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Computer-Aided Business Model Design

THÈSE DE DOCTORAT

présentée à la

Faculté des Hautes Etudes Commerciales
de l'Université de Lausanne

pour l'obtention du grade de
Docteur en Systèmes d'Information

par

Boris FRITSCHER

Directeur de thèse
Prof. Yves Pigneur

Jury

Prof. Jacques Duparc, Président
Dr. Thibault Estier, expert interne
Prof. Jos Van Hillegersberg, expert externe
Prof. Alain Wegmann, expert externe

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HEC Lausanne
Le Décanat
Bâtiment Internef
CH-1015 Lausanne

IMPRIMATUR

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La thèse est intitulée :

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Le doyen

Thomas von Ungern-Sternberg

Jury

Professor Yves Pigneur
Professor at the Faculty of Business and Economics of the University of Lausanne
Thesis supervisor

Professor Jacques Duparc
Professor at the Faculty of Business and Economics of the University of Lausanne
President of the Jury

Doctor Thibault Estier
MER at the Faculty of Business and Economics of the University of Lausanne
Internal expert

Professor Jos Van Hillegersberg
Professor at the School of Management and Governance of the University of Twente
External expert

Professor Alain Wegmann
Professor at the School of Computer and Communication Sciences of the Ecole Polytechnique Fédérale de Lausanne
External expert

Université de Lausanne
Faculté des Hautes Etudes Commerciales

Doctorat en Systèmes d'Information

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Boris FRITSCHER

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Signature :  Date : 6 juin 2014

Prof. Yves PIGNEUR
Directeur de thèse

Université de Lausanne
Faculté des Hautes Etudes Commerciales

Doctorat en Systèmes d'Information

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Signature : Th. Estier Date : **10 juillet 2014**

Dr. Thibault ESTIER
Membre interne du jury

Université de Lausanne
Faculté des Hautes Etudes Commerciales

Doctorat en Systèmes d'Information

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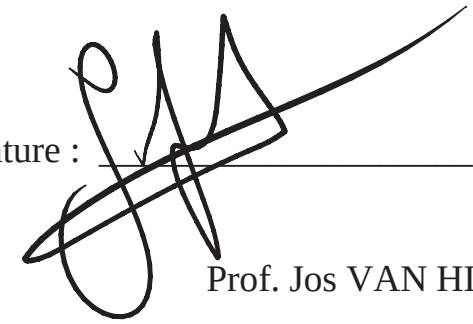
Signature :  Date : 11-6-2014

Prof. Jos VAN HILLEGERSBERG
Membre externe du jury

Université de Lausanne
Faculté des Hautes Etudes Commerciales

Doctorat en Systèmes d'Information

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Boris FRITSCHER

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Signature : A. Wegmann Date : 10.7.2014

Prof. Alain WEGMANN
Membre externe du jury

Abstract

Version française au verso

There is a lack of dedicated tools for business model design at a strategic level. However, in today's economic world the need to be able to quickly reinvent a company's business model is essential to stay competitive. This research focused on identifying the functionalities that are necessary in a computer-aided design (CAD) tool for the design of business models in a strategic context. Using design science research methodology a series of techniques and prototypes have been designed and evaluated to offer solutions to the problem. The work is a collection of articles which can be grouped into three parts:

First establishing the context of how the Business Model Canvas (BMC) is used to design business models and explore the way in which CAD can contribute to the design activity.

The second part extends on this by proposing new technics and tools which support elicitation, evaluation (assessment) and evolution of business models design with CAD. This includes features such as multi-color tagging to easily connect elements, rules to validate coherence of business models and features that are adapted to the correct business model proficiency level of its users. A new way to describe and visualize multiple versions of a business model and thereby help in addressing the business model as a dynamic object was also researched.

The third part explores extensions to the business model canvas such as an intermediary model which helps IT alignment by connecting business model and enterprise architecture. And a business model pattern for privacy in a mobile environment, using privacy as a key value proposition.

The prototyped techniques and proposition for using CAD tools in business model modeling will allow commercial CAD developers to create tools that are better suited to the needs of practitioners.

English version on the front.

Au niveau stratégique, il y a un manque d'outils dédiés d'aide à la conception de modèle d'affaires (business models). Cependant, le monde économique actuel requière de la part d'une entreprise qu'elle soit en mesure de réinventer rapidement son modèle d'affaires, afin de rester compétitif. Cette recherche est axée sur l'identification de fonctionnalités nécessaires à une conception assistée par ordinateur (CAO) de modèles d'affaires dans un contexte stratégique. En utilisant la méthodologie design science research, une série de techniques et de prototypes ont été conçus et évalués pour proposer des solutions au problème. Ce travail est un recueil d'articles qui peuvent être regroupés en trois parties:

La première explore le contexte et la façon dans laquelle le business model canvas (BMC) est utilisé pour concevoir des modèles d'affaires et explore les apports que peut faire la CAO dans cette activité de conception.

La deuxième partie étend cette problématique en proposant de nouvelles techniques et outils qui aident à la découverte, évaluation et l'évolution de modèles d'affaires grâce à la CAO. Cela comprend des fonctionnalités telles que le marquage multi-couleur pour connecter facilement des éléments, des règles pour valider la cohérence des modèles d'affaires et la définition de critères pour adapter les fonctionnalités au niveau de compétence de ses utilisateurs. La recherche s'est également portée sur une manière de décrire et de visualiser plusieurs versions d'un modèle d'affaire. Cette nouvelle approche permet ainsi de représenter des modèles d'affaires comme des objets dynamiques.

La troisième partie explore des extensions apportées au business model canvas, comme un modèle intermédiaire qui aide à l'alignement stratégique de l'informatique en connectant le modèle d'affaires et l'architecture d'une entreprise. Mais également un pattern de modèle d'affaires de gestion de la vie privée dans un environnement mobile, en utilisant la protection de la vie privée comme une offre.

Les techniques prototypées et propositions d'utilisation des outils de CAO dans la modélisation de modèles d'affaires permettront aux entreprises spécialisées dans le développement de telles solutions de créer des outils mieux adaptés aux besoins des praticiens.

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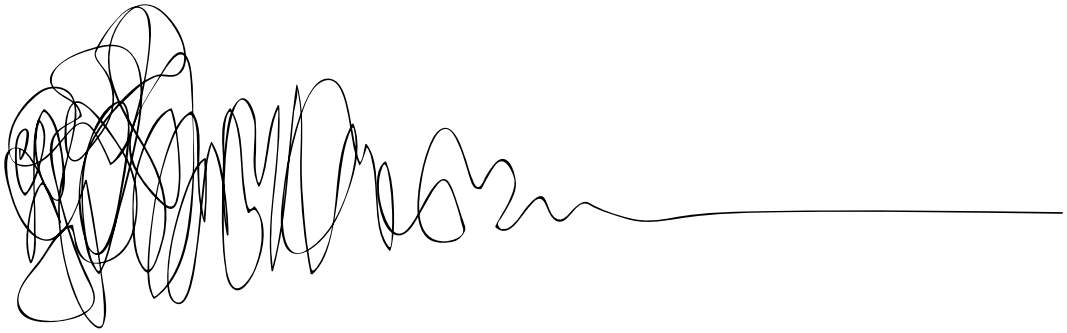
Contents

Chapter 1
Introduction



Damien Newman, Central Office of Design

1.1 Research Definition

In the past decade, competition for companies and start-ups has evolved considerably. Today, product innovation alone does not allow companies to differentiate themselves enough to be able to compete (Teece, 2010). Faster production cycles, and improvements to logistics and communication now offer advantages of value or cost in the same competing environment; however, such advantages last only for a short time. A shift of attention is required from supply to demand, from a focus on competing to a focus on value innovation, and breaking the value/cost tradeoff. According to Kim and Mauborgne (2005), this focus can be achieved by creating a "Blue Ocean Strategy".

At a strategic level, it is important to be able to describe and compare the nature and components of a company's core business. The concept of a business model as a unit of analysis offers a solution by providing a common language that describes how value is created, delivered and captured. Having the means to improve the design of their business models has become a real issue for executives and entrepreneurs alike. However, there is a lack of tools to support strategic objects such as the business model concept. This is partly because most meta-models have loose guidelines on how to visualize and use them, in order that they can maintain flexibility and maintain space for creativity. Additionally, the creative thinking process, which involves design thinking, brainstorming and nonlinear explorative processes, makes it difficult to utilize more traditional task modelling tools. These have a stricter representation of their objects and restrict usage to their precise meta-model.

Currently, other than pen and paper, the tools used are generic; they include, for example, word processing software, spreadsheet software and presentation software, none of which offer any insight into the modelled object. There is a lack of consensus on which features should be

included in a computer-aided design (CAD) tool for strategy and how they can add value to the process. However, if we compare this with other design activities, there is certainly room for improvement. Looking at other design domains, advanced dedicated tools exist which can assist the designer throughout the design process. For example, architects and engineers have access to 3D CAD tools, which not only help them build a virtual prototype, but also simulate the structural integrity of their model. Programmers can use an Integrated Development Environment (IDE), which helps them develop software by providing content assist based on the context in which they are currently editing. Additionally, IDEs also provide pre-compile syntax checking to help produce valid code. In process management there are tools to design and simulate business model processes, which can then also be used as a dashboard for monitoring real-world processes.

By drawing parallels with these other domains we can describe a CAD tool for strategic objects such as a business model. We can also distinguish between three major types of usage: a) creative design (elicitation) of the business model, b) assessing the designed business model, and c) managing the evolution of the business model and its variations.

The term “assessing” can also mean evaluation; indeed, in this text, they are used interchangeably.

1.1.1 Research Question

The purpose of this thesis is to identify the functionality that is necessary in a computer-aided design tool in a strategic context, specifically in the design of business models. The research question can be stated as follows:

How can computer-aided design help in designing and assessing strategic business objects, such as business models?

The question can further be decomposed into sub-questions based on the three identified types. The first identified type of usage for a computer-aided business model design (CABMD) tool is in assisting the creative elicitation process of a business model. This leads to the formulation of the following research sub-question:

Research sub-question 1: How can additional information, which is provided by the system or supporting design technics, help to elicit ideas?

The creative design of a business model heavily depends on the ability to choose the right level of abstraction for each component. In this situation, any tools have to be as non-constraining as possible in order to not hinder the creative effort and thus allow innovations to occur. The tool can also assist the user by constraining him to design within the chosen business model modelling language. Finding the right balance between freedom and constraints is an essential aspect.

With the use of digital tools, it is also possible to quickly filter what users see and allow them to focus on a selection of available elements. This provides the capability to manage more information on one model.

The second identified type of usage is in helping the assessment of the created business model. Thus the second research sub-question can be formulated as follows:

Research sub-question 2: How can additional information, which is provided by the system or supporting design technics, help in the assessment of ideas?

In creative activities there is an opening phase during which many ideas are collected: this is followed by an exploratory phase and finally a closing phase, when a solution is arrived upon. For example, in brainstorming, ideas are grouped and combined. In business modelling, this equates to verifying the coherence of a model, and whether or not any relationships between elements can be defined. A computer-aided tool that has a knowledge of the meta-model of the modelling language can validate constraints and best practice by automatically validating rules calculated on the attributes of the elements.

Assessment is not limited to the meta-model, but can also be used by the user to verify the soundness of attributes of his model such as financial data.

Assessment can also be seen as verifying that the strategic high-level view embodied by the business model is implementable at an operational level, and therefore an alignment between them can be reached.

The third area is a consequence of the creative process. Assessment will give new insight into elements of the business model, which will lead to multiple versions of business models. Furthermore, to reach a blue ocean business model, more than incremental changes are required. Thus, the third research sub-question can be formulated as follows:

Research sub-question 3: How can additional information, which is provided by the system or supporting design technics, help to manage the evolution of ideas?

Innovation and new ideas are not the result of a straightforward process; rather, they emerge under the right circumstances. The design process can make this event more likely by supporting an exploration of the alternatives. For example, different business models can be created for a multitude of scenarios. Solutions are revealed by thinking outside of normal situations. Therefore, it is important to being able to manage the multitude of versions of ideas created as well as switch easily between them.

1.1.2 Structure of the Thesis

This thesis is a collection of articles that were published between 2009 and 2014 in conference proceedings and journals within the extended Information Systems (IS) community. This first chapter is intended to give an overview of how the individual publications contribute to the solutions. The structure of this chapter follows the recommended format for design science papers (Gregor and Hevner, 2013) and includes the following sections: introduction, justificatory knowledge, methodology, artifact (the summary of the papers), evaluation, discussions and conclusion. The chapters that follow present the published articles. Whilst these have been formatted using a uniform style, no changes have been made to the content of the published versions. The final chapter concludes with a look at future research. In addition, this thesis includes three appendices. The first appendix presents all the prototypes, which were developed during this heavily applied research. The second appendix presents a case study, which was created in

order to study business model evolution. The third appendix is an extension to chapter 5 and presents a list of rules obtained from the transformation of guidelines.

1.2 Justificatory Knowledge

This section first highlights the need for the business model concept. It then presents business model methods and the way in which they relate to computer-aided design. Finally, this section concludes with the business model method that was selected and used in the research papers.

1.2.1 Business Model

Today's business world is characterized by an uncertain economic environment, vanishing entry barriers, and faster moving new competitors. In such a world, businesses have to adapt to more and more complex situations. At a strategic level, business models can help a business to better overcome this complexity in different ways. First of all, *"a business model tells a good story, which can be used to get everyone in the organization aligned around the kind of value the company wants to create"* (Magretta, 2002). The business model gives a clear picture about a company's essential resources and interaction, which produces values. As explained by McGrath (2009), the *"business model concept is a powerful idea for strategic thinking and strategic research, and allows us to shift focus from a pre-occupation with the resources a firm has, to the use to which those resources are put"*. Furthermore, business model thinking can lead to innovation through the discovery of new business models by combining existing elements differently or with new ones. As shown by Zott et al. (2010) throughout business strategy literature "*there is an increasing consensus that business model innovation is key to firm performance*".

Unfortunately, the process of experimentation is often only initiated by companies as a reaction to difficulties (Sosna et al., 2010). Additionally, managers who have been operating within the confines of their current business model fail to understand the value potential of technologies and ideas that could be provided by an alternate business model (Chesbrough, 2009).

Chesbrough (2009) proposed that to *"overcome these barriers, they could, for example, construct maps of business models, in order to clarify the process underlying them; the maps then become a source of experiments to consider alternatives"*. Moreover, McGrath (2009) went on to argue that some companies become more adept at experimenting than others and, consequently, can build better models more quickly than their counterparts. This element of speed provides them with competitive differentiation.

Without a well-developed business model, innovators will fail to either deliver or to capture value from their innovations. This is particularly true of Internet companies, where the creation of revenue streams is often most perplexing because of customer expectations that basic services should be free (Teece, 2010).

In addition to using the business model concept to generate ideas, it can be used to assess the state of the company if some metrics are provided. Baden-Fuller and Morgan (2010) put forward a good explanation of the balance that has to be found in order for a assessing tool to be viable: *"Experiments or simulations and other business model manipulations are only possible when the model is (like those of economics) simple enough to work through (or where the implications of a likely change can be programmed into it), but yet complicated enough to capture sufficient content of the firm's arrangements to make the experiment meaningful*". In other words,

business modelling can take place at a level that allows us to evaluate some assumptions without having to go into too much time-consuming detail.

Moreover, Teece confirmed the importance of business models by highlighting the importance of evaluating provisional business models against the current state of the business ecosystem, and also against how it might evolve. It is not sufficient to find a working business model, keeping the model viable is also likely to be a continuing task (Teece, 2010). It is crucial also to consider the future, in other words, *"entrepreneurs and managers must give close considerations to the design of business models and even to building businesses to execute transactions which cannot yet be performed in the market*" (Teece, 2010). This is especially the case since, *"the right business model may not be apparent up front, and learning and adjustments will be necessary: new business models represent provisional solutions to user/customer needs proposed by represent entrepreneurs/managers"* (Teece, 2010). Thus, it is likely that over time it will be replaced by an improved model that takes advantage of further technological or organizational innovations. The business model concept can thereby not only describe a current state, when multiple types are used, it can also provide a picture of its evolution over time.

1.2.2 Business Model Methods

Business model theories provide their own common language by describing the components and the relationships that exist between them. Examples include: SEAM (Wegmann, 2003), e3-value (Gordijn, 2003), Business Model Ontology (BMO) (Osterwalder, 2004), and STOF (Bouwman et al., 2008). Currently, there is no single unifying theory of business models; rather, there are silos of theories that lack consensus. However, the notion of the business model as a new unit of analysis is gaining in popularity and the field is moving towards conceptual consolidation (Zott, 2010). Other modelling tools do exist. Whilst these support business modelling, they differ from the requirement set by this work: to have a simple visual representation, which is compatible with iterative work and the design-thinking process, yet is complicated enough to allow for an assessment of the company. The tool that supports the methods should have a simple user interface, which is targeted at non-technical users who do not have time to get special training to learn the software.

Generic tools such as Visio and PowerPoint can be used to draw up a model. However, they cannot be used to enforce modelling constraints - a requirement that is implied by the assessment condition.

Specific all-purpose editors certainly exist, such as Protégée (Gennari et al., 2003); these are able to model and instantiate any domain that is supported by an ontology. This is a practical way to develop new meta-models or extend existing ones, although it is less practical for end-users.

Other methods have dedicated software; for example, SeamCAD (Lê and Wegmann, 2006) was especially designed to support the hierarchical natural of SEAM. In addition, e3-value uses its own editor (Gordijn et al., 2004) to draw a custom representation. It also has some financial features, which allow it to export to an Excel spreadsheet. However, for both methods, visual representation is more complicated than when using a pen, one page of paper, and sticky notes for interactions.

With regard to BMO, there has been some discussion about the possibility of using support tools (Pigneur and Osterwalder, 2002). Ideas have also been put forward as to the sort of features

it could include: for example, it could help to visualize, understand, communicate, share, measure, track, observe, compare, design and improve decision making (Osterwalder et al., 2005). Such tools *"would make many tasks easier and quicker, while revealing as-yet-unseen opportunities."* (Osterwalder and Pigneur, 2013). However there is also the consensus that in order to provide computer assistance, a more rigorous conceptualization of the business model domain is required (Gordijn 2002, Osterwalder 2004).

In 2005, Osterwalder et al. proposed that rigorously defined meta-models of business models in the form of formal reference models or ontologies may help in the development of new software-based management and IS tools. However, beyond their suggestions and encouragement to explore the possibility of such support tools, a concrete implementation had not, at the time of writing this thesis, be found for the BMO. In terms of assessment, there was also one attempt to illustrate how an OWL BMO example could be augmented with axioms (Pigneur, 2004); however, only one sample was given, and it covers only a small part of the model.

Kijl and Boersma (2010) pointed out that *"most of current literature is focused on business model design only, whereas there is almost no attention for business model validation and actual implementation of and experimentation with business models".* They went on to present a method which helps to identify the key metrics for a business model of a specific organization, which can then be implemented into a tool for this targeted instance. Their method reflects their own interests and is mainly in support of incremental, rather than disruptive business model engineering and experimentation.

A range of commercial tools also exists. It may be possible for these tools to be used in business modelling or to perform similar strategic thinking: (e.g., http://www.strategymap.com.au/, http://www.consideo-modeler.de/, http://enterprise-architecture.org/). However, they all suffer from having complicated interfaces, which are geared more towards expert users.

1.2.3 Business Model Canvas

In all of the papers published as part of this thesis, the Business Model Canvas (BMC) representation of a business model is used. It is an evolution of the Business Model Ontology (BMO), with a number of simplifications that are explained in more detail in chapter 2. Although key aspects are presented in most of the papers, a short presentation is also given here (adapted from the version shown in chapter 4).

In the BMC, a business model is composed of, and described by, nine building blocks. These building blocks can be further grouped into four perspectives, as shown in figure 1. The main perspective is the offer (what we do), which connects the client perspective (who we do it for) and the activity perspective (how we do it). Finally, the financial perspective deals with profit (how much?).

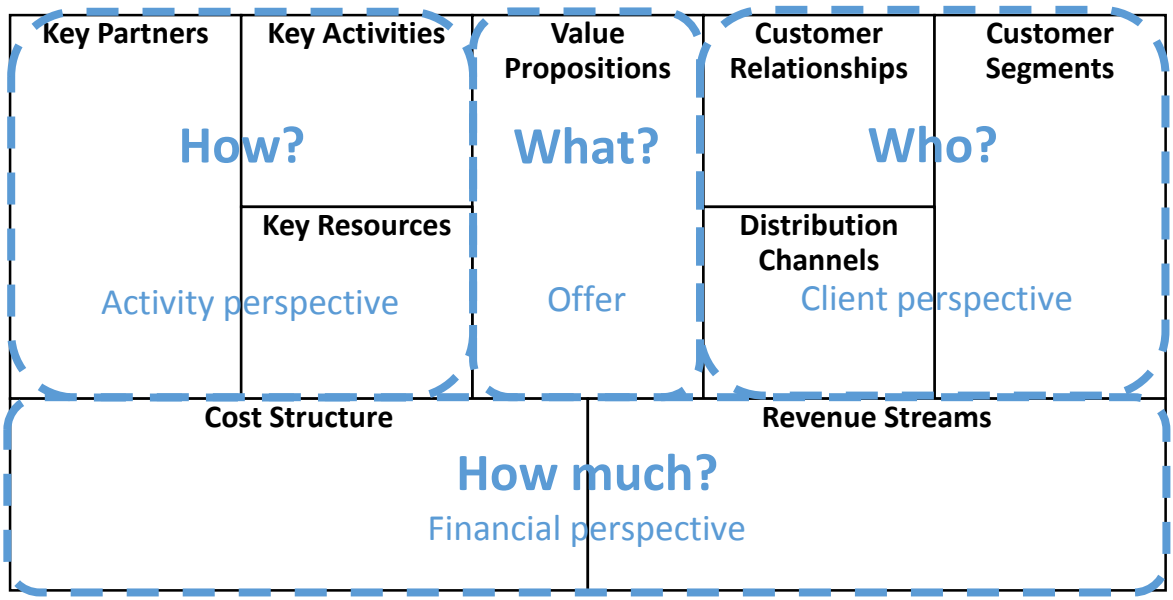


Figure 1. Business Model Canvas and perspectives.

