting worse. Three times a day a nurse comes along to give him his medicine. It is stored in a locker in his room, but he does not have a key himself. Besides medicines, the doctor told him to do a series of exercises each day. In addition to those, he should try to maintain his stamina by going out; walking in the park.

After breakfast, he reads the newspaper carefully. Then takes some rest, and goes down to the restaurant for the meal. It is convenient to eat here as he does not have to do the dishes, but he does not socialize much. If he feels like it, he reads a book or makes a puzzle after lunch. After the evening meal, he usually watches television. The children have provided him with television and DVD-player. They also gave him a mobile phone, urging him to take it with him when he goes out. However, Mr. Pieters does not like to take it. The only thing he does with the mobile phone is charging it when the batteries are empty. His children have offered him a PC. A grandson would come and explain him everything. However, he has declined it; having no need for it.

When asked whether he desires other contacts, Mr. Pieters says he is not keen to become intimate with the Hogerheide population. He dislikes people who complain about their health, and the truth is that most of the Hogerheide inhabitants talk a lot about their major and minor complaints. Yes, perhaps it would be nice to have a mate for going out, but then it should be the right person: someone with whom you can have a proper conversation. Not one of those old sods. He says he counts his blessings and is quite happy. Yet the Hogerheide staff members feel somewhat sorry for him – as for so many others who spend most of their lives locked in their rooms.

No cure exists for COPD. Therefore, the treatment of Mr. Pieters' disease focuses on reducing symptoms and avoiding further deterioration of his condition. Some of his medicines work for the symptoms, but physical exercise is the key treatment. The original series of exercises was explained once at the doctor's office. Since then, Mr. Pieters does them at his home in Hogerheide. During the exercises, he uses a wristband, which measures the oxygen level in his blood and his hart beat. Through the wall mounted screen, Julie provides feedback on how long he should do each exercise, based on those measurements. Thanks to this feedback, Mr. Pieters dares to continue the exercise for longer than he would otherwise. This little bit extra is exactly what improves his condition.

If the measurements exceed limits set by the doctor, Julie notifies the nurse who is on duty. The nurse can then use the two-way video options to check on Mr. Pieters, without having to walk to his room first. If something appears to be seriously wrong, the nurse can notify an emergency response team and go to the room. Fortunately, this functionality was needed only once. This occurred when Mr. Pieters attempted to ignore the screen, and continued his exercises for a little too long. When the nurse appeared on the screen, she told him to stop the exercise and use his inhaler to avoid acute exacerbation. All worked out well.

As a routine, at the start of the daily exercise, Julie asks Mr. Pieters to measure some blood pressure an haemoglobin level. This is used to monitor is progress over time. The positive feedback that Julie provides encourages Mr. Pieters to keep up the exercises. He notes that his condition no longer deteriorates. He hopes that Julie will soon be available in the park as well. It would reassure him when taking a walk there. One thing Julie already helps him with when he wants to take a walk is an update on the outside temperature. As people with COPD have extra difficulty breathing when it is cold, the screen gives the advice to dress warm in those cases.

The doctor uses the two-way video to check-up on Mr. Pieters once a month. Coached by the doctor, he has to blow into a tube, Julie sends the results to the doctor. On those occasions, the doctor may adjust the exercise levels and medicines, based on to the acquired measures and progress of the disease. The doctor also adds the next check-up to Mr. Pieters' calendar. If needed, an appointment with the physiotherapist is made. When there is a change in the exercise level, the physiotherapist can guide Mr Pieters through the new exercises. When Mr. Pieters understands what to do, and the physiotherapist seed that Mr. Pieters does it right, supervision of the exercises can be taken over by Julie.

Because this memory is getting worse, Julie sometimes needs to remind Mr. Pieters that he should do his exercises. If this happens, it is usually on days when he gets up late, and his schedule is disturbed. Julie also shows when the monthly checkups by the doctor approach. Just in case he would forget the appointment otherwise.

10.3.3 Mrs. Stam

"Beep, Beep, Beep."