The positioning of these nine blocks is very important. Visually, they form separate groupings, which help to structure the thought process and facilitate comparisons between the business models drawn using this method. As can be seen in figure 1, the offer is in the center; to the right is the client perspective and revenue stream, whilst to the left is the activity perspective and cost structure.

The importance of having a visual canvas is anchored in the Design Thinking process (Martin, 2010). This method is not a theory, but a set of practices popularized by companies such as IDEO to visualize and prototype concepts for the generation and validation of ideas.

Creating a business model instance with the BMC consists of adding elements to the nine building blocks (i.e., using sticky notes). These elements have keywords that describe a component of the business model; for example, a customer segment of “office worker”. Alternatively, an element can also use a visual illustration to symbolize the keyword; for example, a person at a desk can be used to represent the “office worker” concept.

The visual representation of the BMC has been downloaded over one million times by practitioners around the world since 2009 and has been used in creative sessions to innovate their business models.

These visual representations contribute strongly to the reason why this business model representation was chosen as a meta-model for the computer-aided design of business models:

- The representation is already visual
- The fixed one-page layout distinguishes it from other model and makes it universally identifiable. A user has only to learn it once, and can work instantly with a new business model instance following the same meta-model, without having to identify where the components have been put.
- The meta-model is simple, yet expressive enough to model all key aspects of the firm.
- The BMC is widely adopted by practitioners, the main target of the intended computer-aided design tool.

1.3 Methodology

In this work, the research question itself implies that an artifact has to be conceived and then implemented in a prototype in order to provide an answer. In the IS community, design science research (DSR) methodology is an ideal fit for this kind of research. In particular, the framework proposed by Hevner et al. (2004), focuses on how the conception and evaluation of an artifact in iterations can address a problem. The concept of iteration is used in three cycles: *"The Relevance Cycle bridges the contextual environment of the research project with the design science activities. The Rigor Cycle connects the design science activities with the knowledge base of scientific foundations, experience, and expertise that informs the research project. The central Design Cycle iterates between the core activities of building and evaluating the design artifacts and processes of the research. [...] These three cycles must be present and clearly identifiable in a design science research project*" (Hevner, 2007).

The requirement for research to combine academic knowledge and the need to solve a relevant problem gives credibility to the work from both perspectives, both academic and professional.

1.3.1 Research Process

The research process for this work was heavily exploratory. Ideas on applying computer-aided design features to business models were tested on prototypes following the iterative design science research process which is similar to trial and error. Feedback which lead to alteration of the design can be of many types: the concept may not work, the prototype may be too complicated, or the user interaction may not be simple enough. Evaluation were first carried out to determine the feasibility of the ideas: testing of the representation of the required information could then take place as desired. If successful, a simple example was used to test interaction with the prototype. In a second phase, tests were carried out with the involvement of external stakeholders, students and experts in order to validate the concept further.

These iterations and errors resulted in a number of prototypes and concepts, not all of which ended up being used in the published papers. However, these failed or unfinished projects should still be considered part of the process; indeed, their failures played a key role in the creation of the features and contributions that were published. Thus, all the major prototyped ideas are presented in appendix A.

1.3.2 Paper Structure

There was a distinct lack of guidance on how to structure a DSR paper that uses Hevner's design cycle. We were able, however, to use the proposed structure of a DSR paper put forward by Gregor and Jones (2007b). Their structure is grounded in the eight components that form the basis of their IS design theory (Gregor and Jones 2007a), as seen in table 1. We preferred Hevner's DSR approach because it fits in with the process of designing and evaluating prototypes, something that is dependent on a highly iterative process.

The papers that form part of this thesis, and which were published before 2013, follow Hevner's DSR principles. They use a structure that was inspired by that proposed by Gregor and Jones in 2007. However, we chose to place the justificatory knowledge and literature review in

the same section. And in the majority of the cases, where there is a focus on the validity of the artifact through the existence of its instantiation, they were put together into one section.

Later, Gregor and Hevner (2013) published a paper that provides an updated structure, which integrates their two positions on design science. This new structure fits perfectly our previously adopted structure; thus, we have used it for all subsequent publications.

Table 1: Gregor and Jones (2007) proposed ISDT components and article structure, compared to the updated version of Gregor and Hevner (2013)

ISDT components Gregor and Jones (2007a)	DSR paper structure Gregor and Jones (2007b)	DSR paper structure Gregor and Hevner (2013)
1. Purpose and scope 2. Constructs	1. Introduction	1. Introduction
	2. Literature review / background	2. Literature review
	3. Research methodology	3. Methods
6. Justificatory knowledge	4. Justificatory knowledge	*(included in literature review)*
1. Purpose and scope 3. Principles of form and function 4. Artifact mutability 7. Principles of implementation 5. Testable propositions	5. Specification of the designed artifact	4. Artifact description
8. Expository instantiation.	6. Instantiation	
	7. Evaluation	5. Evaluation
	8. Discussion and conclusions	6. Discussion
		7. Conclusion

1.4 Connecting the Papers

To get an overview of how the different papers fit together, this section gives a summary of each of them and explains how they fit into an overall conceptual schema. An illustration of it can be seen in figure 2, which shows the different topics and chapter numbers.

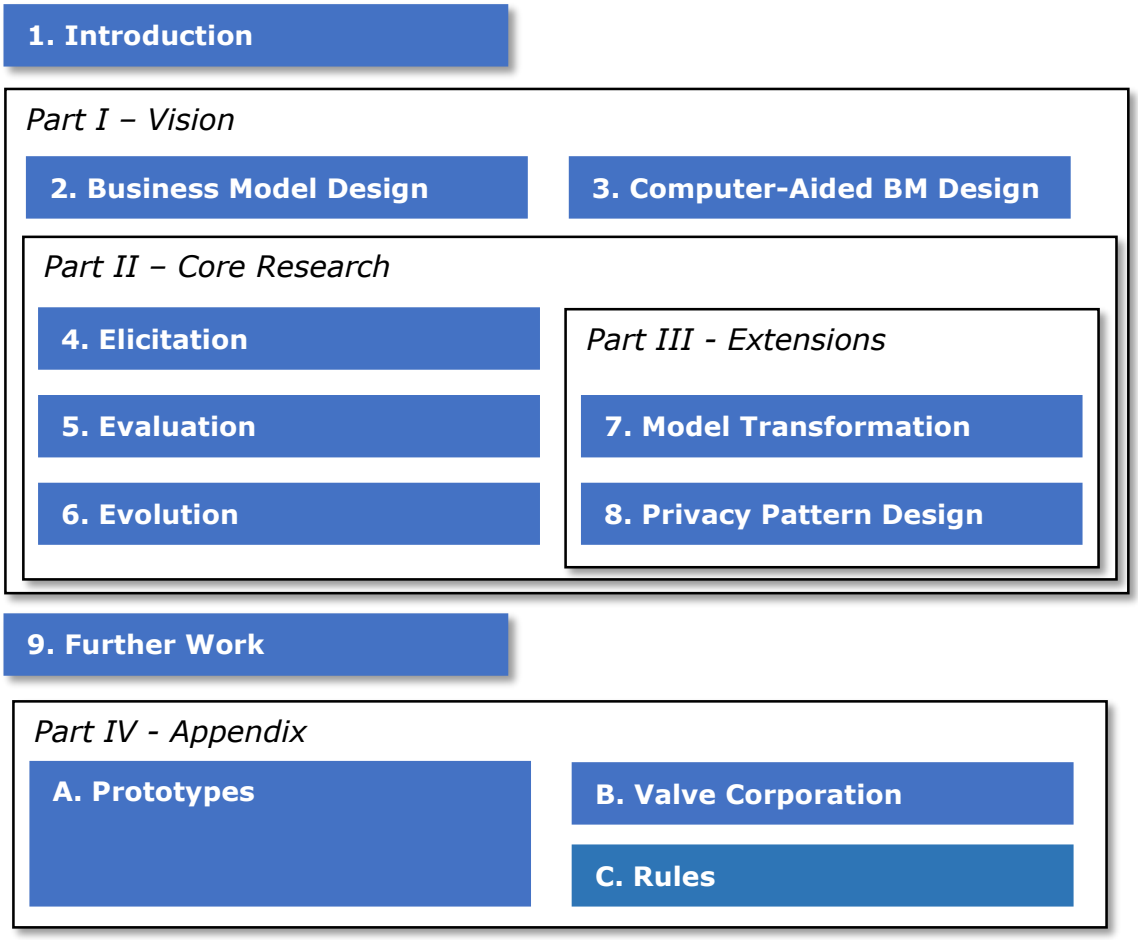


Figure 2. Conceptual schema of research space and chapters.

The main focus is to explore how CAD can support business model design. The work is grouped into four parts in addition to the Introduction and Further Work chapters:

Part I focuses on a vision of CABMD. It establishes the context of how the BMC is used to design business models and explores the way in which CAD contributes to this business model design.

Chapter 2 first identifies what kind of design can be created with the business model for three identified maturity levels.

Chapter 3 then explores the functions that a CAD tool can offer to business model design, such as layers, colors, attributes and position; all of which must not constrain creativity.

Part II contains the core research which was inspired by the vision and in part answers the three research sub-questions with regard to the elicitation, evaluation (assessment) and evolution of business model design.

Chapter 4 begins by addressing the use of CABMD for elicitation. This involves a comparison of real world usage of basic features, as introduced in the previous chapter.

Chapter 5 focuses on the advantages that CABMD can bring to an evaluation of business models. It does so by defining guidelines and rules. More specifically, its related prototype in

appendix A.5 explores how these rules (appendix C) can also be used in the assessment phase of a business model.

Chapter 6 address how, with the help of the concept of layers and some simple transformation rules, it is possible to track the evolution of a business model. This exploration is supported by a use case, which is illustrated in appendix B. An interactive visualization is also offered, something that is only possible because of the existence of a CABMD tool.

Part III presents two extensions, both of which are business model-related research that has the potential to become CABMD-focused. A CAD tool can be more useful if it can handle additional information to augment the business model itself. However, for the BMC to support such extensions they have to be defined at the modelling level before they can be implemented in a tool itself.

Chapter 7 presents a model transformation that allows us to explore the IT alignment of a business model by mapping it through an intermediary visual model to an enterprise architecture. Whilst it does not directly consider CAD, it does lay the ground work for a model which then can be used in connection with CAD. More specifically, it can better assist in the elicitation and evaluation of the alignment between the businesses model canvas and a company's enterprise architecture from an IT perspective.

Chapter 8 explores how the business model canvas is used to define a business model pattern for privacy in a mobile environment. It is not directly related to the exploration of CAD. However, the case could be made that some aspects of this business model pattern approach could be used to help in the assessment of BMCs.

Part IV is an appendix that provides additional information on the material used during the research. Driven by the question to find out how CAD can support the elicitation, evaluation and evolution of business models, a number of prototypes have been designed and evaluated. They are presented in appendices A.1 through to A.9. Appendix B presents in more detail the use case developed to analyze business model evolution in chapter 6. Finally, appendix C includes some rules that have been adapted from the guidelines given in chapter 5.

The following sections give an in-depth description of the main concept for each paper, as well as the way in which they relate to each other.

1.4.1 Chapter 2 From Business Model Ontology to a Business Model Canvas

Before exploring what is required to support the BMC with CAD, this first paper takes a look at the business model canvas usage. Even though there has already been a transformation from the original academic version (Osterwalder, 2004) to its current business model canvas form, the current version is used in a static approach only. This usage correspondence to a maturity level we identify as *novice*. The novice uses the canvas to have a common language to design a business model and uses the canvas 'building blocks almost as a checklist. This does not address the dynamic nature of a business model which transforms over time.

Therefore, inspired by transposing the metaphor of plane building in engineering and evolution in biology to business model designing, as well as with insights gained from workshops on the business model canvas, we propose two additional maturity levels: *experts* and *masters*.

Each level builds on the previous and comes with their respective method: business model story outlining and business model evolution, to address the dynamic nature of business models.

Experts extend the business model canvas knowledge by adding assessments and thinking about the dynamics of business model through the visualization of its story. The Business model story outlining concept (also sometimes called BM Mechanics by practitioners) consist in drawing arrows to outline the main thread in the story of the business model's component interaction. This is more than highlighting the model's traditional relationship which can already be done by color tagging elements. The story illustrates the flow of the exchanged value between customers and the product and how it is produced with a temporal component. It is about understanding the underlying interactions which make the business model possible. For example, outlining how a revenue stream is strongly dependent on a partner through the provided channel (a relationship which is not defined in the basic ontology).

Masters go beyond a single business model, by taking into consideration the influence of internal changes as well as external environmental changes to build multiple models. With the help of the business model evolution concept, a transformation from one model to another can be visualized on layers similar to tracing paper. Combining these transformation steps into branches of possible transformation paths will results in a visual way to handle multiple models and support the master's exploration of business models in combination with technics such as scenario planning.

Providing three maturity level to classify user's proficiency with the business model canvas is based on observation from workshops. In the future, more level may be defined. Increase in adoption of the business model canvas will also shift the required proficiency to reach a given level.

As suggested by Moody, D. L. (2009) for visual methods there is a need to be able to differentiate at least between two types of user's: beginners and experts. This without compromising the visual language's complexity and legibility. This has especially an impact when supporting the concept with CAD tooling where the sophistication of the tool can adopt to the user. This is an observation which is also made in chapter 4 'Computer Aided Business Model Design: Analysis of Key Features Adopted by Users' after analyzing usage data of a large sample of users.

These defined concept provide a starting point on how to address business model beyond its static representation and give an insight on how the business model canvas can be used as a strategic planning tool. Forming the basis for further research.

In particular, we explore the business model evolution concept with layers in more detail in the paper described in chapter 6 'Visualizing Business Model Evolution with the Business Model Canvas: Concept and Tool'.

In addition, the observed transformation of the BMO to BMC gave some useful insight on how simplification and interaction with the community influenced the adoption of the BMC by practitioners around the world.

1.4.2 Chapter 3 Supporting Business Model Modelling: a Compromise between Creativity and Constraints

The premise of this thesis is that, although there are diagrams and tools which help to support task modelling in engineering and process management, they are not fit for use in a business context at a strategic level. This is because of the flexibility needed for creative thinking and for simple, user friendly interactions. However, the assumption is that if a tool is designed to especially address these needs it is possible to propose a CAD environment that bridges the gap between freedom of actions, the encouragement of creativity, and any constraints, whilst still providing new features such as validation and assessment. A first step is to demonstrate the feasibility of a tool for large-scale use by a global public. This paper describes the experiment-building prototype A.1 Business Model Designer, which experiments with such features as the multi-color tagging of elements to show their connections and to create explicit links between them. Other features include customizable attributes and aspects of a social sharing platform such as commenting, rating and sharing of business models.

The idea behind the open public aspects and social features was to see if an open community of business model exchange can be created. In this paper, it was revealed that most people are very private about sharing their business model openly. Nonetheless, enough data was accumulated over time to allow for a usage analysis of the data, which is presented in the next chapter.

This first prototype helped to validate the compromise between allowing enough freedom to create whilst still respect the modelling constraints.

1.4.3 Chapter 4 Computer Aided Business Model Design: Analysis of Key Features Adopted by Users

This chapter complements previous work on building CAD software for business models by drawing lessons from an analysis of its usage data. It is of interest in that we use real-world usage data on a large scale (over 2,000 business models from around the world) and compare two different implementations of the same principles, one of which is commercial. In particular, the focus of this chapter is to compare features such as colors for grouping, custom attributes and positioning of elements. Having similar tools that are based on the same ideas, but with different implementations, allowed us to explore the impact of these choices.

Handling large amounts of data presented a challenge in itself. To get a better overview of this data, a variety of tools were needed, including database queries, heat maps and spreadsheets. Making sense of how color was used as a grouping in a multi-color system was non-trivial and led to the creation of a business model types helper tool (appendix A.9). This tool allowed us to filter, sort and visualize the data based on usage of the nine building blocks of the BMC.

These observations allowed us to make a series of propositions, which will help in the advancement of research into dedicated CAD tools to support strategic objects such as business models.

1.4.4 Chapter 5 Business Model Design: an Evaluation of Paper-Based and Computer-Aided Canvases

Previous work has shown that it is possible to use CABMD tools and still have an experience that is similar to using a paper canvas. The next step is to utilize the capabilities of a CAD to aid not only in the elicitation process, but also in the assessment of the business model's coherence. To that effect, we propose a set of guidelines to help design more coherent business models. When combined with the functionalities offered by CAD tools, they show great potential to improve business model design as an ongoing activity. However, in order to create complex solutions, it is necessary to first compare basic business model design tasks to see how using a CAD system rather than its paper-based counterpart can affect creativity.

To this end, an experiment was carried out to measure user perceptions of both solutions. Performance was evaluated by applying the guidelines to both solutions and then carrying out a comparison of the designed business models. Although CAD did not outperform paper-based design, the results are very encouraging for CABMD in that it did not perform less well.

The experiment also allowed us to consider how a BMC can be evaluated. In this instance, each element was compared with a defined solution and a score was given. Additionally, points were allocated on the basis of the number of guidelines followed.

In this paper, a simple example is given as to how a guideline can be interpreted as a rule, which then can be implemented in a CAD tool in order to be automatically validated. However, this paper goes not further than giving examples of a rule; it does not present a prototype implementation. This is addressed by appendix C, which provides rule transformation where possible for all the guidelines in this paper. And the prototype described in appendix A.5 Business Model Rules implements these rules.

1.4.5 Chapter 6 Visualizing Business Model Evolution with the Business Model Canvas: Concept and Tool

The Business Model Canvas (BMC) assists in the design of a company's business model. As strategies evolve, so too does the company's business model. Unfortunately, each BMC is a standalone representation. Thus, there is a need to be able to describe transformation from one version of a business model to the next, as well as to visualize these operations. To address this issue, and to contribute to CABMD, this paper proposes a set of design principles for business model evolution. A prototype that can assist in the creation and navigation of business model versions in a visual and user-friendly way has also been created and is presented in appendix A.6.

Testing of the prototype was carried out with students as part of their projects. The inspiration for the concept and the prototype came from the creation of a complicated use case of a company with two business models and several evolutions for each of them. This case study is presented in detail in appendix B: Business Model Evolution Case: Valve Corporation.

What started in chapter 2 as an intuition about versioning led to exploratory work being carried out on a more basic concept of CAD support for business modelling. Which in turn, led to a business model evolution concept that is supported by tools and incorporates the concept of layers.

1.4.6 Chapter 7 A Visual Approach to Business IT Alignment between Business Model and Enterprise Architecture

Beyond assessing a business model for its coherence, its alignment with the operational part should also be evaluated. While the BMC already provides a common language to describe part of a strategy, it does not directly relate to the more operational elements, which are described in an enterprise architecture model.

In this paper, which focuses on IT alignment, an intermediary model is presented that can support the transition between a business model and an IT infrastructure. It is based on a combination of existing models: enterprise architecture and the BMC. The paper shows how the proposed intermediary model, which has a strong focus on business model strategy, can help IT alignment. The intermediary model can help alignment both from a business model or an IT infrastructure perspective, thanks to a correspondence between both paradigms. Additionally, with a focus on visualization, the intermediary model helps to quickly share common ground between the parties involved in the alignment. The intermediary model is presented using an example case: Switcher SA.

The proposed intermediary model follows the same concept of a CAD tool for strategy as was used in the previous chapters. It is a simple one-page visual with a fixed layout. Therefore, the same CAD techniques can be used to support it, because it is based on building blocks that contain colored elements. Multi-model tools, such as the prototype given in appendix A.2, can support the intermediary model.

1.4.7 Chapter 8 Privacy-Friendly Business Models for Location-Based Mobile Services

This chapter is a journal paper on a business model pattern for privacy intermediation that was written in collaboration with Riccardo Bonazzi, Zhan Liu and Yves Pigneur. The paper was based on the results of an exploratory field experiment in Switzerland, which assessed the driving factors for the behavior of users when disclosing information on their mobile devices. The results suggest that privacy protection can be seen as a viable value proposition component. From a theoretical model, a set of guidelines was derived to design a privacy-friendly business model pattern for third-party services. Four examples were derived to show how the mobile platform can play a key role in the implementation of these new business models.

This example shows how a pattern-based approach can be applied to business models. Such a business model pattern can be of use in a CABMD tool to help the elicitation of elements from a different perspective and to evaluate if it fits the mechanics described in the pattern. For example, in the case of a privacy pattern, checks can be made to see if the business model has the required elements to offer the value proposition of a privacy infomediary.

A business model pattern can be described by referring to the hierarchy of business model concepts proposed by Osterwalder et al. (2005):

1. A business model concept is an abstract overarching concept which describes the meta-model of a business model (the elements that belong in a business model).

2. A business model type describes and clusters into generic elements a set of businesses with common characteristics that are related to the business model concept.

3. Business model instances are real world business models, where business types and business model concepts are characterized by existing elements.

In the context of a tool, the business model concept is the methodology for which the tool has been configured. The business model instances are the business models that are modeled with the tool. The business model types are templates of generic models, or patterns in architecture or software design. Whereas on paper once an instance is drawn, it cannot be modified without restarting from scratch, on a computer-aided tool, it becomes possible to apply, remove, and compare business model types (patterns) to the modeled instances, thereby identifying missing elements or new combinations.

A library of patterns would be helpful, therefore, to assess a business model for different typical recurring combinations of elements with focuses on such considerations as: freemium, double-sided, privacy, social responsibilities, environmental and legal considerations.

1.4.8 Chapter 9 Further Work

This chapter gives a short presentation of the limitations of this research and gives away future directions for CABMD.

1.4.9 Appendix A Prototypes Factsheets

Focus on identifying what makes a good CAD tool in terms of supporting business modelling required the use of experimental prototypes. Several prototypes were built. Whilst not all of them led to publishable results, they were nonetheless used in the research process. Appendix A presents nine built prototypes (A.1 to A.9) in the form of a double-page factsheet. These sheets contain a screenshot of the prototype, a description of the main underlying ideas, a list of key features, a reference to the key technology used, the evaluation process and the future potential of the prototype. If applicable, the related publication in which it appeared is also mentioned.

The dynamic nature of the concepts tested in the prototypes makes it clear that they are best experienced by interacting with them. Fortunately, all of them are based on web technologies and can be accessed by visiting the following website: http://www.fritscher.ch/phd/. Below is a short summary of each of the nine prototypes.

A.1: Business Model Designer

Computer Aided Business Model Design: Color tagging, fixed layout and global scale.

The Business Model Designer prototype was built to explore CABMD on a global scale. It was used to test the usage of features such as color tagging, custom attributes and social sharing.

A.2: Business Object Modeler

Multi-model CAD: touch inspired workspace with flexible layout.

Business Object Modeler explores a touch-based workspace of building blocks that host elements. In this workspace, everything scales and rotates, and multiple models can be displayed simultaneously. A history of all the edits can be tracked, which allows for real-time collaboration and the projection of parts of the workspace. This prototype also explored storytelling and how elements can be displayed sequentially. The flexibility of the prototype allowed us to create the

business model calculation variant (appendix A.3) and the multiple model approach, which inspired the layer concepts for business model evolution (chapter 6 and appendix A.6).

A.3: Business Model Calculation

BOM experiment with custom attributes for calculation and financial what-if.

Business Model Calculation explores the concept of how calculation and simulation can be carried out on top of a business model, with each business model element holding custom data. A simple visual interface inspired by touch is used to connect elements and create formulas. A chart is used to display possible outcomes when giving thresholds, rather than fixed values to a formula, in the spirit of what-if questions. This design was inspired by Bret Victor's work (2011) and Microsoft Excel's DataTable, which features as an alternative to the fixed formula approach implemented in the Strategyzer tool[1]. The starting point of this experiment was the lack of satisfactory results gathered when using the fixed formula approach to model a use case of a freemium example in a group evaluation. However, the prototype concept need to be further refined and evaluated before being suitable for publication.

A.4: Business Model Diver

Dive (zoom) into connected sub-models powered by graph database storage.

The Business Model Diver prototype is an experiment that takes a graph-based approach to storing multiple connected meta-models and their instances. It explores multiple different views of the same data and therefore allow to "dive", zoom into a sub-model of an element with a different representation. It is the prototype that is closest to the original OWL representation of the BMO. However, it was not pursued very far because of user interface problems that would not fit into the imposed limitation of being simple and one-page in length. And no immediate solution was identified. However, in terms of a more enterprise architecture-oriented approach, it looks promising.

A.5: Business Model Rules

Validate rules on busniess model elements interactions based on best practices.

The Business Model Rules prototype helps to build a coherent business model, assisted by rule validation that is carried out through the evaluation of elements and their attributes. Appendix C presents an adaptation of the guidelines that are defined in chapter 5. This prototype provides a proof of concept of what was described. Additionally, the prototype also explores the concept of providing attributes on which rules can be applied to elements by using the concept of layers. This is a different usage of the layer concept presented in chapter 6, where rules are used to group mutation operations into evolutions.

A.6: Business Model Layers

Visualize BM evolution and BM story outlining with a layered approach.

Business Model Layers helps to visualize and manipulate the evolution and alternatives of a BMC, whilst also guaranteeing the coherence of the operations. They form the main artifact, thus

[1] http://strategyzer.com/

supporting chapter 6 and are the result of multiple iterations. This also supports the use case described in appendix B.

A.7: Strategy Canvas

Realtime business object collaboration on simple data.

Strategy Canvas is an experiment that applied the design principles of CABMD to another business object (Blue Ocean's Strategy Canvas). It also aimed to explore the aggregation of values in order to provide some sort of crowdsourced collective hinting. However, this has not yet been explored to any extent, because the topic of collaborative work lies outside of the perimeter of current work.

A.8: Business Model Text

Business Model Story writer with auto-suggest and element creation from text.

Business Model Text is a small experiment that explores how we can transform between the text and canvas representations of business model data. Chapter 4 addressed the debate between the list-based versus free positioning of elements. Text is a third way of representing this information.

A.9: Business Model Types

Visualize business model's color grouping data.

Business Model Types is a prototype that was built as a research tool to visualize and analyze data on the business model types defined in chapter 4.

1.4.10 Appendix B Business Model Evolution Case: Valve Corporation

Appendix B gives a complete description of the two business models of Valve Corporation and their seven evolutions. It was used to identify and test the concepts put forward in chapter 6.

1.4.11 Appendix C Business Model Rules

Appendix C gives a description of the rules obtained by transforming the guidelines laid out in chapter 5, before implementing them with code developed in prototype A.5.

1.5 Artifacts

All of the articles use the design science research methodology in which the iteration around artifact plays a key role. An artifact can take many forms in DSR such as: concept, tool, language or methods. Table 2 presents a summary of each artifact for each chapter.

Table 2: Artifacts for each chapter.

Chapter	Artifacts
2. From Business Model Ontology to a Business Model Canvas	A **classification** of business model user proficiency into three levels: novice, expert and master. Accompanied by two new **concepts** to handle business model in a more dynamic way: - Business model story outlining (links and arrows) - Business model evolution (mutations and layers)
3. Supporting Business Model Modelling: a Compromise between Creativity and Constraints	A new CAD **tool/software** for business model design: BMDesigner (appendix A1).
4. Computer Aided Business Model Design: Analysis of Key Features Adopted by Users	Use of existing artifact to perform evaluation. Definition of a **visual notation** to compare business model by color tagging, attributes and position.
5. Business Model Design: an Evaluation of Paper-Based and Computer-Aided Canvases	**Guidelines** to enable business model consistency checking and transformation into **rules** which can be validated.
6. Visualizing Business Model Evolution with the Business Model Canvas: Concept and Tool	Refining of the visual layer **concept** to handle business model evolution, as well as its mutation (transformation) actions from one business model into another. A **prototype** tool to support the concept.
7. A Visual Approach to Business IT Alignment between Business Model and Enterprise Architecture	An intermediary **model** following the business model design language.
8. Privacy-Friendly Business Models for Location-Based Mobile Services	A business model **pattern** of an infomerdiary for privacy as value proposition.

1.6 Evaluation

In this research the focus is not on building a theory that can be proven by evaluation; rather, evaluation is focused on the created artifact. As proposed by Gregor and Hevner, (2013) in design science research it is possible to evaluate the artifact "*in terms of criteria that can include validity, utility, quality, and efficacy. Validity means that the artifact works and does what it is meant to do; that it is dependable in operational terms in achieving its goals. The utility criteria assesses whether the achievement of goals has value outside the development environment".*

The prototypes of this research validity must correctly support the design of a BMC. In addition, any additional features must offer utility to the end users; namely, the business model practitioners. Table 3 gives a summary of the type of evaluation carried out for each chapter. At different stages of the research different evaluation method have been used. Before asking users to evaluate whether or not the artifact works, its validity has been tested using the modelling of use case. To clarify the evaluation of each chapter the following four points are specified:

Objective: focus of the evaluation.
Criteria: aspect on which the evaluation is focused on.
Measure: type of evaluation and sample size.
Lesson: key insight gained by the chosen evaluation method.

Table 3: Evaluation summary for each chapter.

Chapter	Evaluation
2. From Business Model Ontology to a Business Model Canvas	Business Model Story Outlining and Business Model Evolution concept validated by the creation of a use case and prototype presented in chapter 6 (see below).
3. Supporting Business Model Modelling: a Compromise between Creativity and Constraints	Validity of the concept in the creation of the CAD tool in appendix A.1 Business Model Designer. **Objective:** beyond validity of the prototype, evaluate utility with end-users. **Criteria:** digital Prototype assist the creation of a business model, enforcing the constraints, while allowing for creativity. **Measure:** prototype evaluation through cognitive walkthrough with a small number of users. (Large-scale usage is evaluated in chapter 4.) **Lesson:** prototype is usable and provides a possible compromise between creativity and constraints for a CAD tool.
4. Computer Aided Business Model Design: Analysis of Key Features Adopted by Users	**Objective:** comparison of large-scale usage of two different CAD implementations. **Criteria:** usage of color, attribute and position in business model elements. **Measure:** analytics of usage data (database queries) of over 7'000 business models from around the world collected by two different CAD tool. **Lesson:** series of proposition to improve usage of advanced features by more users.
5. Business Model Design: an Evaluation of Paper-Based and Computer-Aided Canvases	Creation of the Zumba use case using the proposed guidelines Transformation of the guidelines into rules in appendix C. An implementation of the rules in a prototype in appendix A.5. The use case served as the basis for a comparison experiment between digital and paper tooling. **Objective:** experiment with students to compare paper-based business model design and CAD. **Criteria:** perceived usefulness, perceived ease of use, perceived task outcome, perceived task innovation, total elements, correct elements **Measure:** 43 master students of an e-business course. **Lesson:** the tested digital tool did not perform worse nor better than the paper canvas.
6. Visualizing Business Model Evolution with the Business Model Canvas: Concept and Tool	Prototype A.6 supports the Valve Corporation use case. Presents a solution to a problem that was described by practitioners in a survey: *"Evolution of a BM over time is difficult to visualize".* **Objective:** evaluate the usability and usefulness of the prototype implementing the concept method. **Criteria:** capacity for group of student to input and analyze their previously created project. **Measure:** direct observation of the 8 groups of students who used it to model their own project evolution. And Collection of feedback forms.

	Lesson: Preliminary evaluation that shows the validity of the concept in generating discussion and potential of the tool. The tool itself may require further iterations.
7. A Visual Approach to Business IT Alignment between Business Model and Enterprise Architecture	Intermediary model used on the Switcher SA use case. Intermediary model used by master's students. Cited by the academic community more than 10 times Presents a solution to a problem that was described by practitioners in a survey: *"Difficulty in translating ideas into business model architecture".* **Objective:** demonstrate the viability of the intermediary model. **Criteria:** feasibility of a use case of a real company. **Measure:** use case achievable without compromising the modeling. **Lesson:** works for the given use case.
8. Privacy-Friendly Business Models for Location-Based Mobile Services	The proposed business model pattern for privacy wad adapted from a model that was elaborated and evaluated through a statistical analysis of a survey. **Objective:** validate the privacy disclosure model **Criteria:** user's payoff of privacy information disclosed, based on the amount of control and personalization he has in a mobile application. **Measure:** 187 survey responses from bachelor students. **Lesson:** the amount of personalization available has a direct and positive effect on user's payoff. The pattern is used to illustrate four variant of business models, one of which is currently being implemented in a mobile prototype application.

Having used different evaluation method, none is absolutely better than the other, each has its merit in the right situation. However some comments can be made:

Direct observation and cognitive walkthrough allowed to be the closest to the participants, which was useful to separate user experience issues from concept issues during the evaluation.

The impact of user experience issues affecting the relevance of the data collected in the large scale experiment was harder to predict. On the other hand, it provided very interesting insights over a broader population. In order to better clean real world data (discarding unfinished models or models not following the methodology), the more additional context data is collected in the logs the better.

As for the statistical evaluation it was hard to create a model which isolates a specific variable. The complexity of the interaction of variables in the prototypes between user experience constraints and other technical factors which influence the key concepts makes them difficult to target.

1.7 Discussions

The findings of the seven presented papers can be used to answer the research question and its sub-questions. In this section, the contribution made by each of these papers is presented, along with the implications for practitioners.

How can computer-aided design help in designing and assessing strategic business objects, such as business models?

Chapter 2 shows that there are three different levels of use that need to be addressed when supporting BMC modelling. On the first level, the BMC supports novice users as they elicit their models; it also helps novices to build coherent models. On the second level, the BMC allows expert users to evaluate the interaction of business model elements by outlining the thread in the story ("business model mechanics"). On the third level, master users are empowered to create multiple versions of their business models, allowing them to evaluate alternatives and retain the history of the business model's evolution.

The lessons learned from observing the success of adopting a BMC success can be applied by academics to increase the chance of adoption of their future strategic model by practitioners.

For practitioners, this means that they will have access to better and more understandable methods that are aligned with their modelling proficiency levels.

Research sub-question 1: How can additional information, which is provided by the system or supporting design technics, help to elicit ideas?

To answer this sub-question, we should first refer to chapter 3, which shows that it is possible to replicate the paper experience of the BMC, whilst adding features such as attributes and multi-color tagging.

Following on from this, chapter 4 provides an analysis of the large-scale data which resulting knowledge was captured in a series of propositions for designing a strategic CAD.

Chapter 5 presents a way for us to evaluate CABMD tools using such metrics as perceived usefulness, and perceived outcome compared with real outcome in a given design task.

Chapter 8 introduces a business model pattern for privacy which can be used to elicit value propositions that are based on offering privacy as an intermediary.

For practitioners, this means that, in the future, tools that are designed in line with the propositions will better fit their needs and adapt to their business model proficiency level. For example, the positioning of elements for novice users could be automatic, with a free mode being left for experts who wish to use spatial layout positioning to provide additional meaning. Expert users could then test their model against the privacy pattern to see if it has any benefits. In addition, it may help them elicit new elements.

Research sub-question 2: How can additional information, which is provided by the system or supporting design technics, help in the assessment of ideas?

This question has been addressed by two different sub-topics. Firstly, chapter 5 proposes a set of guidelines which, if followed, can help build a more coherent business model. They can also be used to assess whether or not an existing business model is coherent. In order to be used with CAD tools, the guidelines first need to be transformed into rules. The way in which this is done is also illustrated. Prototype A.5 contributes by showing that the transformation from guidelines to a working assessment of a business model through rule validation is feasible.

Secondly, the outcome of chapter 7 is an intermediary model that can be used to connect the BMC with enterprise architecture. It also demonstrates that the concept of a one-page model based on a visual fixed layout can be applied to strategic objects other than the business model. In the use case, an example of the visual highlighting of alignment in a model is given. Although focused on the activity building block and IT, this "zoomed in" decomposition of a BMC model shows a possible way to further extend the canvas using a third party model and without changing it directly. Keeping a popular model unchanged has the advantage of limiting fragmentation in the practitioner community.

Practitioners can already use the given guidelines to manually improve the coherence of their business model, even if they are waiting on a commercial tool that implements these guidelines as rules in their software. The intermediary model is also useful in its own right as it offers common ground in discussions between strategic and operational concerns.

Research sub-question 3: How can additional information, which is provided by the system or supporting design technics, help to manage the evolution of ideas?

The introduction to this thesis described how innovation can be seen to emerge from iterations that occur when prototyping a wide range of possibilities. To support this iteration, it is important to track changes in the evolution of a business model. Chapter 6 proposed how to handle and visualize business model evolution, and presented the relevant techniques. An example implementation of the concept in a tool was also given.

Practitioners have access to a new way of visualizing the evolution of their business model. They can now also refer back to a detailed example in the form of the Valve Corporation use case presented in appendix B.

1.7.1 Contribution for practitioners

In summary, the prototyped techniques and proposition for using CAD tools in business will allow commercial CAD developers to create tools that are better suited to the needs of practitioners. This includes multi-color tagging to easily connect elements, rules to validate coherence of business models and features that are adapted to the correct business model proficiency level. An intermediary model can manage the alignment of IT with the business model. A business model pattern for privacy can focus on the value propositions. Finally, there is the possibility of describing and visualizing multiple versions of a business model.

1.8 Conclusions

Strategic thinking that uses the business model concept is growing in importance; nevertheless, there is still a lack of a tool to support it. An opportunity to provide computer-aided support to the task of business model design does exist. However, the typical user targeted by such a tool poses several constraints on its complexity and visual appearance. In an iterative design process, a number of concepts have been conceived, prototyped and tested in order to find working solutions that support the three phases of business model design (elicitation, assessment and evolution):

a) Creative design (elicitation) of the business model is addressed by giving the freedom that is available with paper-based methods, while offering additional help, such as multi-color tagging.

b) Assessment of the designed business model is explored with rules that validate the coherence of the model and an intermediary model to align it with enterprise architecture.

c) Management of the evolution of the business model and its variations is addressed by a concept of business model evolution and it's supporting visual representation.

The iterative and incremental design science research process based on improving prototypes has been an essential aspect of this research. Indeed, a failure to identify the prototype functions that did not work, would have meant it unlikely that a working solution could be found.

It should not be forgotten that, whilst good tools can be very helpful in that they allow us to achieve things which would be beyond our normal reach, they will not replace the need to think creatively!

References

Baden-Fuller, C., & Morgan, M. S. (2010). Business models as models. Long Range Planning, 43(2), 156-171.

Bouwman, H., De Vos, H., & Haaker, T. (2008). Mobile service innovation and business models (Vol. 2010). Berlin: Springer.

Chesbrough, H. (2010). Business model innovation: opportunities and barriers. Long range planning, 43(2), 354-363.

Gennari, J. H., Musen, M. A., Fergerson, R. W., Grosso, W. E., Crubézy, M., Eriksson, H., ... & Tu, S. W. (2003). The evolution of Protégé: an environment for knowledge-based systems development. International Journal of Human-computer studies, 58(1), 89-123.

Gordijn, J., & Akkermans, J. M. (2003). Value-based requirements engineering: exploring innovative e-commerce ideas. Requirements engineering, 8(2), 114-134.

Gordijn, J., Akkermans, H., Koks, A., & Schildwacht, J. (2004). User manual e 3-value editor.

Kim, W. C., & Mauborgne, R. (2005). Blue ocean strategy: How to create uncontested market space and make competition irrelevant. Harvard Business Press.

Gregor, S., & Jones, D. (2007a). The anatomy of a design theory. Journal of the Association for Information Systems, 8(5), 312–335.

Gregor, S., & Jones, D. (2007b). The Anatomy of a Design Science Paper: A Research Note. Retrieved July 03, 2009, from http://davidtjones.wordpress.com/2008/10/09/the-anatomy-of-a-design-science-paper-a-research-note/

Gregor, S., & Hevner, A. (2013). Positioning and Presenting Design Science Research for Maximum Impact. MIS Quarterly, 37(2), 337–355.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. Management Information Systems Quarterly, 28(1), 75–105.

Hevner, A. R. (2007). A Three Cycle View of Design Science Research. Information Systems, 19(2), 87–92.

Lê, L. S., & Wegmann, A. (2006, January). SeamCAD: object-oriented modeling tool for hierarchical systems in enterprise architecture. In System Sciences, 2006. HICSS'06. Proceedings of the 39th Annual Hawaii International Conference on (Vol. 8, pp. 179c-179c). IEEE.

Magretta, J. (2002). Why business models matter, Harvard Business Review. The Magazine. May 2002

Martin, R. (2010). Design thinking: achieving insights via the "knowledge funnel". Strategy & Leadership, 38(2), 37-41.

McGrath, R. G. (2010). Business models: A discovery driven approach. Long range planning, 43(2), 247-261.

Moody, D. L. (2009). The “physics” of notations: toward a scientific basis for constructing visual notations in software engineering. Software Engineering, IEEE Transactions on, 35(6), 756-779.

Osterwalder, A. (2004). The business model ontology: A proposition in a design science approach. Institut d’Informatique et Organisation. Lausanne, Switzerland, University of Lausanne, Ecole des Hautes Etudes Commerciales HEC

Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying business models: Origins, present, and future of the concept. Communications of the Association for Information Systems, 16(1), 1–25.

Osterwalder, A., & Pigneur, Y. (2013). Designing Business Models and Similar Strategic Objects: The Contribution of IS. Journal of the Association for Information Systems, 14.

Sosna, M., Trevinyo-Rodríguez, R. N., & Velamuri, S. R. (2010). Business model innovation through trial-and-error learning: The Naturhouse case. Long range planning, 43(2), 383-407.

Teece, D. J. (2010). Business models, business strategy and innovation. Long range planning, 43(2), 172-194.

Victor, B. (2011). Up and Down the Ladder of Abstraction: A systematic Approach to Interactive Visualization, retrieved April 4th 2012 http://worrydream.com/#!2/LadderOfAbstraction

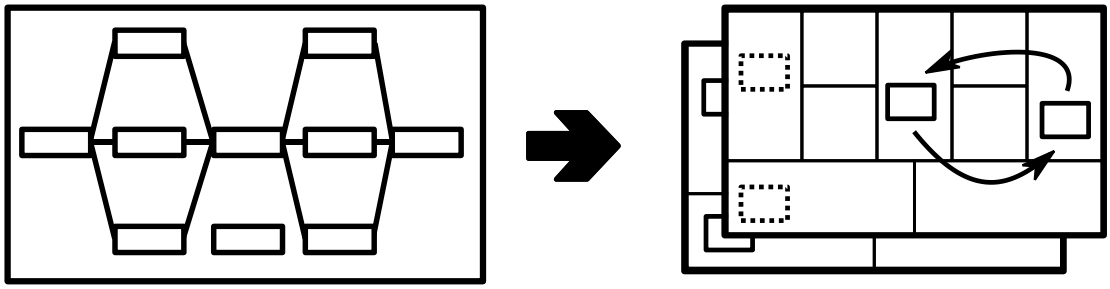
Wegmann, A. (2002). The Systemic Enterprise Architecture Methodology (SEAM). Business and IT Alignment for Competitiveness.

Zott, C., Amit, R., & Massa, L. (2010). The business model: Theoretical roots, recent developments, and future research. WP-862, IESE. September.

PART I – VISION

Chapter 2
From Business Model Ontology to a Business Model Canvas

Submitted to Communications of the Association for Information Systems 2014



Abstract
When designing and assessing a business model, a more visual and practical ontology and framework is necessary. We show how an academic theory such as Business Model Ontology has evolved into the Business Model Canvas that is used by practitioners around the world today. We draw lessons from usage and define three maturity level. We propose new concept to help design the dynamic aspect of a business model. On the first level, the BMC supports novice users as they elicit their models; it also helps novices to build coherent models. On the second level, the BMC allows expert users to evaluate the interaction of business model elements by outlining the thread in the story. On the third level, master users are empowered to create multiple versions of their business models, allowing them to evaluate alternatives and retain the history of the business model's evolution. These new concepts for the BMC which can be supported by Computer-Aided Design tools provide a clearer picture of the business model as a strategic planning tool and are the basis for further research.

Keywords: Business Model, Business Model Canvas, CABMD

2.1 Introduction

A variety of ontologies exist which are geared to describing enterprises. In this paper we focus on an ontology that describes a specific part of an enterprise: its business model. Nonetheless, there are many different business model ontologies which focus, for example, on economics, process, or value exchange between companies. Methods that use these ontologies can be more or less formal, ranging from those that have basic elements to those with complex interactions between attributes and subcomponents. Business models are a good way to share a common language about part of a strategy across a multidisciplinary team. These methods enable quick

communication, and help improve the design of a new business model, as well as assess existing ones. Visual representation and a simple common language are two essential characteristics for creating such a business model tool.