The persistent noise of Julie, the wall-mounted screen of the care service, calls for the attention of Mrs. Astrid Stam. She was watching a slideshow of pictures taken at the celebration of her 55th birthday yesterday. The pictures show up on her TV-screen on demand. Sometimes she stops the slideshow to compare the people on the picture with pictures of her birthday two years ago. Two years ago, she was very exhausted. She had to have her daughter cancel some of the visitors. From that moment on, she started working on her stamina. The home trainer serves as a platform for exercise, three days a week. On the other days, she takes a walk in the nearby park. Sometimes with friends, but also on her own if she feels like it. The exercise on the home trainer provides good results. While on the home trainer, Julie automatically monitors her heartbeat and body-mass index. Feedback from Julie, based on the heartbeat, encourages Mrs. Stam to push further, but stops her from going too far. The bmi-graph shows improvement over time, helping her to continue.

"Beep, Beep."

Julie speeds-up the sound. This indicates Mrs. Stam should react immediately. She swiftly goes to see what Julie has to say. As Julie detects that Mrs. Stam approaches the screen, the beeping stops and the cause for the distress appears on the screen. The messages alarms Mrs. Stam; her next-door neighbour, Mrs. Meier, made an unexpected movement, and has not moved since, nor has she reacted to the signals from Julie's counterpart (i.e. Mrs. Meiers version of Julie).

Mrs. Meier is not only a neighbour but also a good friend of Mrs. Stam. In addition to this, Mrs. Stam serves as a voluntary caregiver for her. They were not aware of each other's presence in the building until they met online. The matchmaking site Carey, run by the local home-healthcare organization, brought them together almost a year ago. Carey aims to bring people in the neighbourhood together. While it focuses on the elderly in the nursing home and the accompanying protected housing, the whole neighbourhood may use it. Carey can make use of the two-way video screen when trust has been established.

Mrs. Meier found Mrs. Stam when she was looking for voluntary aid. Her son had taken care of her until then, but immigrated to South Africa. They now have regular contact through the two-way video. Mrs. Stam had placed her name on the list with possible volunteer caregivers in the neighbourhood. She once again had time on her hands, now that her last child moved out to live on his own. Carey's match was successful. They have grown to be good friends over the past year.

And now Mrs. Stam finds her friend in trouble.

As she hurries toward her friends flat, her front door automatically opens, and closes behind Mrs. Stam. She lives just across the hallway of their apartment building. When Mrs. Meiers Julie detects that Mrs. Stam approaches, the front door to the flat opens. She acquired the permission to enter the flat previously. While all appropriate caregivers have this access in case of an emergency, she also received it because she frequently has to enter the flat to water the plants.

The site she finds in the living room shocks Mrs. Stam. Mrs. Meier is lying on the ground; not moving. She is very pale too. "Alarm Nurse!" is the first thing Mrs. Stam calls out. This command immediately contacts the nurse at the nursing home in the vicinity of their apartment building. While she waits for the nurse to appear on the two-way video screen, Mrs. Stam checks her friend's wrist for a pulse. Phew, her heart is beating still.

"Can you apply the FAST-approach?" asks the nurse, as she quickly assesses the situation over the two-way video.

"No. She is unconscious." responds Mrs. Stam. On hearing that, the nurse immediately contacts the emergency service. They are able to get to Mrs. Meier faster than she can. This at least conforms to the last aspect of the FAST-approach (Face, Arms, Speech, Time), used in case of possible stroke (CVA).