Competition for companies and start-ups has evolved in the past decade. Today, success cannot be achieved on product innovation alone. Having the means to improve the design of business models has become a real issue for entrepreneurs and executives alike. New ways to brainstorm and structure ideas relating to business models are required. This can be translated into a need for a more visual and practical ontology or framework for designing and assessing a business model.

One such business model tool which is getting adopted is the Business Model Canvas (BMC) (Osterwalder & Pigneur, 2010). The current, version of the BMC is an evolution from the original academic work the Business Model Ontology (BMO) (Osterwalder, 2004). The need to evolve the model took place to better fit the needs of practitioners and was influenced by design thinking practices. From this basis, we look at what are the next evolution of the canvas. Through observation gained from, giving workshops, teaching to students and a survey, it appears that the building blocks of the BMC are covering the main needs, however usage itself of the model seems very basic and is limited to static analysis of one business model at a given time. In reality, companies have to change and adapt to internal and external changes which impact their business. Therefore, a business model method should also consider the dynamic nature of transformation and evolution of the model.

This brings us to the following research question:

How to represent and help to design the dynamic aspect of a business model with the Business Model Canvas?

The current usage of the business model canvas correspondence to a maturity level we define as novice. Novices use the canvas to have a common language to design a business model and use the canvas ‘building blocks similarly to a checklist. This does not address the dynamic nature of a business model which transforms over time.

Inspired by transposing the metaphor of plane building in engineering and evolution in biology to business model designing, as well as with insights gained from workshops on the business model canvas, we propose two additional maturity levels: experts and masters. Each level builds on the previous and comes with their respective method: business model story outlining and business model evolution, to address the dynamic nature of business models.

We adopted the following design science structure for our paper: After this introduction, we present the prior work on the business model canvas with a focus on its origin, evolution and adoption. Followed by a short presentation of the methodology and how we address the research question in multiple parts. The main artifact section presents two new concepts: business model story outlining and business model evolution, to help address designing the dynamic aspect of a business model. In the evaluation section we present the validity of the concept. We end the paper with a discussion and a conclusion on the implications for future research in business model design.

2.2 Prior Work

In this section we present the origin of the business model canvas and how it evolved through the years influenced by its adoption. Business model ontology has evolved since its initial design. Retrospectively, we can distinguish there distinct stages: 1) the creation of BMO, 2) followed by its first confrontation with reality, 3) which then paved the way for its design-influenced redevelopment.

Additionally, we present some results from a survey as further justificatory knowledge to support our claim of adoption and relevance of the business model canvas design techniques.

2.2.1 Business Model Ontology

Business Model Ontology (BMO) uses nine building blocks to describe a business model: Value Proposition, Customer, Channel, Relationship, Revenue, Value Configuration, Capability, Partnership, and Cost. These buildings blocks are shown in Figure 1. The model's scope is limited to the business itself and does not directly cover any environmental factors. Its key strength is the emphasis it gives to the relationship between the components. A coherent business model is created by correctly connecting elements from within the nine building blocks. Exploring these connections can help to identify missing elements or discover ambiguous assumptions within a model. In summary, BMO focuses on identifying **what** is provided to **whom**, **how** it is produced and **how much** profit it generates.

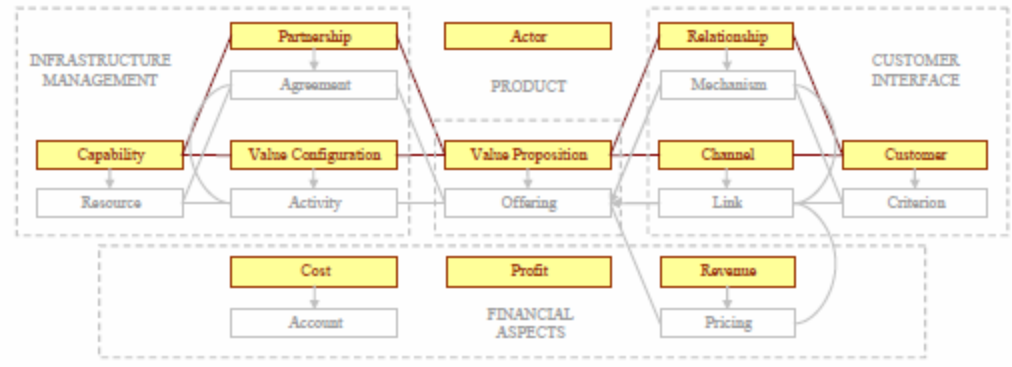


Figure 1. Business Model Ontology (Osterwalder, 2004, p. 44)

2.2.2 Alternative Business Model Languages

Whilst many other business model languages exist, this paper does not include a detailed comparison of them. We have, however, sought to highlight the differences between BMO and its closest alternatives. Starting around the same time as BMO, e3-value (Gordijn & Akkermans, 2001) includes many similar concepts, many of which can be mapped between them (Gordijn, Osterwalder, & Pigneur, 2005). In particular, e3-value goes into more detail about the interactions between the components. In addition, it specifies the value which is exchanged in both directions and the way in which it flows. Using e3-value, it is possible to go beyond creating a single business model; indeed, it is also possible to model the interactions between business models within a sector. This detailed modeling of interactions comes with the necessity to specify ports through which the connections flow. Consequently, this makes visual representation more complex. The

relationship between elements can further be described with types and values that allow for the basic financial calculation of the model.

Business Model Ontology can assess financial elements only on a very abstract level, using cost structures and revenue streams. In contrast, REA (McCarthy, 1982) is a business modeling language that has its origins inspired by accounting. The focus is on the description of the transaction and the monetary values. Different representations exist, but are based on technical visuals such as UML.

Whilst BMO is concerned with providing a small but complete set of strategic components to describe a business model, another modeling language, known as SEAM (Wegmann, 2003) also exists. SEAM focuses on enterprise architecture and addresses the issue by providing a hierarchical decomposition. It uses a visual representation to handle the encapsulation of its hierarchies, which allows an exploration of the underlying resources and processes that contribute to the high level element. In the past few years, SEAM (Golnam, Ritala, Viswanathan, & Wegmann, 2012) and BMO (Osterwalder, 2012) have both evolved ways to better describe and explore the connection between the value proposition and customer segments. An essential part of both models is to be able to visually display the elements and show their connections at the same level as the concepts. The visual handling of encapsulation does, however, generate complex diagrams, which can be hard to read for the non-initiated.

Weill and Vitale (2001) illustrated a method for the schematic description of e-business models. The focus is on the simple interactions between the firm and its customer and suppliers, which are drawn on a blank canvas. An indication of the direction of interactions is given, along with the type of flow. Thus, it adds value to an interaction in a way that is similar to e3-value; however, it is more general since it does not define ports or go into more detail about the flow itself.

2.2.3 2000-2004: Business Model Ontology

The development of BMO emerged from the need to define new business models for e-commerce around the year 2000. Following academic research, a first version of BMO was published in 2002 at the 15th Bled Electronic Commerce Conference by Osterwalder and Pigneur; it took the form of a framework that was specially targeted at e-businesses. Over the next two years, the work further matured, resulting in the publication of Alexander Osterwalder's thesis (Osterwalder, 2004) in which he described the key building blocks and their interactions. The model was presented as an ontology with elements of the modeled case becoming instances of the meta-level elements defined by the ontology.

2.2.4 2004-2008: Simplification

Following its academic publication (Osterwalder, Pigneur, Tucci, 2005) the model was used in two different contexts between 2004 and 2008. It was applied to tutorial cases delivered to IS students; thus, it was simplified, but still used in an academic context. The model was also used with practitioners in workshops and consulting sessions. Here, the model was applied to actual business problems in order to gain an understanding of how the model is used within a wide spectrum of business types, beyond just e-business models. Both of these applications sought to constraint the model as a one-page diagram. Special positioning was used to identify the type of

each element and best practice was further strengthened by using keywords to describe each element. The changes were not only visual; the names of some of the elements themselves were also changed to better fit the vocabulary of its users. The nine names, which are shown in Figure 2, are: Value Proposition, Customer Segment, Distribution Channel, Customer Relationship, Revenue Stream, Key Resources, Key Activities, Partner Networks, and Cost Structure.

2.2.5 2008-2012: Business Model Generation

Insight gathered during the previous years and the emergence of a small community around Alexander Osterwalder's blog led to the creation of a book project to communicate the result of these transformations. Convinced that the visual aspect of the model is a key component and largely influenced by the design-thinking movement and "managing as designing" (Boland & Collopy, 2004), the book was intended to offer a visual perspective. In turn, this led to a designer being brought on board to redevelop the layout of the canvas so that it became the BMC we know today. New features include the pictograms that illustrate the nine building blocks from the theory, their rectangular layout and an axis of symmetry around the value proposition (left side, right side) , as seen in Figure 2. By providing examples from different industries, the book project further helped to crystalize the ideas on the usage of the BMC. In particular, it showed how the BMC can integrate a design-thinking process and explored the notion of partial meta business models known as patterns (Osterwalder & Pigneur, 2010).

To strengthen the link between theory and practice, the book was written in collaboration with the community. This was done by setting up a community hub with forums. Early drafts were published on the hub for review by subscribed members. This created a following of those interested in business model generation and further helped to promote the book. Many followers also put business model generation into practice, which eventually led to its success. From the start, the community was global in nature. Now, with many translations of the book made available, it is expanding even further.

Teaching of the BMC has been adopted by managerial and entrepreneurship courses in over 250 universities. In turn, this has increased adoption. Furthermore, there has been a steadily increasing number of workshops and consultant-led master classes, as well as internal education programs in large corporations

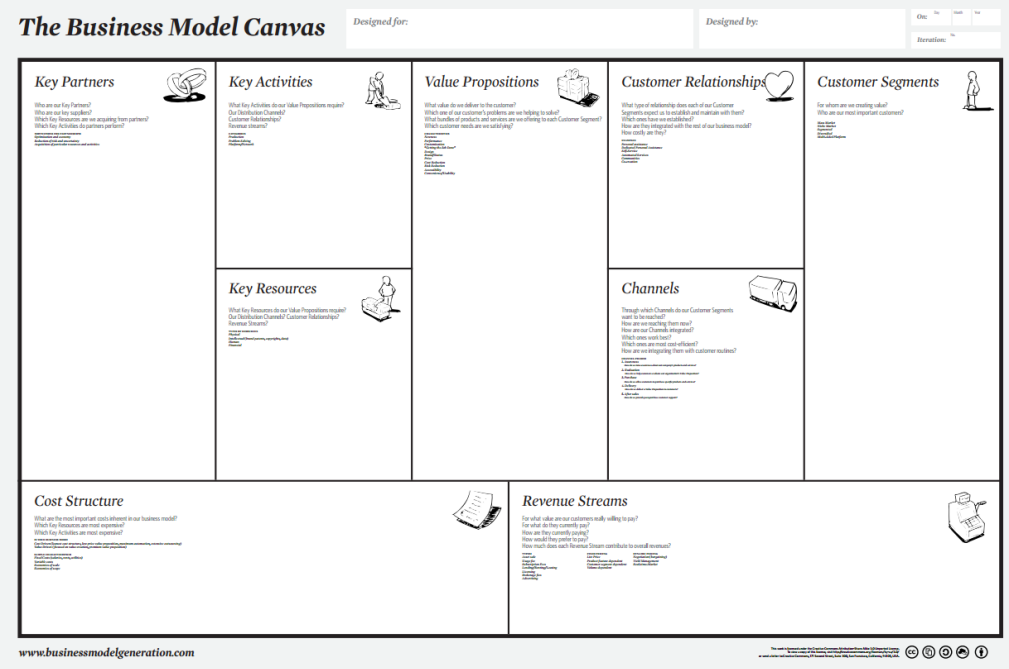


Figure 2. Business Model Canvas – businessmodelgeneration.com

2.2.6 Adoption after Book Release

Since the release of the book Business Model Generation in 2010, adoption of the BMC has grown to become a worldwide phenomenon: the original community hub of 400 people which helped create the book has grown to 14,000 members. The book itself has been translated into 29 languages and sold over 1,000,000 copies. Using one popular search engine, a search on "Business Model Canvas" results in over 3.5 million results. Other communities, such as Customer Development (Blank & Dorf, 2012), have started using the BMC as a supporting model for their theories.

2.2.7 Practitioners' Survey

Business Model community members participated in a survey. The participants confirmed that visual aspects and the use of a common language to facilitate group discussion were key reasons for opting to use the BMC (as shown in Table 1). One interviewee summarized it clearly by stating that: "It makes an integrated discussion, focused on the interrelationships of essential building blocks possible" (Survey 2013 - Why did you choose to use the Canvas?)

Table 1: Survey question

Why did you choose to use the Canvas?		N= 1,229
Visual aspects	65.3%	803
To facilitate group discussion	61.0%	750
Intuitive	54.3%	667

The BMC gained the strongest foothold in the entrepreneurial community, who have in an interest in building new business models. However, the BMC is not limited to only design such models. A common language can also be used to analyze a current situation and then help with strategic reorientation towards a better performing business model. Table 2 shows that whilst a

new business model is the primary activity, the desire to work on an existing business model is non-negligible.

Table 2: Survey question

What has been your primary reason for using the Canvas?		N= 1,120
Development of an entirely new business	35.8%	401
New product/service development within existing business model	21.3%	238
Strategic reorientation	19.6%	219
Renovate old business model	14.8%	166

As can be seen in Table 3, the participants came as much from corporations as from the entrepreneurial world; meaning that neither has biased the previous result.

Table 3: Survey question

What type of organization do you primarily work for?		N= 1,616
Corporation	29.1%	470
Start-up (younger than 5 years)	21.3%	345
Self-employed	15.4%	249
Boutique consultancy	14.6%	236
University	8.6%	139
NGO/non-profit	5.3%	85

From this survey we can see that the simplicity of the one page visual layout is a key component from its adoption. But the results also show that a third of the use is focused on improving / transforming an existing business model. A usage which is not best served by the static BMC, a more dynamic approach to move between as-is and to-be state is needed. Additionally, the current design method and recommendation focus on breaking innovation, while maybe a more traditional methods focus on renovation with planned transformation is needed.

2.3 Methodology

In this study, we used Design Science Research (DSR), as described by (Gregor & Hevner, 2013). They defined a process in which artifacts are built and evaluated in an iterative process in order to solve the relevant problems. The need to take a visual approach to creating the BMC was driven by design-thinking theories and the identified need for practitioners to have better tools that can be easily integrated into daily practice. Existing knowledge of business model ontology has been described in the previous section. It was shown that Information Systems (IS) has the necessary body of knowledge to handle “strategizing as designing” (Osterwalder & Pigneur, 2013).

2.3.1 Users maturity level of business model canvas modeling

The BM canvas was evaluated using data and evidence from its use in the real world, books, canvas, hub, and the workshops and lectures that were used to inform the following three maturity levels:

- Novice – use the BMC as a simple common language and visualization help.

- Expert – use the BMC as a holistic vision to understand and target a business model's sustainability. They understand the model's methods, such as high level links and colors, which helps to connect ideas and follow the interactions.
- Master – use the BMC in the global Strategy, which is a process that evolves and adapts to its environment. They understand that the design of a model has to accompany such a process by supporting concepts of iteration, transformation (mutation) and choosing alternatives (selection).

Having defined these three level of proficiency we use it to decompose the research question into three sub-questions:

Novice level usage is the most commonly observed and fully applies to the static use of the BMC. Before moving to a dynamic representation of a business model, it should be guaranteed that at a static level it is already a coherent model. Which leads us to the following sub-question:

How can the static design usage of the business model canvas be improved (in relation to its coherence)?

Expert and Master level design of BMC are not observed frequently and lack representation due to their requiring a more dynamic aspect of the BMC.

For the expert with a focus on internal interactions this leads us to the following sub-question:

How to represent the dynamic aspect of interactions happening inside the business model?

Handling multiple states of a business model at the master level leads to the following sub-question:

How to represent the transformation from one state to another of a business model?

In the next section, we address these questions individually each with their own artifact.

2.4 Artifact

In the next three subsection we consider each business model canvas design task of each mastery level by looking first at a metaphor of a similar design task in another design domain. This metaphor applied to business modeling does then guide the proposition of a new concept. We then illustrate how each concept applies to a small common example: the case of Apple's iPod business model. Each Artifact also describes in a short summary the essence of the mastery level to further offer a clear way to differentiate the three levels.

The following three concepts are presented below:

- BM Canvas Coherence helps to improve static business model modeling by way of using guidelines to check coherence of the business model.
- BM Story outlining proposed to use colors and arrows to outline the interactions happening inside the business model.
- BM Evolution is a way to visualize business model transformation from one state into another. Applying these transformation multiple times results in a branch showing the evolution of the business model.

2.4.1 BM Canvas Coherence

At the novice level, the focus is on the concepts of the ontology, meaning the nine building blocks that define a business model. The main task consists of designing a business model by filling in elements for each block. Designing a business model can be best described using the metaphor of an architect engaged in designing a house. The architect needs to know about the various components of a house, such as the walls, doors, windows, roof and stairs, and also how they relate to each other. A wall can have windows and doors. A room has four walls with at least one door. Beyond such constraints, however, the architect is free to produce a variety of designs for a house. During the design process, the architect puts forwards his ideas using sketches and prototype models. These prototypes are not finished products, but are specifically aimed at testing the interaction of a selection of concepts in the specified context of the prototype. Transferring this design technique to a business model design means creating different business model variations of component interactions. For example, when prototyping a specific customer segment, the value proposition set could have its revenue stream type switched from paying to free, or from sales to subscription. This could then lead to further prototype changes to dependent components. This iterative validation of ideas leads to a business model that has all its components matching to become a “usable” business model. Checking the coherence between the elements is a key requirement for a valid business model. It is not enough to only produce a checklist of items without verifying their compatibility. Again, with reference to our architecture metaphor, stairs should be used to connect floors, and a door should lead to a room rather than nowhere. We call this “usability”. Similarly, in a business model, a value proposition needs to offer added value to a customer segment requiring it. A value proposition without a customer segment indicates a non-coherent business model. The iterative validation of design ideas can go as far as “getting out of the building” and test the assumptions directly with the potential customer as is done in Customer Development (Blank & Dorf, 2012). The gained insights may help to validate the hypothesis of the prototype or else offer new ideas to make a pivot of the model to target different customers.

2.4.1.1 In summary

At the novice level, the concepts of the model identify the right elements and how they are related to one another. An iterative process that explores detailed features of the elements helps to adjust the elements that make up the model in order to solve real problems. This leads to a coherent model that addresses the right job.

2.4.1.2 Apple iPod BM Canvas

In this example, we focus on Apple’s iPod business model. A model can be described by its elements, with keywords for each of the nine building blocks. Alternatively, illustrations can be used, as shown in Figure 3. The value proposition is a seamless experience that includes listening, managing and buying music. It is targeted at consumers who want to listen to music wherever they go and have access to a computer. The distribution channels to reach these consumers is a store or online-shop where the device can be bought along with iTunes software to manage the music library. Sales of the device generate revenue with higher margins than sales of the songs, where most of it goes to the majors. The customer relationship is oriented towards the lifestyle

experience of Apple products. In order to offer these services, the key activity is the design of the device. Key resources are the device itself, music contracts, the developers and the Apple brand which strengthens the customer relationship. Marketing and developers are the key cost structures. Music licensing and device manufacturing is carried out through the partners.

This business model slice is coherent since as described each element is connected to another. There are no orphan elements, nor any combination of elements not connected to the rest of the business model.

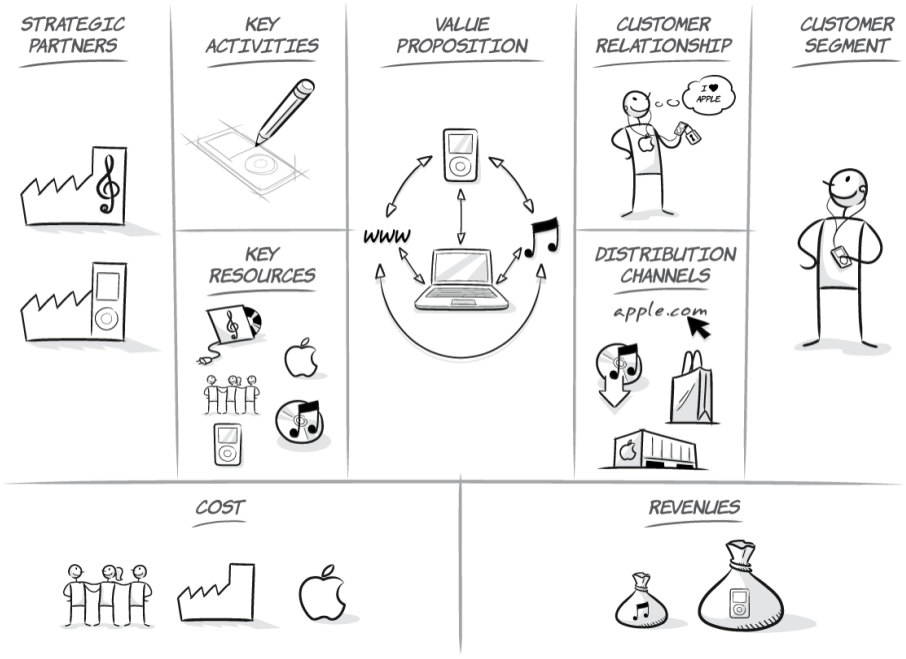


Figure 3. Apple iPod BM Canvas ©XPLANE 2008

2.4.2 BM Story Outlining

At the expert level, knowledge about the BMC and the requirement to design a coherent model is well incorporated into practice. The focus is on analyzing the interaction of the model's elements beyond the relationships between them. It is not just about how one element relates with its connected elements, but about how they contribute to the overall thread of the business model story. A chain of interactions must be built from one element to another throughout their relationship. To continue with our comparison with other design domains, we move from architecture to engineering, where it is not enough to just know about the concept. An engineer needs to know about the underlying physics that supports the concepts. For example, it is not enough to know about the concepts that make a plane; we also need to know about their interactions. Without knowing how the aerodynamic properties of a wing generate lift, it would be impossible to design a plane that flies. Trial and error with prototypes that are not based on physical calculation would result in a large number of failures. What's more, the end result could not be explained fully. Similarly, in the design of business models, the activity has to move beyond prototyping and try to simulate the model to see if it is "workable". A good business model needs to both do the right job and be sustainable. Business model story outlining, outlines how elements influence each other beyond their relationship. The story can illustrate the flow of the exchange

value between customers and the product and how it is produced. It is about understanding the underlying interactions which make the business model possible. In this context, explaining a revenue stream can for example depend on a partner (a relationship which is not defined in the basic ontology). These connections can be drawn using arrows at the top of the canvas to show the story. Elements can also be added to the canvas one after another while telling the story; this helps to strengthen the illustration. Another way to highlight the connectedness of elements is to use colors.