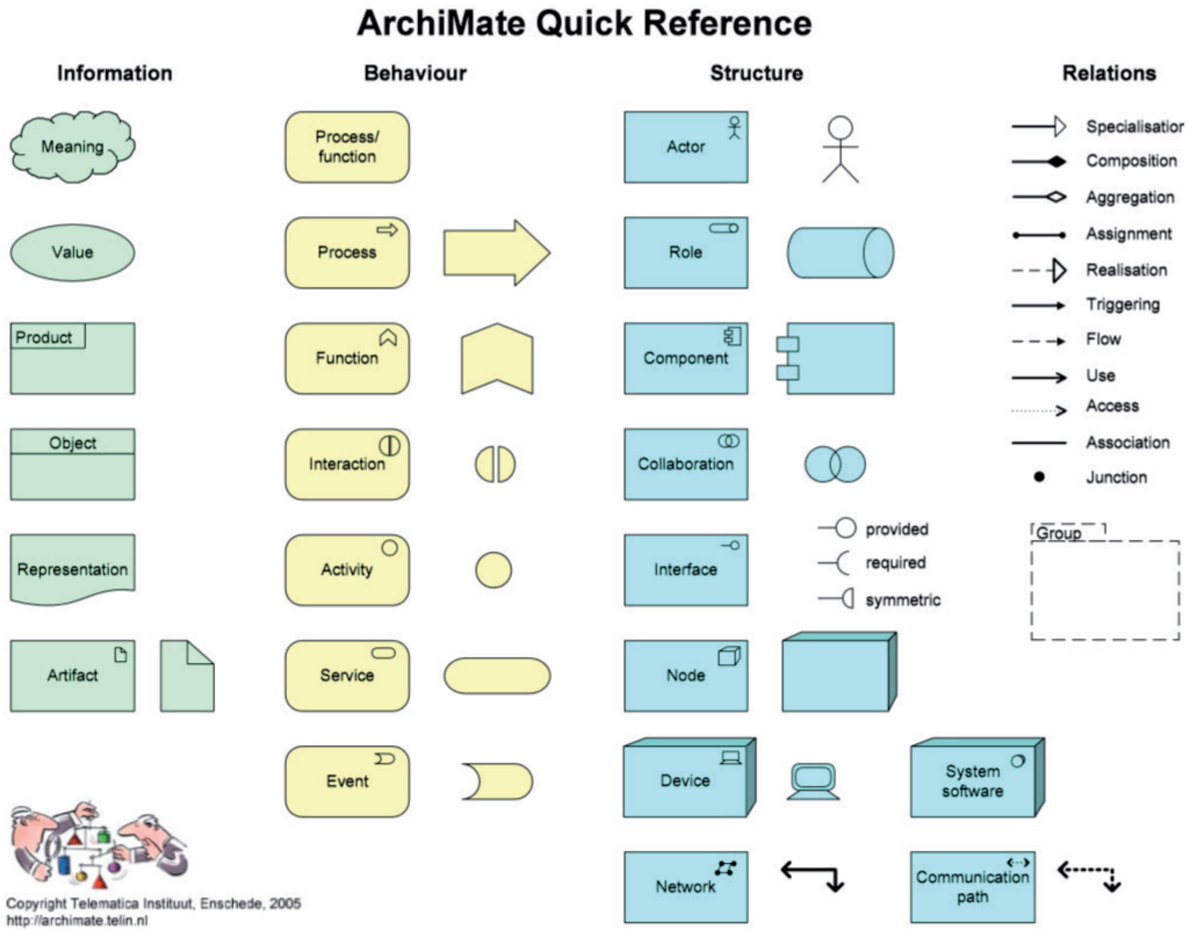
While Mrs. Stam attends to her friend, Julie reacts to the signal that the emergency response team is on their way here. She brings the elevator down to the ground floor, and sends Mrs. Meier's medical history to the incoming team members to see. In addition to this, they take over the two-way video from the nurse. "Hi, my name is Stephan. Is she usually so pale?" one of the team members asks Mrs. Stam. "No," she replies, "usually she has more colour in her face." A couple of questions follow. With this information, they can make a preliminary diagnosis.

As they arrive, Julie also opens the doors that they have to pass. The team members quickly confirm their preliminary diagnosis when they get to the scene. "We'll rush her to the hospital." they tell Mrs. Stam. When they have left with Mrs. Meier on their gurney a moment later, Mrs. Stam looks around the room. "You can leave now. I will close down." Julie states, "Thank you for helping." The lights go out and the door closes behind her, as she leaves the flat.

While she enters her own flat, Julie signals that she has an incoming video conversation. It is the nurse from the nursing home. “They are taking her to the stroke unit in the hospital.” she announces, “Can I do anything for you? Arrange transport there for example?” “No, thank you,” Mrs. Stam answers, “I’ll be just fine.” “Goodbye then.” “Goodbye.”

After this dialogue, she asks Julie to contact her daughter for a two-way video conversation. Right now, she really needs somebody close to talk to.

10.4 ArchiMate Legend (Chapter 6)



Nederlandse samenvatting

Dit proefschrift legt een verband tussen "Business Modelling" en "Enterprise Architecture". Specifiek stellen wij een methodologie voor om business modellen te creëren, te evalueren en te verbinden met enterprise architectuur. De methode bestaat uit meerdere stappen, die erop gericht zijn een organisatie vanuit haar huidige situatie naar een gewenste situatie te leiden, via business modellen en enterprise architectuur.

Problemen met "Business-IT Alignment"

Business-IT Alignment gaat over de afstemming van de bedrijfskant van een organisatie met de IT-kant van diezelfde organisatie. Organisaties zijn steeds meer afhankelijk van hun IT-systemen. Helaas zijn veel IT-implementatietrajecten niet succesvol. Het blijkt lastig om de doelen van de bedrijfskant goed af te stemmen met de IT-kant. Zowel onderzoekers als de mensen in de praktijk ondervinden de noodzaak van een betere afstemming om de resultaten van organisaties te verbeteren. Typische symptomen van slechte afstemming zijn:

- Mensen kunnen slecht met de systemen overweg.
- Voor verandering in de systemen wordt meestal niet naar de invloed op de financiën gekeken.
- Systemen zijn lastig aan te passen aan nieuwe situaties.

Daarnaast zijn er grote uitdagingen voor technologische innovaties. Meestal worden de moeilijkheden niet veroorzaakt door technische problemen. Een gebrek aan aandacht voor de financiële en organisatorische vraagstukken zorgt ervoor dat veel innovatieprojecten nooit verder komen dan de pilotfase. De financiële kwesties van innovatie blijven onderbelicht. Projecten blijken vaak duurder te zijn dan gepland doordat de eisen aan het begin van het project niet goed bekend zijn en vervolgens gedurende de looptijd van het project veranderen.

Derhalve is er een probleem bij het bouwen en aanpassen van IT-systemen voor veranderende eisen van de bedrijfskant van een organisatie. Dit proefschrift probeert twee gedeeltelijke oplossingen te combineren en streeft ernaar het probleem op deze manier op te lossen.

Enterprise Architecture als gedeeltelijke oplossing

Enterprise architectuur bestaat uit een verzameling van versimpelde representaties (modellen) van een organisatie. De modellen belichten verschillende aspecten en zijn geschikt voor de verschillende belanghebbenden. De samenhangende beschrijving van een organisatie in een enterprise architectuur zorgt voor beter inzicht, helpt met duidelijke communicatie tussen belanghebbenden en leidt het ingewikkelde veranderproces. Een taal die die zulke beschrijvingen op een precieze en formele manier mogelijk maakt is ArchiMate. Hoewel Enterprise Architectuur helpt bij verandermanagement, bevat het te weinig bedrijfsstrategie en het gebruik van ArchiMate is alleen voor experts weggelegd.

Business Modelling als gedeeltelijke oplossing

Business modellen worden gebruikt om bedrijven te beschrijven en toekomstige ontwikkelingen te verkennen. Ze zijn intuïtief in het gebruik voor zowel managers, consultants als ondernemers. Business Modelling is een relatief nieuw vakgebied en staat nog in de kinderschoenen: Verscheidende tegenstrijdige denkwijzen bestaan en de voortgang wordt belemmerd doordat nauwelijks op bestaande kennis wordt voortgebouwd. Verbindingen met andere vakgebieden zijn van groot belang om Business Modelling als eigen onderzoeksgebied te laten groeien. Een gebrek aan samenhang in het vakgebied vermindert de toegevoegde waarde van business modellen voor organisaties.

Een gecombineerde oplossing: Verbind Business Modelling en Enterprise Architectuur

Op zichzelf biedt Business Modelling noch Enterprise Architecture een complete oplossing voor het probleem. Gelukkig lijken de zwakke plekken van elk te worden gecompenseerd door de sterke punten van de ander. Aan de ene kant heeft Enterprise Architecture een zwakke plek op het gebied van bedrijfsstrategie en gebruiksgemak, terwijl business modellen zich richten op bedrijfsaspecten en intuïtief in gebruik zijn. Aan de andere kant heeft Business Modelling een gebrek aan methodologie, is nauwelijks geformaliseerd en ontbeert wetenschappelijke onderbouwing, terwijl Enterprise Architecture onderbouwde methodes heeft (bijvoorbeeld TOGAF ADM) en geformaliseerd is in ArchiMate. Hiermee oogt de combinatie van Business Modelling en Enterprise Architecture als een goede stap richting het oplossen van het probleem.