2.4.2.1 In summary

At the expert level, the business model concepts of the canvas are well understood, and analysis has moved beyond the elements towards the interactions based on their relationships. The business model is coherent and does the right job. Above all, the interactions needed to make it work are understood. Thus, the model is the right one and has the potential to be sustainable if implemented correctly.

2.4.2.2 Apple iTunes BM Story Outline

In the case of the Apple iTunes, two stories can be identified (see Figure 4): the music part (shown using dotted lines), and the device (iPod) and brand part (shown using dashed lines).

In order to make the platform attractive, Apple had to offer a broad selection of titles, including all the popular songs. This was achieved by making deals with all the big majors. Skill and leverage were required to be able to make deals which will make the platform competitive on pricing and title selection. Initially, to get the majors on board Apple added Digital Rights Management (DRM) to protect the digital music files; this had the side benefit of locking the user in to Apple's devices and software platform.

On the device side, functionality and esthetics had to be combined in the design activity to create a product which is in line with the customers' brand expectations.

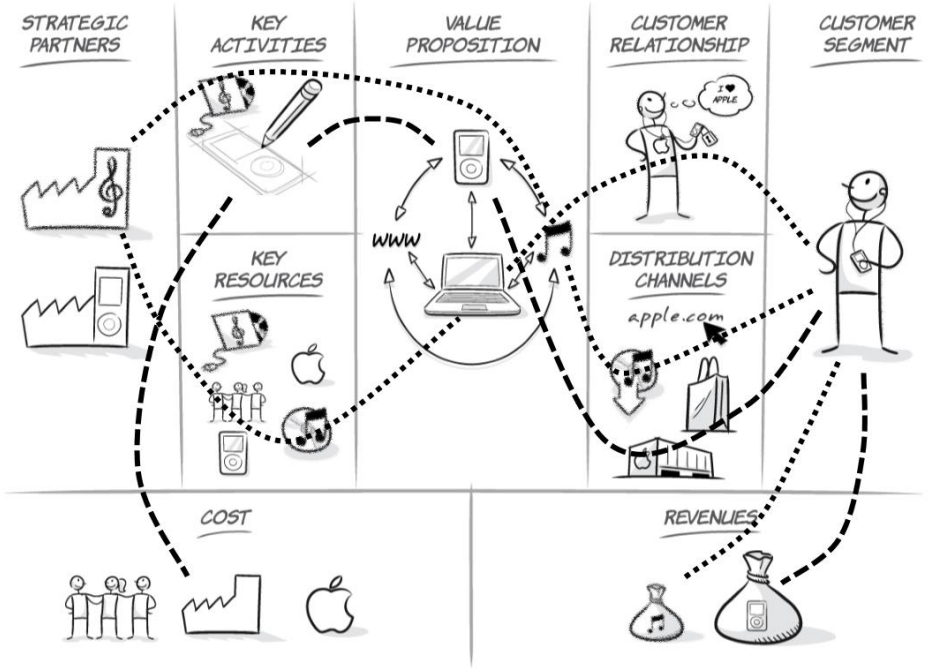


Figure 4. Apple iPad BM Mechanics adapted from ©XPLANE 2008

2.4.3 BM Evolution

At the master's level, any considerations go beyond the current business model. Masters are not afraid of the unknown and are ready for anything. There is an understanding that the strategy has to have a longer-term vision that extends beyond the current business model, and that to survive, it has to be able to evolve. The focus is on actions that can be taken to evolve from one business model to another. In order to be aware of incoming changes, observation of the business model's environment is key. Our architecture and engineering metaphor has its limits; indeed, we would need to use analogies from the realm of science fiction to illustrate transforming behaviors. Therefore, a better analogy is the concept of biological evolution. Individual business models can become obsolete and die off; however, the "species" evolves and survives through mutation and selection. This means that in order to survive decay, new business models (mutations from existing ones) have to be tested continuously. When proven successful, they are selected. Sometimes, the previous business model might even be cannibalized by it.

A business model can do the right job and be sustainable and still fail if it is not adapted to its environment. Unlike our biology analogy, the variations of a business model can be planned so that it can be ready to adapt when the environment changes. This involves planning different business models for a range of scenarios (Schoemaker, 1995) and then being ready to switch to them depending on the environment. The adaptability of a business model to its context is key.

Various external occurrences may affect the business model at any time; thus, different alternatives need to be kept should one of them become a reality. Keeping track of the mutation in relation to external stimuli necessitates the management of different versions of the business model. The creation of multiple versions of a business model to address different external environments is a first step. Another step is to know how to adapt from one version of a model to another. In this case, the transformation between them needs to be highlighted. For that purpose, we propose to use the concept of transparent layers to stack business models parts on top of each other. On paper this can be done with tracing paper, each new layer can show new elements and reuse of element which are visible in a semi-translucent fashion from lower layers.

Together, the two steps allow us to evaluate a model in the light of external factors, thus enabling us to select the business model that fits best.

The combination of multiple transformation from a given state help form a graph or a tree with branches of possible evolution paths to follow for the future business model. As well as to visualize the past transformations which lead to the current state of the business model.

2.4.3.1 In summary

At the master's level, business model concepts and interactions (story) are well understood, both in terms of a single model and the analysis of multiple models. Decisions are made with the environment in mind in order to deploy the right model in the right context. Using this strategy, business models can be evolved to adapt to any change.

2.4.3.2 Apple iTunes to App Store BM Evolution

The transformation from a music service to a software platform takes place in an environment that has many components. It is not possible to go into detail here because of the limited space available. However, one external factor we can mention is the opportunity to switch to a touch-

based screen for a phone device by combining new external technology with internal knowledge of the design of human friendly interfaces.

To create the App Store business model (seen in Figure 5), Apple evolved their iTunes business model by reusing existing components, expanding others and adding new ones. Apple capitalized on its knowledge of design, value chain management and store to build and distribute a new touch based phone (iPhone). New components included the extension of the distribution channel to also include the new partner, the mobile phone operators. Taking advantage of their knowledge of building software development kits for computers, Apple created a development kit for the phone which is targeted at a new customer segment of developers to create mobile apps. To manage the quality of these apps and handle financial transactions, a validation process and revenue sharing model had to be put in place. Putting these pieces into place helped to create an eco-system that connects phone users in need of specialized apps with a large developer community willing to provide them for a small price. This transformation was much more than a product innovation; rather, the whole business model moved to a double sided business model (Eisenmann, Parker, & Alstyne, 2006), connecting the developers with the phone users.

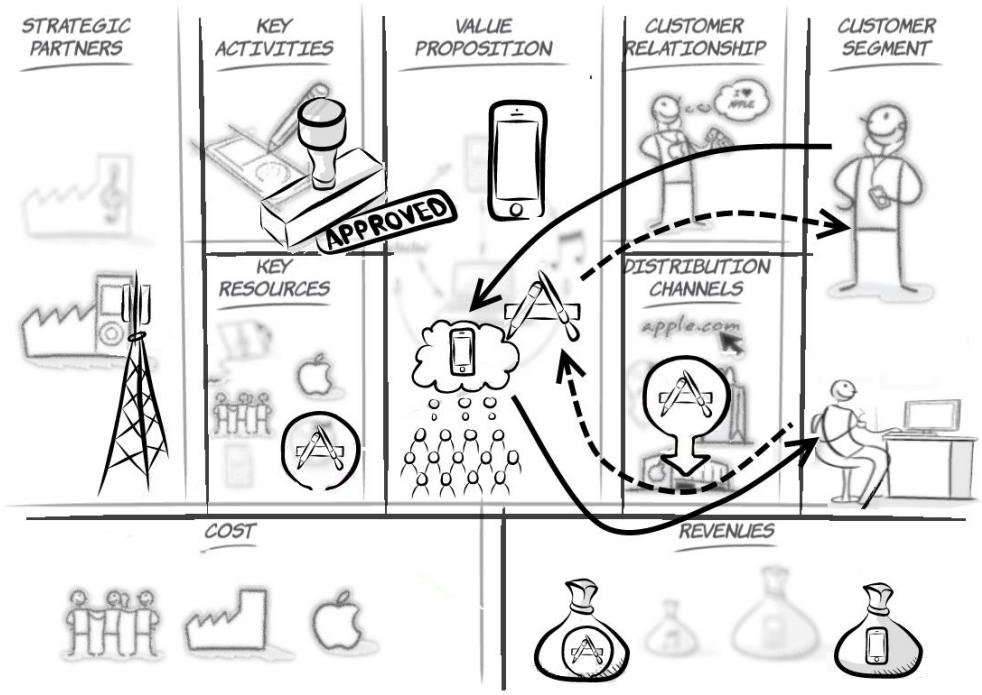


Figure 5. Apple iTunes to App Store adapted from ©XPLANE 2008

This example illustrated one transformation, to form an evolution path multiple such transformation can be combined, for example one path is the following list of business model transformations: Apple iPod mp3 player -> Apple iPod with iTunes music service -> Apple iPhone and App Store -> Apple iPad addition -> possible new business model direction in either personal health devices, televisions, automotive or different pricing structure for existing products.

2.5 Evaluation

The first evaluation of the proposed concept is their instantiation into cases. Being able to use the concept to represent real world business models demonstrates the validity of the artifact. The

second part is to show their utility having user employing the proposed technics to represent their own business models. Since the proposed concept are still very early ideas, a further step would be to refine them. This would allow for them, for example, to be implemented into a computer-aided design tools for business models. Providing advantages of automating some of the concepts more tedious interactions such as validating constraints, editing arrows paths and changing visibility of elements.

For each of the three artifact, we give a summary of related work which was done to extend and evaluate the concept and propose some further possible evaluations.

2.5.1 BM Canvas Coherence

Useful validation questions and best practices emerged during the years of teaching workshops on the business model canvas. Some of which have been formalized into guidelines and applied to build an expository case business model (Fritscher and Pigneur, 2014c). Future work is to transform these guidelines into rules which can be validated by a CAD system. This could then be evaluated to see how automated validation of the coherence of a business model can assist the creation of better business models. Initial testing with a group of students without computer-aided design showed that they lacked the perseverance to rigorously apply them manually.

2.5.2 BM Story Outlining

Drawing arrows on top of business models is also something that emerges naturally in design session. Therefore it is already somewhat in use although not in a guided fashion. However, it is not always used as described in the story outlining technique. Previous work has shown that formalized links do not get adopted by the users, instead color tagging of elements can be used (Fritscher and Pigneur, 2014b). This suggests that for formalizing the story outlining feature, attention should be focused on not making the arrow interaction too constraining or complicated.

2.5.3 BM Evolution

The business model evolution concept with its two parts: transformation (mutation) and path of possible (selection) is a somewhat complicated concept. Especially to create the visual representation on paper. Wanting to explore alternatives can lead to a lot of copy work and stacking multiple versions of transformation on top of each other can get visually cluttered. An initial instantiation into a CAD tool has been attempted and shows promising results (Fritscher and Pigneur, 2014d). The creation of the prototype tool lead also to the building of a case which describes a real world business model evolution over seven transformations and two business models evolving in parallel (appendix B). This illustrate the potential of using a layered visual approach to represent the dynamic nature of business model evolution.

2.6 Discussion

Although we presented the three concept separately, each successive level of maturity builds on top of the previous ones. A business model has to be coherent in itself before exploring its dynamic aspect. The prototype built to support BM evolution visualization also supports drawing of arrows for BM story outlining. This shows that the feature of drawing arrows combines itself nicely with

the layers that support the transformations of the evolution. This combination which provides means to decompose the internal story into states that from a temporal segmentation of the actions happening in the business model story. This can then be visualized with layers as the evolution of the story.

Implementing prototypes to support the concept required to identify how the different design technique can be support by CAD functions. We summarize them in the next section.

Documenting the transformation which BMO went through to get adopted by practitioners gave us some insight into elements which made it possible. We present our observation in the section entitled: Lessons learned for business model methods designers.

2.6.1 Design Techniques and Supporting CAD Functions

In table 4 we provide a summary of the key design techniques and supporting CAD functions for each concept of the three maturity levels.

At the novice level, BM Canvas Coherence can be improved by following guidelines. It is possible to formalize these guidelines into verifiable rules. This in turn allows to perform validation or trigger contextual hinting assistance with a CAD tool. In order for the tool to get a better model, it is needed to indicate some of the elements relationship. This can be accomplished by tagging them into different colors, which is simpler for the user than explicitly connecting them with links.

At the expert level, BM Story Outlining helps to provide a clearer picture on the internal interaction of the business model. In order to support such storytelling, functions like color and arrows can be used on top of the BMC. In addition, a CAD tool can help by toggling the visibility of elements as the story progresses allowing for a dynamic representation of another ways static canvas. This temporal execution of the models' story can then be tailored to the individual stakeholders, the dynamic management of the visibility allowing to support multiple stories on the same canvas.

At the master level, BM Evolution helps to address the transformation required by renovation and exploration of possible future states envisioned by scenario planning. Through layers, versioning and by allowing to compute custom views of superposing layers CAD tools offer dynamic visualization showing any chosen past, present or future state of a business model. Also by chaining the transformations, it can be known which change affects any descendant element's future state. A new computation of these updated views can be performed by the tool without any work from the designer

Table 4: Summary of concept, design technique and CAD functions

Maturity	Concept	Design Technique	CAD functions
Novice	BM Canvas Coherence	Guidelines, rules	Colors, validation, hinting
Expert	BM Story Outlining	Storytelling	Colors, arrows, elements visibility
Master	BM Evolution	Renovation, what-if, scenario planning	Layers, versioning, computed views

2.6.2 Lessons Learned for Business Model Methods Designers

Based on the lessons gained from our experience we can share the following observations on the possible influences on the success of a business modeling methods. These will help to broaden the adoption of an academic enterprise ontology by practitioners:

- Designing a method that can scale in complexity for various proficiency levels, from novice to masters, helps its adoption.
- Performing design science evaluation cycles and evolving the method after each evaluation is key to identifying the right balance between simplification and the re-addition of elements at different proficiency levels.
- Finding the right community is important: people need to be willing to quickly test and iterate the model's concepts. (In our case, entrepreneurs were the ideal test participants; it is in their nature to try out business model concepts, which allowed for quick iterations).
- Providing a tool (free canvas and book) empowers teaching at a university level as well as in workshops, thus helping to spread the method.

2.7 Conclusion

Starting from observation on the evolution and adoption of the BMC we identified the need to address the issue of how to represent and help to design the dynamic aspect of a business model with the Business Model Canvas. Based on observations we identified three maturity levels of business model canvas design and addressed the issues in three sub-questions:

How can the static design usage of the business model canvas be improved (in relation to its coherence)?

At the novice level, the simple nature of the canvas helped in its adoption. This simplicity lends to the use of building blocks as a checklist. It is however necessary to keep in mind the relationship between the elements in order to maintain the underlying ontological nature of the business model theory. Guidelines can help to verify these relationships and thereby help to create more coherent models.

How to represent the dynamic aspect of interactions happening inside the business model?

At the expert level, it is necessary to understand the big picture. Showing a completed model to a person for the first time would overload them with information. Thus, design-thinking mechanics, such as storytelling, have to be used to present the story outline of a model one step at a time. This allows users to understand all the elements of a business model, as well as the way they interact with each other. These interactions can be further strengthened by drawing arrows to outline the main story thread in what we call BM Story Outlining.

How to represent the transformation from one state to another of a business model?

At the master level, it was found that making different versions of a business model could help in analyzing its reaction to the context. The management of these versions quickly became a constraining factor, particularly if only part of the business model changed. Using layers to illustrate only the changes is a design technique that helps to overcome some of these constraints. Having the means to describe transformation from one state into another, can then be combined to form a chain of transformation leading to a tree of possible path of evolution for the business model in what we call the BM Evolution.

To conclude, we provide several opportunities that could be further investigated for each of the discussed levels.

2.7.1 Opportunities

The business model ontology can be directly extended in several ways. However, it is most advantageous to capitalize on the diffusion and knowledge of the current version. We argue that it is helpful to develop extension as a plugin. For example, a customer segment can be analyzed through the lens of such tools as personas and customer insight or through the framework of jobs to be done (Johnson, 2010). The current focus on plugins is mainly on the value proposition and the customers, or the connection between the two. There are many more elements, however, that could benefit from in-depth analysis at a component or relationship level. Those that come to mind include categorizing the channel based on the time and type of interaction of the client-to-customer relationship for this particular event; this would make better use of the customer relationship component. Key activities can be decomposed into types and supporting applications. This allows us to better align the enterprise architecture, its business processes and infrastructure to the business model (Fritscher & Pigneur, 2014).

Links have been drawn to outline the story interactions; however, there are no guidelines as yet that define how it connects with BMO's relationship. Such a feature could be formalized, but care has to be taken not to impose too many constraints. The risk would be to end up overcomplicating the model, thus hindering its usage in practice. Rapid iteration requires simplicity.

Beyond small transformation of business model, research into a theory of evolution for business models is of great interest, particularly in identifying why some business models survive change better than others.

References

Blank, S. G., & Dorf, B. (2012). The startup owner's manual: the step-by-step guide for building a great company. K&S Ranch, Incorporated.

Boland, R. J., & Collopy, F. (2004). Managing as designing. Stanford University Press.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. The Academy of Management Review, 14(4), 532.

Eisenmann, T., Parker, G., & Alstyne, M. Van. (2006). Strategies for two-sided markets. Harvard Business Review.

Fritscher, B., Pigneur, Y. (2014). A Visual Approach to Business IT Alignment between Business Model and Enterprise Architecture. IJISMD (forthcoming)

Fritscher, B., Pigneur, Y. (2014b). Computer Aided Business Model Design: Analysis of Key Features Adopted by Users. Proceedings of the 47 Annual Hawaii International Conference on System Sciences, Computer Society Press (Ed.)

Fritscher, B., Pigneur, Y. (2014c). Business Model Design: an Evaluation of Paper-Based and Computer-Aided Canvases. Fourth International Symposium on (BMSD) Business Modeling and Software Design. Scitepress

Fritscher, B., Pigneur, Y. (2014d). Visualizing Business Model Evolution with the Business Model Canvas: Concept and Tool. Published in Proc. 16th IEEE Conference on Business Informatics (CBI'2014), IEEE Computer Society Press

Golnam, A., Ritala, P., Viswanathan, V., & Wegmann, A. (2012). Modeling Value Creation and Capture in Service Systems. In Exploring Services Science (pp. 155–169). Springer.

Gordijn, J., & Akkermans, H. (2001). Designing and Evaluating E-Business Models, (August), 11–17.

Gordijn, J., Osterwalder, A., & Pigneur, Y. (2005). Comparing two business model ontologies for designing e-business models and value constellations. Proceedings of the 18th Bled eConference, Bled, Slovenia, 6–8.

Gregor, S., & Hevner, A. (2013). Positioning and Presenting Design Science Research for Maximum Impact. MIS Quarterly, 37(2), 337–355.

Gregor, S., & Jones, D. (2007). The anatomy of a design theory. Journal of the Association for Information Systems, 8(5), 312–335.

Johnson, M. W. (2010). Seizing the white space. Harvard Business Press Boston.

McCarthy, W. (1982). The REA accounting model: A generalized framework for accounting systems in a shared data environment. Accounting Review.

Osterwalder, A. (2004). The Business Model Ontology-a proposition in a design science approach. Academic Dissertation, Universite de Lausanne, Ecole des Hautes Etudes Commerciales. Citeseer.

Osterwalder, A. (2012). Achieve Product-Market Fit with Our Brand-New Value Proposition Designer Canvas. Retrieved September 24, 2013, from http://businessmodelalchemist.com/blog/2012/08/achieve-product-market-fit-with-our-brand-new-value-proposition-designer.html

Osterwalder, A., & Pigneur, Y. (2002). An e-business model ontology for modeling e-business. In 15th Bled Electronic Commerce Conference (pp. 17–19). Bled, Slovenia.

Osterwalder, A., & Pigneur, Y. (2010). Business model generation : a handbook for visionaries, game changers, and challengers. Wiley.

Osterwalder, A., & Pigneur, Y. (2013). Designing Business Models and Similar Strategic Objects : The Contribution of IS Designing. Journal of the Association for Information Systems, 14(5), 237–244.

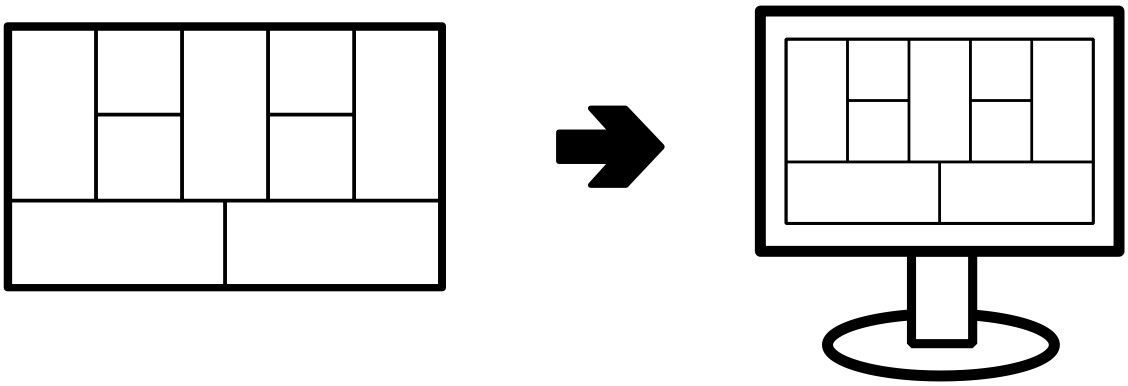
Schoemaker, P. (1995). Scenario planning: a tool for strategic thinking. Sloan management review, 28(3), 117.

Wegmann, A. (2003). On the Systemic Enterprise Architecture Methodology (SEAM. Proceedings of the 5th International Conference on Enterprise Information Systems, 483–490.

Weill, P., & Vitale, M. R. (2001). Place to space: Migrating to eBusiness Models. Harvard Business Press.

Chapter 3
Supporting Business Model Modelling: a Compromise between Creativity and Constraints

Published in Task Models and Diagrams for User Interface Design (pp. 28-43), Springer Berlin Heidelberg, 2010



Abstract
Diagrams and tools help to support task modelling in engineering and process management. Unfortunately they are unfit to help in a business context at a strategic level, because of the flexibility needed for creative thinking and user friendly interactions. We propose a tool which bridges the gap between freedom of actions, encouraging creativity, and constraints, allowing validation and advanced features.

3.1 Introduction

Representing information and tasks has gained importance at all levels: UML class diagrams, CAD, business process modelling, GDSS, at nearly every stage there are models to help us cope with the complexity of structuring information. Business information management at a strategic level is not an exception to it, but contrary to the other fields it lacks the visual tools to support them. The problem is in part due to the business objects which have no real fixed representation that can be formalized by a specification, and also due to the freedom needed in such models to allow a creative thinking process. These requirements make it difficult to utilize the more classical task modelling tools which have more strict representation of their objects.

For a tool to support an application in the business context, the challenge is to provide enough specialized functionality to enforce the rules of the methodology (meta-model), without compromising the freedom of creativity. This creativity is the necessary intuition for abstracting the business model to a strategic level out of ongoing activities. From a research methodology

standpoint we decided to adopt Hevner et al's design science research framework [1], which focuses on solving a real world problem by applying knowledge to an information system prototype conceived iteratively. Therefore, we focused on resolving the gap between creativity and constraints by creating a new tool. This software has to at the same time, be as flexible as a paper based method, but in addition shares features with computer assisted design programs. This paper explores the compromises which were required and demonstrate the resulting prototype.

First we introduce the business model canvas we choose to support. Then we review some of the existing models and their support tools. In the third section we present the tool and its iterations. We then discuss some of the early testing which was done. In the last section we look at future iterations of the proposed visual tool.

3.2 Designing Business Models

3.2.1 Business Model Canvas

For our prototype we choose to implement a tool for a very visual business model canvas called the Business Model Ontology [2]. A business model canvas or ontology (BMO) can be described by looking at a set of nine building blocks. These building blocks were derived from an in-depth literature review of a large number of previous conceptualizations of business models. In this depiction, the business model of a company is a simplified representation of its business logic viewed from a strategic standpoint (i.e. on top of Business Process Modelling). The layout of the nine component has its importance as can be seen in Figure 1.

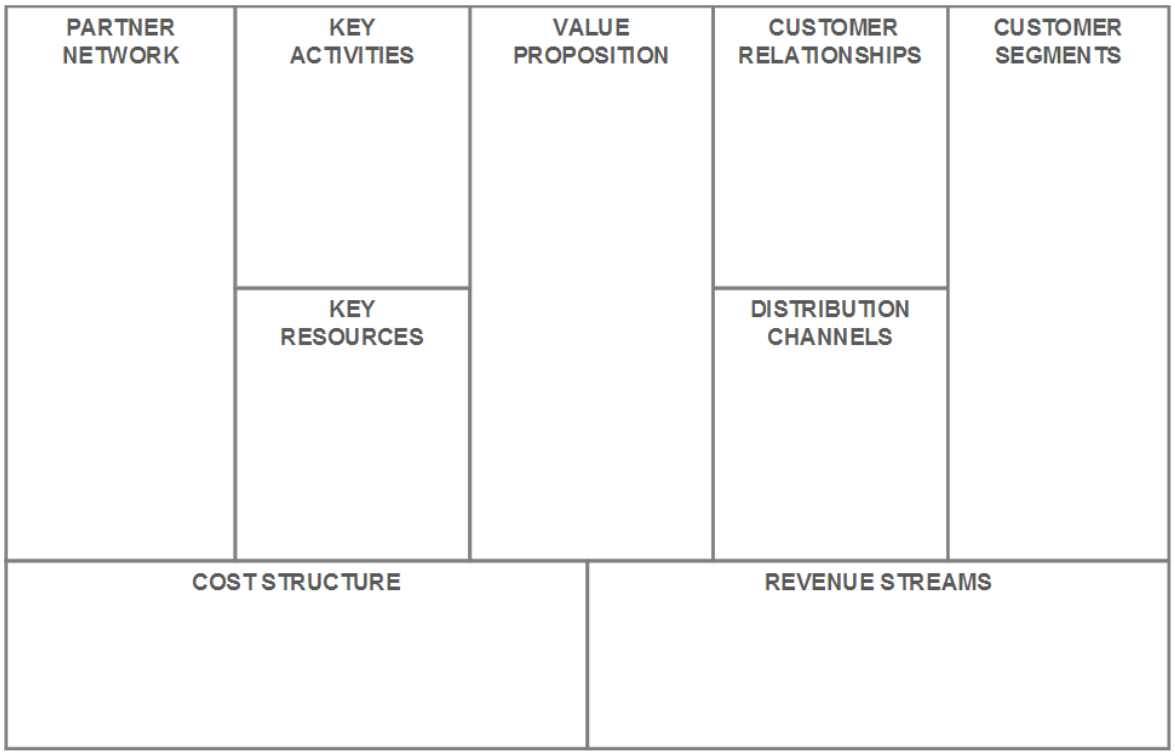


Figure 1. Business Model Ontology Canvas

Each building block can contain elements instantiating the building block's business logic. For example, Customer Segments could be teenagers, families, young single men. Every element is represented by a sticky note in the real world or a distinctively identifiable component in a digital representation.

At the center there is the Value Proposition, it describes which customer's problems are solved and why the offer is more valuable than similar products from competitors (product, service). The customer themselves are analyzed in Customer Segment, separated into groups to help in identifying their needs, desires and ambitions (singles, families). Distribution Channel illustrates how the customer wants to be reached and by whom he is addressed (Internet, store). In addition, Customer Relationships specifies what type of relationship the customer expects and how it is establish and maintained with him (promotion, support, individual or mass). To be able to deliverer the value proposition the business has to have Resources (staff, machines, secret knowledge). And transform theses resources through Key Activities into the final product or service (development, production, secret process). Most of the time a business depends also either for resources or for activities on an external Partner Network (logistics, financial), which can provide better quality or a lower price on non-essential components. As any business model would not be complete without financial information the last two building blocks focus on cost and revenue: The Cost Structure which should be aligned to the core ideas of the business model (key resources, key activities) and Revenue Streams which mirrors the value the customers are willing to pay an how they will perform the transaction (onetime fee, subscription).

The most interesting feature is the ability to describe the business logic of a company on one page: none of the individual elements of the business model canvas are new to business people. But the simple and yet holistic look at a business on a single page is surprisingly new to most of them. The current state of the canvas has been reached through a number of iterations in the last eight years, during which over hundred students have applied the canvas to a variety of class projects. Moreover, usage is not limited to academia; since the model is freely available a lot of companies have started using it, as well as consulting firms. Gartner for example used it in an adapted version in one of their publication [3]. Particularly interesting is the fact that over three hundred persons have paid a subscription to be part of a community experience to co-write the current book [4] about the canvas.

3.2.2 Example

To better understand the thinking applied to designing a model, we will describe one possible overview of Skype™'s business model. Even if for purpose of explaining we choose to present the nine building blocks in a particular order, this is by no means the order which was used when identifying the elements. Also in figure 2 the color of the sticky notes has no special meaning. Skype's main value proposition is to offer free VoIP & video calling. In addition, they offer additional services like for example cheap international calls through Skype out. Their customer segments are mainly global mass customers and they also try to target SMEs. To be able to reach their customers Skype uses the internet to distribute their software, but they also bundle a cdrom of their application with some of Logitech™'s webcams. Support of their service is also done through their internet website to allow for mass customization. Since the software and the basic service are offered for free, we show the importance of this fact by adding a sticky note called free

to revenue streams. The other real revenues are from their bundle agreements and the Skype out charges. Service usage having been described, we focus on how the value proposition is produced. The resources which Skype needs to provide their service is their software and the software developers building it. These resources are used in an activity of software development. In addition, Skype has to maintain an activity of fraud management using for resources their staff and partners. Skype is heavily dependent on their partners since, they do not have their own network infrastructure. Therefore, they need payment providers, telecommunication providers, and naturally hardware vendor. Finally, everything has a cost, but it was decided to feature software development and complaint management as the main cost structures.

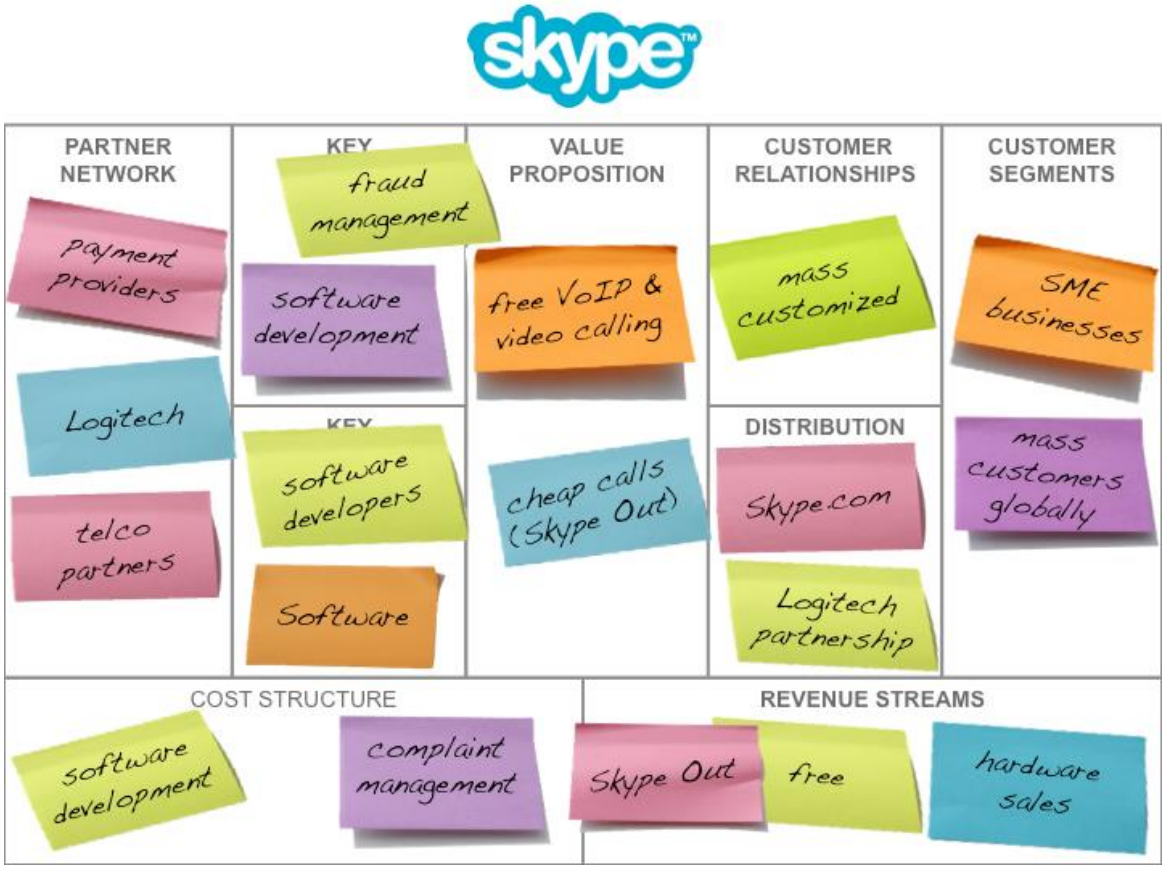


Figure 2. Skype's Business Model

3.2.3 Business Model Ontology

The canvas shown in figure 1 is a simplified version of the real business model ontology canvas in order to facilitate working with it. The real canvas of the BMO meta-model is depicted in figure 3 and adds perspectives and links to the building blocks.

When describing the example there already emerges a way to group some building blocks together. We propose to call theses groupings perspectives. As can be seen in figure 3 we identify four perspectives. The value proposition is in its own perspective. Financial aspects like cost and revenue have been grouped into a financial perspective. Moreover, the remaining six blocks have been split into two perspectives: activity and customer. They both are somewhat mirrored, due to the specific position in the canvas. The activity perspective focuses on how the value proposition is produced and the customer perspective how it is consumed.

To imply a strong relationship between two elements there is the possibility to link them. To further understand the meaning a link should convey we named them in figure 3. For example, applied to Skype's canvas: free VoIP targets mass customers, which are reached by skype.com delivering it. This way of connecting the elements can also help in identifying missing elements in neighbouring blocks.

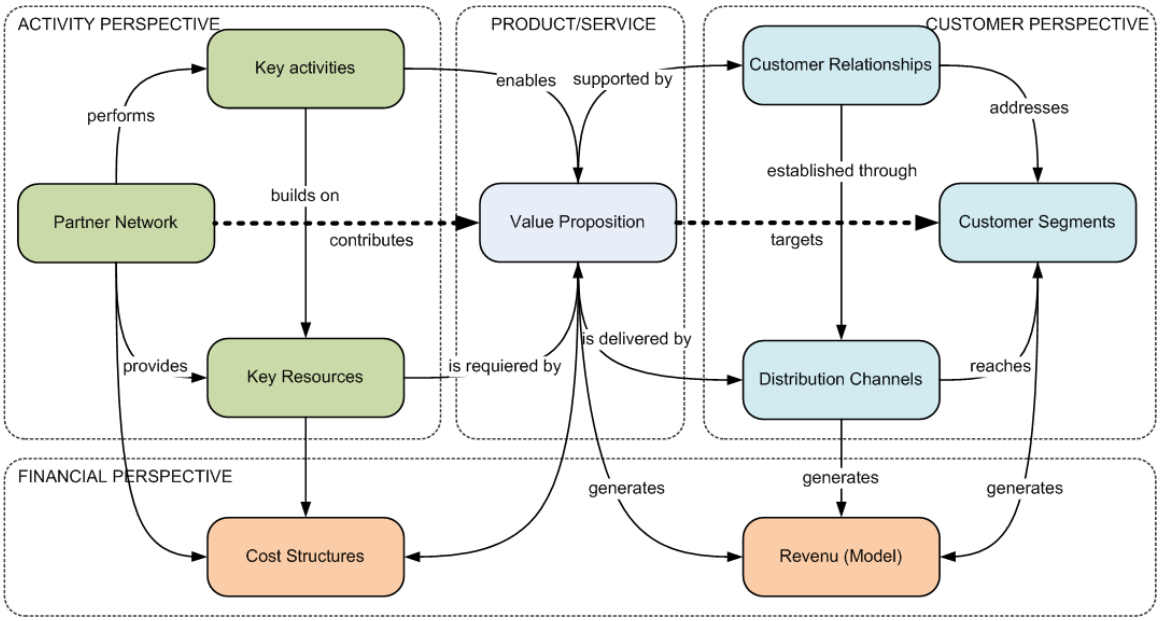


Figure 3. Business Model Ontology Canvas with the nine building blocks grouped into perspectives and their relations named

3.2.4 Typical Session

To better understand the BMO methodology let us describe the tasks involved in a paper based session. The power of the method originates from its visual positioning of the block and the relationship they have between each other. Simply adding, removing or changing sticky notes containing a short title, to the building blocks, helps in identifying existing business models, as well as new opportunities. The typical setting is to work on a whiteboard or a big piece of paper, depending on the number of users. The preparation work is to draw an empty canvas on the working surface. After that, the user can start to add an element to any building block, or even temporarily store a sticky note with his idea on a border. As the elements are on sticky notes they can easily be moved, grouped or discarded. If there is a strong relationship between some elements a link will be drawn between them. Elements can be grouped together or even be replaced by a more generalized element during the creation process, or elements can be refined and become a new sticky note. After an initial brainstorm, it can be useful to focus on a specific perspective and identify the strong links between elements and see if there are some missing components.

3.2.5 Technique and Task

There are no given task sequences to follow in order to design a business model with the Business Model Canvas [4]. An element (sticky note) can be added at one place and then moved or even removed. The important thing is the discussion it generated, and perhaps the other elements

which have been identified through this discussion. Therefore, instead of identifying small task which can be executed in an undefined order or repeated, we instead propose some techniques to help structure the idea generation without imposing a too formal process. These techniques include, but are not limited to: Brainstorming [5], ideation, visual thinking, customer insight, storytelling, scenarios [4].

In general, it is a good practice to generate ideas by adding everything we think of to the canvas. Like in a Brainstorming session, the ideas have to be written down without jugging them. Some persons are more inspired by visuals; this can be addressed by drawing a sketch of an object illustrating the element that has to be added. The drawn object does not need to be a perfect representation of the element, but can also be a metaphor of the activity. A small illustration can communicate a lot more than a single word. Naturally, at some point the visuals will have to be describes by a text clearly sharing its full meaning and the amount of generated elements through creative thinking will have to be synthesized into a coherent working business model. Perspectives, besides helping to group the nine blocks into fewer components, can be interesting starting points. A business model can have its focus centered on the resources (activity perspective), the value proposition itself, the customer or even focus on the financials at the very beginning. Once the canvas is already populated with elements, it can be helpful to see which element is linked to others. This identifies if an element is missing, another way to get more related elements is to use storytelling. Telling a story involving the elements and how they are connected, can not only show missing or unused elements, but helps in communicating the whole business model to outsiders. The business canvas covers different knowledge area about a company; it is therefore natural that the design activity should be performed in groups, discussing the opinions of each other. The task of co-designing is very important, since every participant has to be aware that his vision is not the only one and should be able to take the stakeholder's perspective about the element which is discussed.

3.2.6 Life Cycle

In its current state the business model canvas [4] and the application supporting it consider a completed canvas as the finished product itself. The business model components are not transformed to generate a process, but the canvas as a whole provides a map or an overview for the management of the current service offering, or a future offering, they aspire to reach. Even though, the canvas can be used at different stage of a business model lifecycle and could in future work be extend to be used as a reference for implementing appropriate solution in other tools.

Process

- Mobilize people to generate new business opportunities: in this first phase the business model canvas can help to set a simple common language through its nine blocks, links and layout.
- Understand the current situation: using the above described techniques the canvas helps to regroup the collected information and hints at missing information.
- Design, extending the business model: with the sticky notes and it all in one page format, alternatives can be identified until a best one emerges.

- Implement the chosen business model: the canvas and techniques like story telling help share the vision and therefore facilitated the implementation.
- Manage the current business model: like strategy maps the canvas could help to monitor the current situation.

In its paper form, the final designed business model canvas is shared as a picture of the sticky notes, or for better sharing it is sometimes recreated in a time consuming task on a graphics program. The biggest drawback of these representations is that they lack any additional semantic value. In the next section we take a look at other visual methodologies and how their tools have tried to overcome this problem.

3.3 Overview of Tools Assisting Design

Most of the time innovation starts on a piece of paper, as a little sketch or some keywords which are written on it. This is done mostly to structure ideas, remember them or help communicate them. Communicating one's ideas can generate discussions and help us generate new ones. In addition, the paper represents the shared knowledge, as well as the history of the collaboration session. Today, there are many techniques to help strengthen the power of manual note taking. Some are best used in a multi-user scenario like Brainstorming [5], while others are intended for a single user like some note taking canvas. The constraints of these techniques can be very structured like in said canvas or unstructured like in Brainstorming which really insist on pushing the boundaries of creativity with its rules. There are also techniques which are semi-structured and can be used as well in a single user, as in a multi-user context, like Mind Maps [6] and concept maps [7].

Many tools exist to support these techniques, but they are all lacking some features to be really useful in a business modelling context. The more unstructured tools like Mind maps provide a great range of freedom to create elements as ideas come to mind, but lack the possibility to impose meta-model constraints. Structured tools, like CAD programs, are for the major part very feature reach, but always geared towards a specific domain. This makes them very powerful for the expert user, but useless for office workers. Furthermore, their complexity often requires a sequential input which hinders creative thinking [8]. For example, Protégé is a powerful ontology editor, but is hard to use by a novice user to simply navigate or add his custom element.

The key is to find the right balance between supporting the model by enforcing its rules and still give the user enough degrees of freedom to allow him to follow his own path of creation. The application should be flexible enough to allow for its interaction to be as seamless and close as possible to the paper based version and still enforce the meta-model's constraints to be able to provide additional value.

For example, Consideo-modeler[2] is a nice solution which implements a complete workflow from strategy level modelling down to process level with simulation possibilities, but it requires having quite a lot of knowledge about their modelling rules and there are advanced dialogs boxes to configure the required attributes. A lot more intuitive, Lombardi's BluePrint[3] web offering allows for real-time collaborative process modelling design. Their service is a good example of

[2] http://www.consideo-modeler.de/
[3] http://www.lombardisoftware.com/

collaborative application done with web technologies, but a process model is a lot more structured than the business model canvas we propose to use. On the other hand a tool like Denim [9] offers great capabilities of zoom levels and ways to create and explore hierarchical content, but through their blank canvas do not provide the block constraint needed to have a meta-model which is stronger than just links. Outpost [10] which has an interesting tangible approach towards sticky notes, suffers from the same problem where the importance is set on the link and not the position. Sketchixml [11] shows how we can forgo the need to create elements before using them by drawing their content directly. Is also proposes direct design feedback through pattern analysis, but is geared towards user interface design.

No tool having all the necessary features of constraint versus freedom we required, we propose our own implementation of a solution meeting our need.

3.4 Specification of the Design Artefact

The initial goal for our prototype was to replicate the sticky note experience of adding, moving and discarding elements in the most natural and intuitive way to users, used to the paper based experience. The goal is not only to mimic the user's interaction experience, but also the way the canvas' possibilities drive the creative session. Thus, keeping the trial and error aspect of paper based sticky notes is a core design choice we made throughout the project.