Hoewel het uiteindelijk doel is om het bouwen en aanpassen van IT-systemen aan de behoefte van de bedrijfskant te verbeteren, en daarmee het succespercentage van IT-implementatieprojecten te verhogen, blijft de bijdrage van dit proefschrift beperkt tot het verbinden van Business Modelling en Enterprise Architecture. Dit proefschrift stelt een methodologie voor om business modellen te creëren, te evalueren en te verbinden met enterprise architectuur. Dit doen wij door verschillende stappen te ontwikkelen van de methode, die samen de overgang van een huidige situatie naar een gewenste situatie in een organisatie ondersteunen. Het ontworpen proces helpt Business Modelling te formaliseren en tegelijkertijd Enterprise Architecture meer gericht op bedrijfsaspecten en handiger in gebruik te maken. Dit ondersteunt onze hypothese dat het combineren van Business Modelling en Enterprise Architecture leidt tot beter modellen en daarmee tot meer succesvolle bedrijfsinformatietechnologische (BIT) innovaties.

Een meta-meta-perspectief op Business Modelling

Het onderzoek naar business modellen mistte tot op heden een conceptueel model. Wij introduceren een meta-modelleerperspectief op business modellen. Wij ontwikkelen een meta-meta-business model (Me2BM) door de bestaande reviewliteratuur te plaatsen in de context van meta-lagen en het te structureren volgens Design Theory. Hiermee wordt meer duidelijkheid geschept in de terminologie rondom business modellen en de verschillende interpretaties ervan.

Hoe maak je een business model?

Voor het maken van een business model bestaat nog geen algemeen geaccepteerde methode. Wij stellen daarom de Business Modelling Methode (BMM) voor, waarmee een business model gemaakt kan worden. In dit proefschrift ontwikkelen, demonstreren en evalueren wij de zes stappen van deze methode. De BMM biedt een manier aan om business modellen op een systematische manier te maken. Innovators kunnen de stappen gebruiken om business cases voor hun ideeën te ontwikkelen. Dit helpt hun om de haalbaarheid aan te tonen van hun ideeën en die uitgevoerd te krijgen.

Hoe evalueer je een business model?

Na het maken van verschillende business modellen is het nodig om die objectief te vergelijken. Wij stellen een methode voor om business modellen te evalueren op basis van business cases. Met de ontworpen methode kunnen business modellen objectief uitgewerkt en vergeleken worden, zodat de beste keuze duidelijk is. Deze methode maakt onderdeel uit van de laatste stappen van de BMM.

Hoe verbind je Business Modelling en Enterptrise Architecture?

In dit proefschrift tonen we aan dat het mogelijk is Business Modelling en Enterprise Architectuur te verbinden. De bijdrage is drieledig. Ten eerste verbinden we de bouwblokken van het Business model Canvas met ArchiMate. Ten tweede tonen we de waarde aan van die verbinding met een kosten-batenanalyse. Ten derde bieden we methodologische ondersteuning, door de rol van business modellen in de TOGAF ADM duidelijk te maken.

Het U*Care project dient als casus om de combinatie van drie bovenstaande methodes samen te demonstreren. In de setting van de Nederlandse ouderenzorg maken en evalueren wij verschillende business modellen en koppelen die aan Enterprise

Architectuur. De combinatie van Business Modelling en Enterprise Architecture leidt tot beter modellen, en daarmee tot meer succesvolle BIT innovaties.

Conclusie

De voornaamste bijdrage van dit proefschrift aan de vakgebieden Business Modelling en Enterprise Architecture is een nieuwe manier om met de problemen om te gaan van de afstemming tussen de bedrijfskant en de IT-kant van organisaties. Deze manier uit zich in een Design Science methodologie om business modellen te maken, te evalueren en te verbinden met Enterprise Architecture.

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