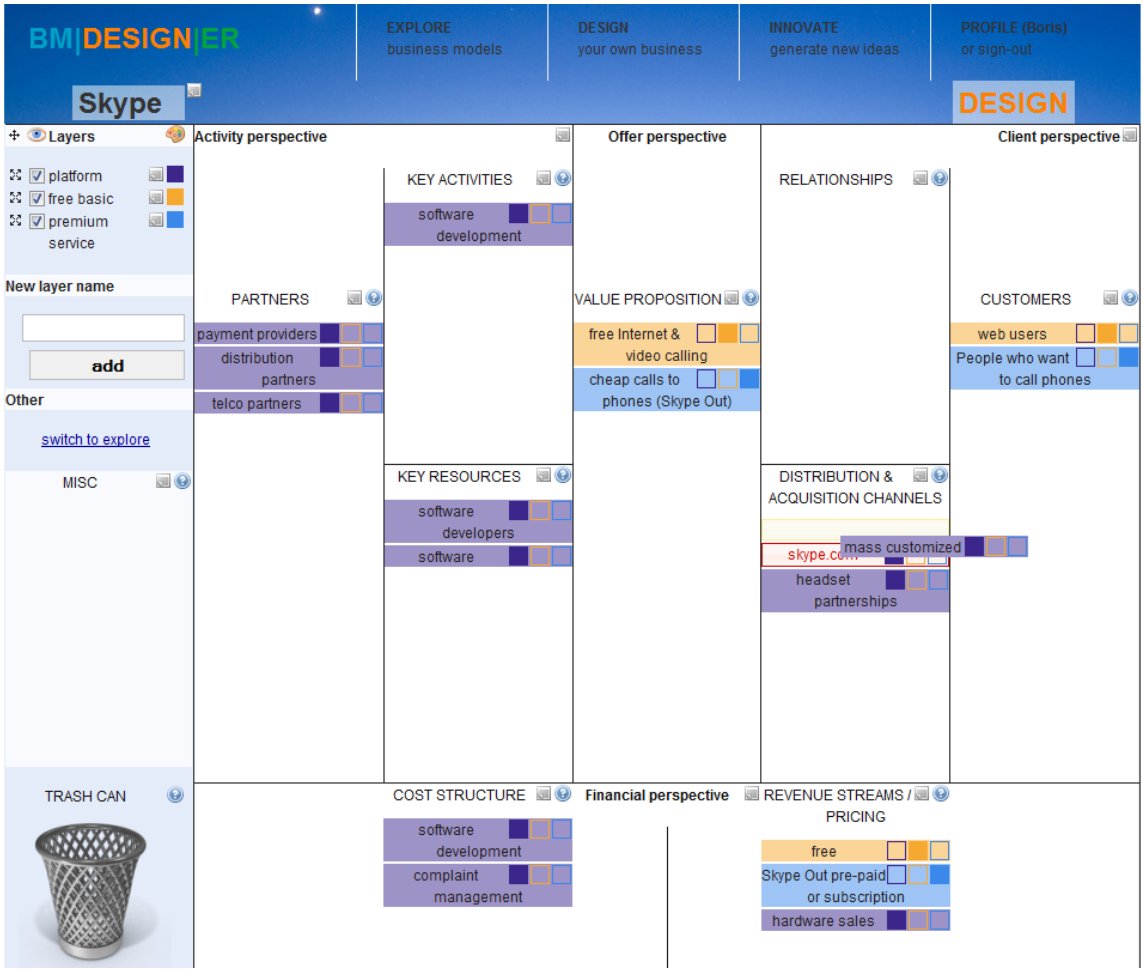


Figure 4. BM|DESIGN|ER design view: dragging mass customized from relationships to distribution channels

3.4.1 Prototypes

In the current iteration of the prototype, a double click creates a new element and drag and drop moves it (figure 4). Discarding an element is done by replicating a trashcan; drop an element on it to remove it. The intention is to provide a feeling as close as possible to the real world sticky note experience. But the fact that the elements now are digital, allows for new functionalities, like giving elements some attributes which can be used to better describe them. We also added a possibility to store annotations to keep track of design choices or ideas for future changes. Some degrees of freedom of drag and drop operations have been limited to allow only movement between the nine blocks, this to ensure that the meta-model of the canvas is maintained. This and element's attributes gives the virtual canvas a semantic meaning which can contributes to more advanced features.

We have created multiple prototypes and iterations [12], but to a certain level they share all the same set of basic interaction features, as well as the ability to link elements (by drag and dropping one element over another). Moreover, a layer feature has also been added. An element can belong to one or more layers and each layer can be turned on or off. For example, a layer identified by a specific color can be used for each product offering thereby helping to identify which other elements are used by multiple products and thus very important for the business. Different layers can also be used to identify alternatives or future evolutions of the business model.

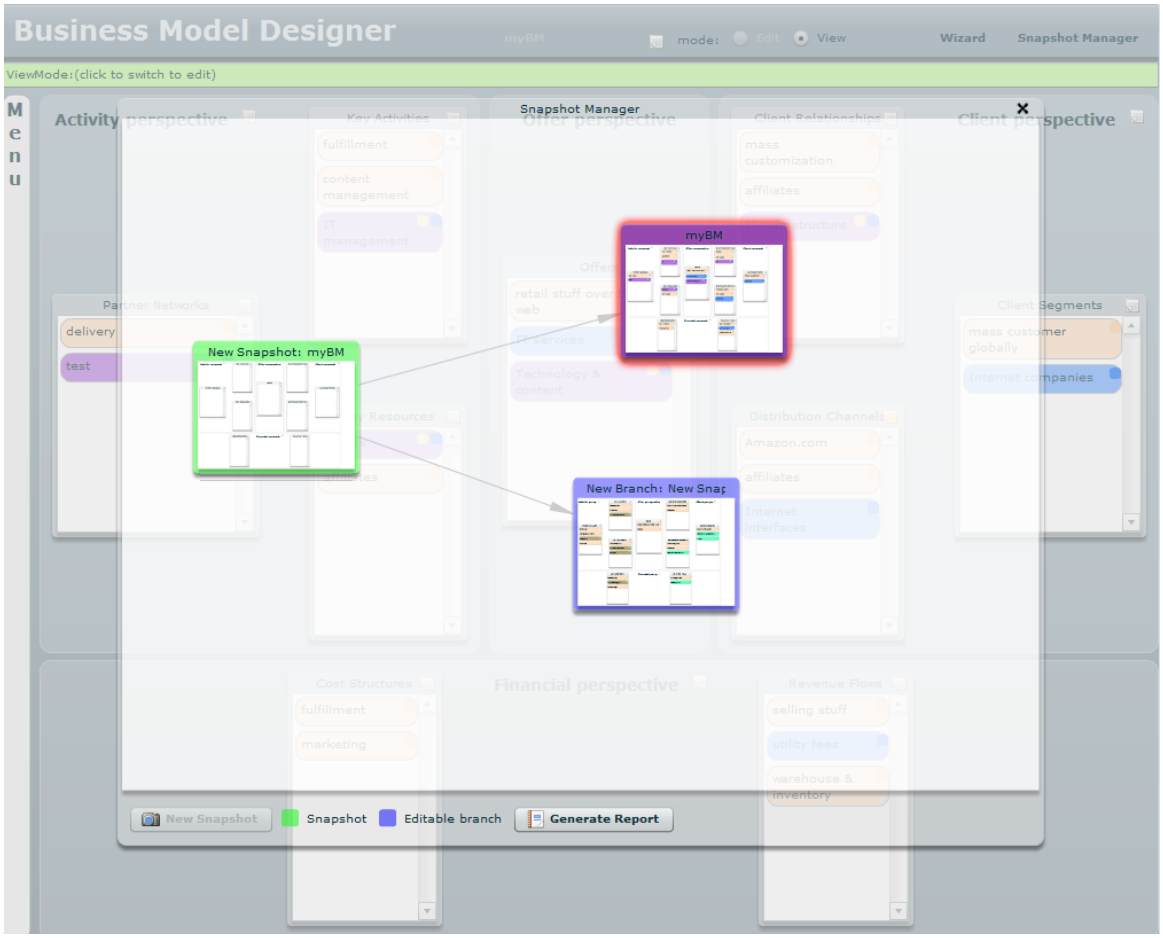


Figure 5. Flex prototype: overview of snapshots (versions) of a Business Model

The concept of versioning has been extended in one of the prototype (figure 5) to allow for taking snapshots (saving its states) and drawing a graph of the history of snapshots of a model. From each snapshot a new branch can be created. This was extended to a notion of merging, by adding multiple instances of a model onto a separate layer of a new empty canvas, thus enabling a limited comparison of the merged business models.

To further enhance the usefulness of the digital application we tested the notion of wizard, which would guide the user through some question to help him identify missing elements. This is intended to be used after the initial creative thinking process since using it at the beginning would render our tool very structured and thereby missing our initial intention.

The last version of our prototype called BM|DESIGN|ER[4] focuses more on ways to navigate through created business models and collaborating on new business model ideas with the help of a community. This is achieved by having a website with modern social web interactions: commenting, voting, tagging, categorizing and searching.

3.4.2 Example

To better illustrate the prototype and its interaction techniques the Skype example was reproduced on BM|DESIGN|ER[5] and are described with the help of figures 4, 6, 7. When creating a new business model the canvas is empty. By double-clicking one of the nine building blocks the user can add a new element (virtual sticky note) to it through an input dialog box which asks for the element's name. Once it is created it is possible to provide additional attributes. This can be seen in the right hand side of figure 6. Some default attributes are provided for each element type, but new ones can be configured at the user's discretion. Figure 6 also illustrates the input box displayed when clicking an element to rename it (look for the software development element), as well as additional attributes which can be added at the canvas level like tags (top part of the figure). Figure 4 illustrates the drag and drop behaviors. An element can be dragged to a different building block, here mass customized is moved from relationships to distribution channel. While dragging new possible positions for the currently dragged element are highlighted to the user by an empty element at the open spot. The possibility to link two elements is shown when dragging one element over another, the element which is not dragged has its appearance changed (red border and background). Upon releasing an element in a link creation action, the dragged element will go back to its original position, but both elements will have been linked.

In the example shown in figure 4, three layers have been define to make out the free versus premium service Skype offers, and the elements which both these service depend on (platform). Layers are created with the left hand side menu. Adding and removing an element to a layer is done by toggling the corresponding color swatch on each element. The small sticky note icon which can be seen next to each layer and building block title bring up a dialog to add annotations. Annotations can also have priorities to behave like to-do tasks. In the case of todo's, the type of annotation shows a number related to its priority. Figure 7 shows annotations of the key activity block from a viewer's angle. The two first figures showed the edition mode (design) of the prototype, while this third one shows the guest mode (explore). In this mode double-clicking an

[4] http://bmdesigner.com/
[5] http://bmdesigner.com/explore/bm/67/Skype

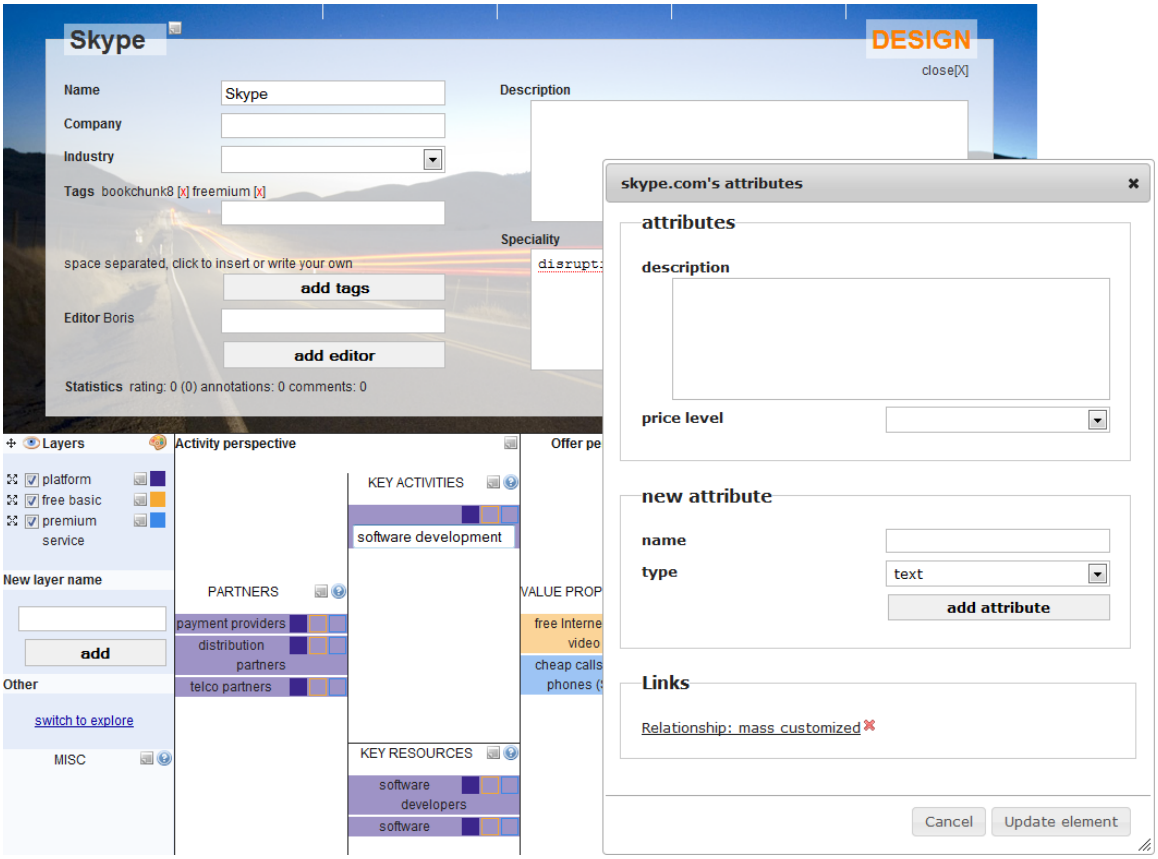


Figure 6. BM|DESIGN|ER design view: dialogs to provide additional data

element will draw links it has with other elements. The link between mass customized and skype.com can be seen in figure 7. In view mode the user cannot add new annotations, but he can post comments at the bottom of the canvas, as well as rate it.

3.4.3 Implementation

The prototype is developed on the Grails[6] framework to capitalize on modern features like convention over coding, Model View Controller and Object Relational Mapping that these web frameworks provide. In addition, Grails has the advantage of being able to use a lot of third party libraries since it run on the java runtime environment. Therefore, by convention the architecture is separated into data and presentation. The backend data manipulation and persistence is stored in a relational database. The frontend is built in standard web technologies with quite a few asynchronous JavaScript[7] calls to be able to provide a seamless interaction without having to reload the web page. In a prior prototype, the same backend technology was used, but the frontend was design in Adobe Flex[8]. This one is mainly used for touch device testing, which still presents challenging in current web browsers. Other than that web interface are preferred since modifications are simpler, loading time faster and communication with the backend easier.

[6] http://grails.org/
[7] http://jquery.com/
[8] http://www.adobe.com/products/flex/

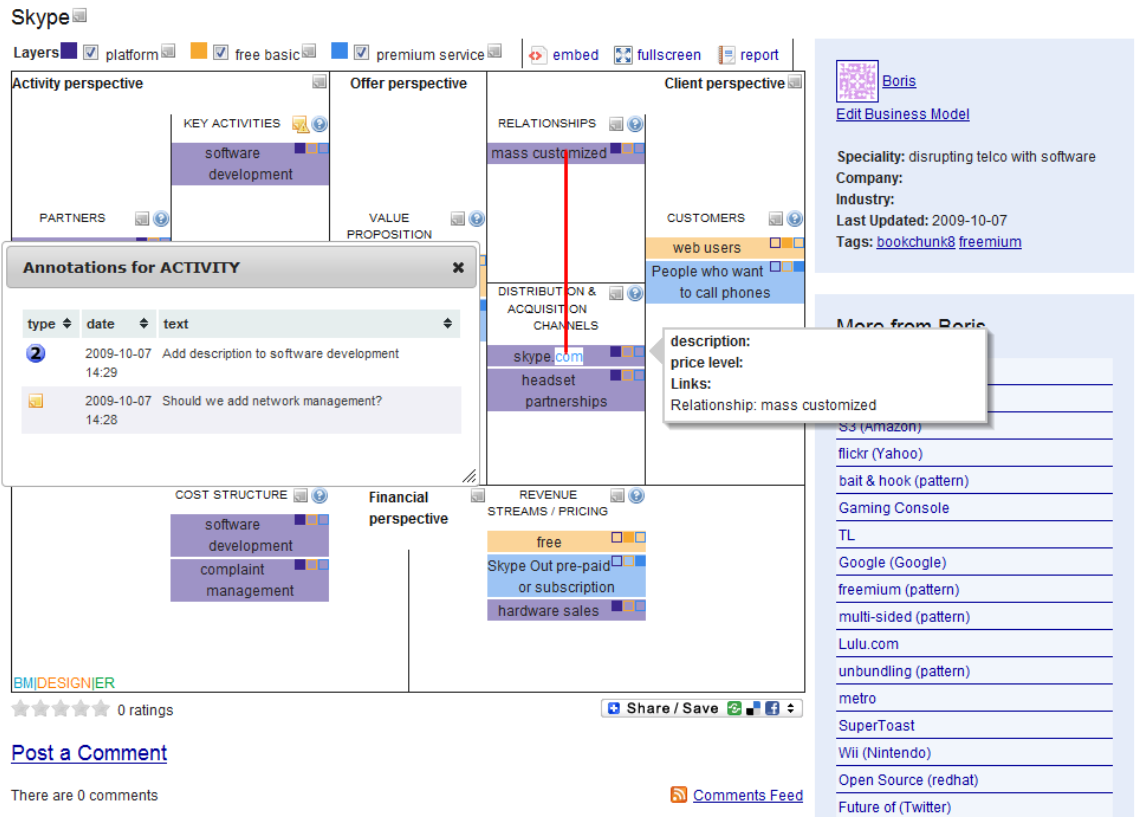


Figure 7. BM|DESIGN|ER explore view: displaying links and reading annotations

3.5 Evaluation

Evaluation of the prototype was done using cognitive walkthrough [7] methodology with users having different levels of familiarity of the BMO and coming from different backgrounds (students and businessmen).

Globally feedback was positive. Testers managed to use the prototype without having too much trouble identifying the right action for their intensions. General opinion is that versioning, layers and annotation features may certainly help in providing value over the paper based static solution. There was also a test using an e-Beam[9] touch screen setup as can be seen in figure 8.

The idea was twofold: firstly, we wanted to test usability of the tool with a wall projected solution; secondly, we were interested to compare on-screen interaction to the paper based system in relation to group interactions, brainstorming possibilities and other design aspects. We will continue investigating applicability of the tool in a collaborative context, in future iterations, as during preliminary testing mostly usability problems were detected.

As for the business model community testing site, we just started, but already has over 200 users and 150 models including all the business models from an upcoming book. We hope to be able to study real interaction usage through logs of our tool and use the community as testing platform for new features.

In terms of evaluation, we only are at the beginning and still have a lot of ground to cover. There is an additional difficulty, that in some cases, it is hard to distinguish between problems originating in lack of usability, or in lack of understanding of the business model canvas

[9] http://e-beam.com/

methodology. For example, do users prefer to use annotations instead of virtual sticky notes because of usability, or methodology? Or even, because on the current prototype all business models are public, due to concerns for the privacy of their model. Either they are generally cautious about their ideas, or this could indicate that even if there are only keywords on the canvas, the users feel it provides enough insight into their activity that it warrants protection. This could be interpreted as an indication to the usefulness of the canvas' expressive power.

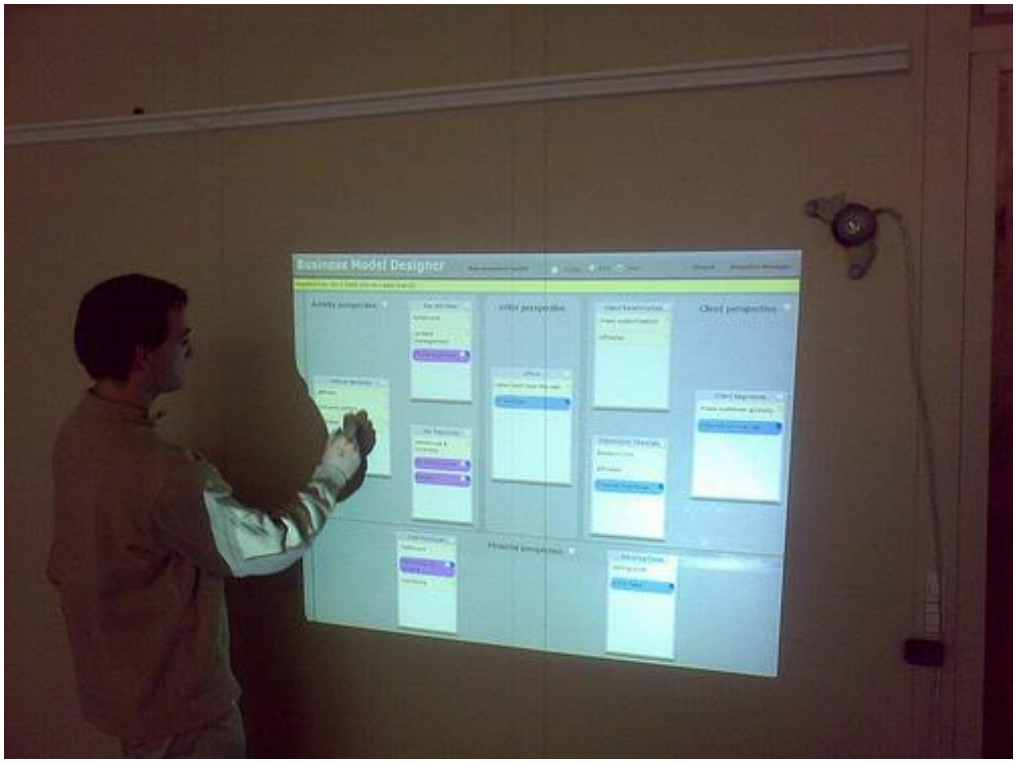


Figure 8. Prototype projected onto a wall and eBeam interact as pointer

3.6 Discussion and Conclusion

Our research has been conducted according to Hevner et al's design science research framework [1] and has fulfilled the requirements of his proposed seven guidelines.

1. Design as an Artifact: we developed prototypes which can be evaluated.

2. Problem Relevance: we have shown that a tool supporting business model innovation is relevant and emerges from a real business need.

3. Design Evaluation: Preliminary evaluation results suggest that the proposed solution is useful in helping to overcome barriers between creativity of business model innovation and constraints of modelling tools.

4. Research Contributions: we contributed to the business model ontology by refining links between the elements.

5. Research Rigor: the business model canvas we based our research on has been validated and is itself based on known ontology research.

6. Design as a Search Process: we iteratively built several prototypes based on evaluation feedback.

7. Communication of Research: Earlier prototypes have been presented in a Master Thesis as well as a workshop on modelling (VMBO 2009, Stockholm).

We have shown that it is possible to find a compromise between freedom and constraints to keep idea generation going, but still enforce a meta-model. Digital alternatives to paper based methodologies can help in providing additional value and style be user friendly enough to be used by office worker.

3.6.1 Future Work

We hope to grow a community around our tool to promote business model innovation at a strategic level and collect valuable feedback. Some tests have been done to investigate collaboration possibility which can be offered by tabletops or touch walls, but this needs further research

There are many possibilities to extend on the prototype as well from an HCI perspective as from a business model meta-model one. For example, selective zoom and focus on elements and their details depending on the context, like is done in Denim [9]. We could also imagine moving from a sketch level to a more detailed element view. Testing tangible interactions with real stick notes likes was done in the Outpost project [10] is also an interesting opportunity to further explore ways to enhanced collaboration as well as bridging information and usability. Another interesting direction to explore is to try some kind of SketchiXML [11] application, but instead of drawing UI-elements the user would draw business components and directly generate an appropriate XML or OWL description of the business model. In relation to the stages of the business model canvas' lifecycle, it would also make sense to explore the possibilities offered by multi-fidelity user interfaces [13] to better fit the stage's different needs of flexibility.

As for extending the business model such a tool would benefit of being more than a tool to help designing the model, but also manage the active version by helping at monitoring it like a dashboard. Such a tool could also help in identifying future or alternative version of business model by providing simulation possibilities.

References

[1] Hevner, A.R., March, S.T., Park, J., Ram, S.: Design science in information systems research. Management Information Systems Quarterly 28(1) (2004) 75{105

[2] Osterwalder, A., Pigneur, Y.: An e-business model ontology for modeling e-business. In: 15th Bled Electronic Commerce Conference, Bled, Slovenia (2002) 1719

[3] Gartner: Getting the right IT: using business models. EXP CIO signature (octobre2007) (2007)

[4] Osterwalder, A., Pigneur, Y.: Business Model Generation. businessmodelgeneration.com (2009)

[5] Osborn, A.F.: Applied Imagination: Principles and Procedures of Creative Problem-Solving 3rd Edition. 3rd rev edn. Creative Education Foundation (February 1993)

[6] Buzan, T.: The mind map book : how to use radiant thinking to maximize your brain's untapped potential. Plume, New York (1993)

[7] Novak, J.D., Canas, A.J.: The theory underlying concept maps and how to construct them. University of West Florida (2001)

[8] Stacey, M., Eckert, C.: CAD system bias in engineering design. In: Proceedings of the 12th International Conference on Engineering Design. Volume 2. (1999) 923{928

[9] Lin, J., Newman, M.W., Hong, J.I., Landay, J.A.: DENIM: _nding a tighter _t between tools and practice for web site design. In: Proceedings of the SIGCHI conference on Human factors in computing systems, ACM New York, NY, USA (2000) 510{517

[10] Klemmer, S.R., Newman, M.W., Farrell, R., Bilezikjian, M., Landay, J.A.: The designers' outpost: a tangible interface for collaborative web site. In: Proceedings of the 14th annual ACM symposium on User interface software and technology, ACM New York, NY, USA (2001) 1{10

[11] Coyette, A., Faulkner, S., Kolp, M., Limbourg, Q., Vanderdonckt, J.: SketchiXML: towards a Multi-Agent design tool for sketching user interfaces based on UsiXML. ACM Press (Proc. of 3rd Int. Workshop on Task Models and Diagrams for user interface design TAMODIA'2004) (2004) 75{82

[12] Fritscher, B.: Business Model Designer From Post-it to screen interaction. Ms, University of Lausanne (December 2008)

[13] Memmel, T., Vanderdonckt, J., Reiterer, H.: Multi-fidelity user interface specifications. Lecture Notes In Computer Science 5136 (2008) 4357

PART II – CORE RESEARCH

Chapter 4
Computer Aided Business Model Design: Analysis of Key Features Adopted by Users

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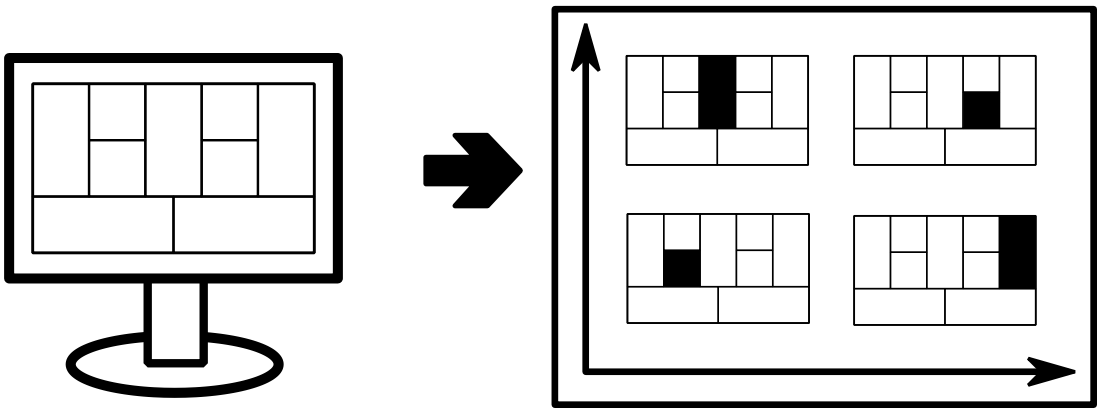


Abstract
Business model innovation comprises many theoretical models, frameworks and methodologies; however, there is still little in the way of digital support for them using Computer Aided Design software. In this paper, we present an analysis of real-world usage data from the first generation of such tools that were designed to support the business model canvas. We first present how two artifacts implement features such as colors for grouping, custom attributes and positioning of elements. An examination of how digital support brings about new opportunities in business modeling allows us to compare this with a paper-based version. We then analyze how variations of these features have been used in the real world. Finally, we examine the implications of our observations for the next generation of tools and the advancement of research for dedicated Computer Aided Design tools to support strategic objects such as business models.

4.1 Introduction

Growing competition between companies has led to the increasing popularity of business model innovation. Product innovation alone does not, however, enable companies to differentiate themselves enough to be able to compete [1]. Thus, businesses are finding that they need to look to methods and design techniques that can help them create new business models in order to outperform their competitors. To discuss business models, a common language is required.

Business model theories provide a common language by describing the components and the relationships that exist between them [2-5].

In order to help develop innovative ideas, it is not enough to provide an ontology that only includes the elements of a business model. The creation of a business model also requires a design process [6] that uses visual techniques to generate new ideas. Thus, the design process enables

the transformation of business model concepts into paper-based canvases; these can then be worked on by practitioners.

The use of pen and paper adds a further set of constraints to a model's complexities. However, it can also provide creative freedom to "draw outside the box"; in other words, changes to the model can be made freely. Currently, the only common alternatives available to a leader of business model innovation are such generic tools as word processors, spreadsheet software and presentation programs. Generally, most models start out on paper as a series of boxes: these are later redrawn using presentation software, or are displayed as a list of bullet points.

Currently, there is a lack of consensus on which features should be included in a Computer Aided Design tool for strategy and how they can add value to the process. However, if we compare this with other design activities, there is certainly room for improvement. Looking at other design domains, advanced dedicated tools exist which can assist the designer throughout the design process. For example, architects and engineers have access to 3D Computer Aided Design (CAD) tools, which not only help them build a virtual prototype, but also simulate the structural integrity of their model. Programmers can use an Integrated Development Environment (IDE), which helps them develop software by providing content assist based on the context in which they are currently editing. Additionally, IDEs also provide pre-test run syntax checking to help produce valid code. In process management there are tools to design and simulate business model processes, which can then also be used as a dashboard for monitoring real-world processes.

By drawing parallels with these other domains we can describe what a Computer Aided Design tool for strategy, such as a business model, could look like. We distinguish between three major types of usage: a) creative design of the business model, b) assessing the designed business model, and c) managing the evolution of the business model and its variations.

The creative design of a business model heavily depends on the ability to choose the right level of abstraction for each component. In this situation, any tools have to be as non-constraining as possible in order to not hinder the creative effort and thus allow innovations to occur. Mostly, this results in the replication of a paper-based experience where everything is possible. The tool can also assist the user by constraining him to design within the chosen business model modeling language.

Digital formats enable the attachment of additional information relating to the elements, including: description fields, origin of sources, comments, category information, and grouping information. The visual appearance of a virtual element, such as color and form, can be altered at will without incurring the cost of recreating the element, as would be the case with a physical object. With the use of digital tools, it is also possible to quickly filter what users see and allow them to focus on a selection of available elements. This provides the capability to manage more information on one model.

In the context of a CAD tool for business models, we will explore the usage of three features: colors, attributes and positioning of elements.

Colors are a simple way to provide additional information; for example, labels can be used to group or connect elements.

Optional attributes, such as free form, guided or those used with formulas, can help in the storage of additional information in the model.

Element positioning can be free from constraints or can be assisted by the tool: it offers creative freedom and can help to reduce the burden of managing them.

Knowledge of the impact that the usage of these features has on the design of business models provides a basis on which new features can be built. In order to give an overview of potential extensions we will attempt to outline what these new features may look like.

In creative activities there is an opening phase during which any ideas are collected: this is followed by an exploratory phase and finally a closing phase, when a solution is arrived upon. For example, in brainstorming, ideas are grouped and combined [7]. In business modeling, this equates to verifying the coherence of a model, and whether or not any relationships between elements are defined. In this paper, we describe a dedicated computer assisted tool which has a knowledge of the meta-model of the modeling language. Thus, it can offer validation of constraints and best practice by automatically validating rules calculated on attributes which are then added to the elements.

When custom attributes are present, further opportunities are available. For example, users can add custom financial data and define relationships. This also allows users to perform calculations between them. Such calculations can build the basis for a simulation by asking what-if questions; for example, how the different estimates of market size, costs and revenues affect the potential profitability of the business model under design.

A business model evolves by adapting to its changing environment. It is therefore beneficial to be able to track the evolution of models, compare them and also simulate what-if questions at an environment level. Alternatives are generated by creating different business models for a multitude of scenarios [8]. Thus, innovative solutions are revealed by thinking outside of normal situations.

This paper's goal is to identify a set of features used in the design of a business model, such as color, examine changes brought about by different implementation choices and how they are used. It aims to compare these features in situations when alternative design tools are used and when traditional theory-based modeling methods are used. Based on the results, we then propose a set of recommendations for the next generation of business model design tools. Additionally, observing large-scale usage of a method also provides an opportunity for the co-evolution [9] of a tool and the theory that supports it. In this way, the theory itself is able to evolve and adapt to new use cases.

The structure of this paper follows design science recommendations [10]. In the next section we present the underlying theories on which our work is based. We then go on to describe our methodology. The artifact section that follows describes two instantiations of a tool to support business model design. The following two sections deal with the evaluation of the two artifacts and a discussion of the results. We conclude by discussing any implications of this study for future research.

4.2 Justificatory knowledge

Currently, there is no single unifying theory of business models; rather, there are silos of theories that lack consensus. However, the notion of the business model as a new unit of analysis is gaining in popularity and the field is moving towards conceptual consolidation [11].

Table 1: Business Model Canvas Components

Perspective	Question	Building block
Offer	What?	Value proposition
Client (right side)	Who?	Customer segment Distribution channels Customer relationships
Activity (left side)	How?	Key resources Key activities Key partnerships
Financial	How much?	Revenue stream Cost structure

One business model methodology in particular is starting to be widely adopted by practitioners: the Business Model Canvas (BMC). In the BMC, a business model is composed of nine building blocks, which describe it. These building blocks can be further grouped into four perspectives, as shown in Table 1. The main perspective is the offer (what we do), which connects the client perspective (who we do it for) and the activity perspective (how we do it). Finally, the financial perspective deals with profit (how much?).

The positioning of these nine blocks is very important. Visually, they form separate groupings which help to structure the thought process and facilitate comparisons between the business models drawn using this method. As can be seen in Figure 1, the offer is in the center; to the right is the client perspective and revenue stream, whilst to the left is the activity perspective and cost structure.

The importance of having a visual canvas is anchored in the Design Thinking [12] process. This method is not a theory, but a set of practices popularized by companies such as IDEO to visualize and prototype concepts for the generation and validation of ideas.

The visual representation of the BMC has been downloaded over one million times by practitioners around the world since 2009 and has been used in creative sessions to innovate their business models.

Previous work [13] has shown that the BMC [14] is a good candidate for implementing a visual and accessible CAD tool for people who do not have an engineering background.

Other modeling tools do exist. Whilst these support business modeling, they differ from the simple visual interaction on which we focus.

Application-supported and object-oriented modeling, enterprise architecture modeling, or such generic tools as Visio and PowerPoint can all be used to draw up a model. However, they cannot be used to enforce modeling constraints - a requirement that we decided to include in this study.

Generic editors certainly exist, such as Protégée [15]; these are able to model and instantiate any domain that is supported by an ontology. This is a practical way to develop new meta-models or extend existing ones, although it is less practical for end-users.

Alternatively, a special editor can be generated, based on a Domain Specific Language (DSL) generated editor [16]. This allows model-specific constraints to be enforced.

Other methods have dedicated software; for example, SeamCAD [17] was specially designed to support the hierarchical natural of SEAM [2]. In addition, e3-value uses its own editor [18] to draw a custom representation. It also has some financial features, which allow it to export an Excel

spreadsheet. However, both methods lack the visual simplicity and ease of use we want to achieve.

In this paper, we will describe two applications that implement the BMC. After presenting our methodology, we will analyze their use.

4.3 Method

In our study, we chose to follow a design science research (DSR) approach [10], [19] because our primary goal is to develop artifacts for the purpose of helping in the design of business models. Previously [13], we built an artifact to collect usage data on the features evaluated in this paper. Basing the evaluation on real-world usage data allowed us to show the relevance of the proposed ideas. Communicating this iteration contributed to knowledge in the form of a set of recommendations for future artifacts.

Analyzing the results was not straightforward. In order to help visualize and group the results, and thus obtain the relevant information, it was necessary to build artifacts using an iterative process.

4.4 Artifact description

In order to identify real-world use of features, we decided to analyze and compare usage data from two implementations of specialized business model design software made for the BMC. Both are web applications and include basic features, as well as those that are more advanced. However, they each take a different approach to how these features are implemented.

The first application, which we will refer to as B, is an artifact that is the result of previous research [13]; however, it has not yet been evaluated in terms of features usage.

The second application, which we will refer to as S, is an alpha version that was developed by a commercial entity using knowledge derived from research and guidance by the original authors of the BMC methodology.

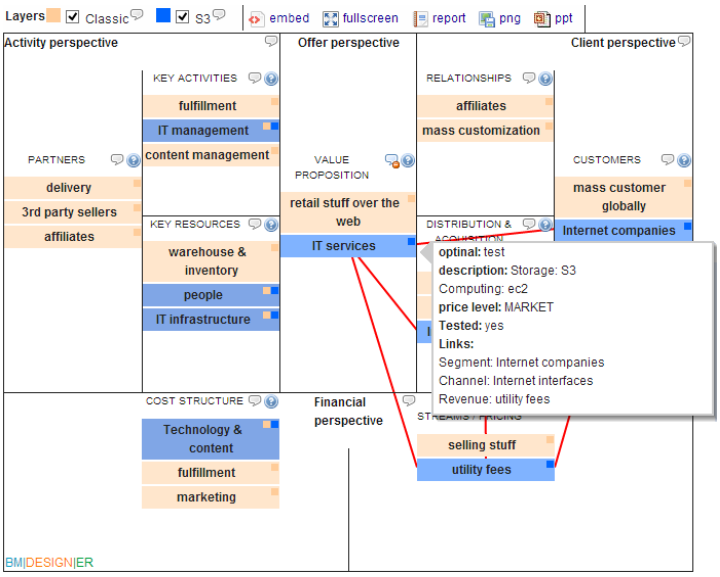


Figure 1. Business Model Canvas view in application B, with multiple colors, elements, links and attributes, and list positioning

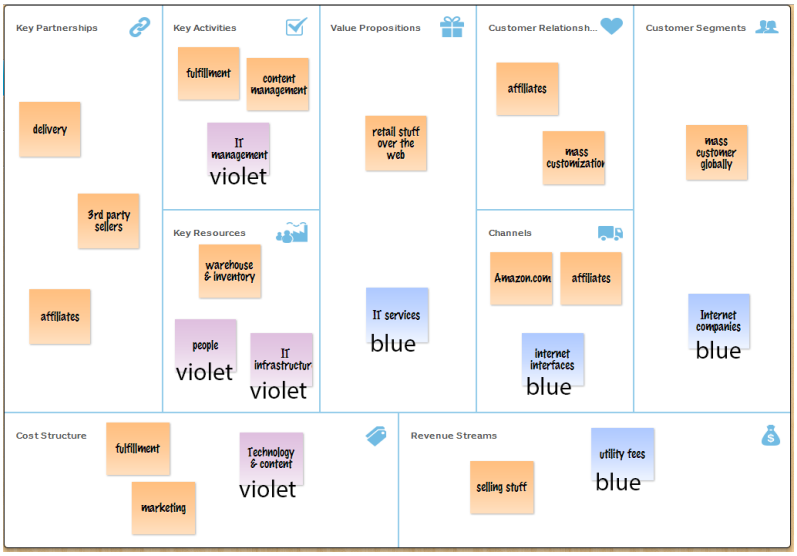


Figure 2. Business Model Canvas view in application S, elements with one color, free positioning

Both applications provide basic functionality by replicating the paper-based experience of the BMC. As can be seen in Figure 1 for B and Figure 2 for S, both display a visual canvas, with nine blocks making up a business model. Each of these blocks will receive elements that represent instances of the type of block.

The elements can then be moved from one block to another or deleted as the design of the model evolves. The three functions on which the analysis of this paper is focused, and the different ways they are implemented by each application are summarized in Table 2. The following sections explain the choices that underlie implementation and how they can be used in each artifact.

Table 2: Summary of differences between applications' functions

Feature	B	S
Element Colors	Has many colors	Has one color
Attributes	Optional, free form and lists	Optional free form and financial with benefits
Element positioning	Guided, list	Free inside each block

4.4.1 Element colors

In application S it was decided to replicate the paper-based experience as truthfully as possible. Thus, each element could have one of six colors, to equate with their real-world sticky note counterpart. On the other hand, for application B it was decided that color indicates some kind of belonging to a group of information. Utilizing the capabilities of a digital tool, an element was allowed to have multiple colors. The color of an element is given by the mix of colors that relate to each group it belongs to. Each individual color can be seen as a small square on the right of each element. The visibility of the elements that belong to each group can be toggled.

Users are free to use these colors in any way they like; no special indication is given in the software itself. A single color system can be replicated if the user chooses to limit himself to using one color at a time for each element. There are different ways of using colors to highlight elements. For example, a different color can indicate that an element is a comment, a future addition to the model or something that has been removed. A set of elements in a specific color

can also be seen as an alternative model; this can assist in comparisons between multiple variations on the same canvas.

One of the best practices with the use of colors is to identify specific connected parts of the same business model. A multi-sided business model [20] has a common set of resources, which it uses to connect each multiple customer segment with a specific value proposition. For such cases, it is useful to pair the individual customer segments and their value propositions in their own color. Grouping can also be of use when highlighting new business opportunities, as can be seen in both Figure 1 and Figure 2: here, Amazon's standard business model is extended to offer a new value proposition of IT services to a new customer segment (blue) by reusing their existing infrastructure and IT knowledge. The main business model is presented using one color, whilst the new value proposition and customer segment are given in a different color. With regard to application B, Figure 1 illustrates the advantage of multiple colors where shared resources can be added to both color groups. It clearly illustrates that resources are used by both. On the other hand, in Figure 2, which shows application S, an element can only have one color. The resource can use one of the two colors already used, but the information that they share is lost. Alternatively, a different color must be chosen (violet in the example) to indicate that something is shared. If there are more than two shared segments it still does not provide enough information to show the limitations of entirely replicating the paper-based environment.

4.4.2 Attributes

All the elements have one attribute in common: the name that is written and visible on them. Both applications allow extra content to be written on each element when accessing a detailed panel. In addition to this free form attribute, which is defined for each created element, application B provides attributes with a predefined selection of values for elements of specific blocks. These attributes and lists are taken from the original business model ontology [4]. By way of example, value proposition elements have a price level attribute that can have the following values: free, economy, market and high-end. To create a more semantic model, application B also allows the user to define his own attributes, title and value pairs. This gives more control over the structure of data than a single description field, but requires more work. All these additional attributes can be viewed by hovering over an element.

Application S does not provide custom attributes, but has specific predefined attributes on cost structure and revenue stream elements to allow the selection of basic predetermined profit calculation. In this paper, for the evaluation and comparison of attribute features we have only considered whether or not these calculation attributes are filled in; we have not sought to evaluate the efficiency of the calculation feature.

4.4.3 Element position

The extent to which the representation of a physical sticky note is replicated in both applications is different. In application S, the element represents a virtual sticky note that can be positioned anywhere in the block. On the other hand, application B positions elements in a list that can be reordered or moved from one block to another. However, they will always be aligned vertically, one above another. By allowing an element to take any position, it is possible to visually group them, although this does add to the task of managing their overlap and exact positioning. This can

either be perceived as a positive or negative experience by the user. In list mode, the experience is closer to the bullet point list concept used in traditional office applications.

Application S has fixed size elements, which limits the length of text that can be displayed. In the list mode (B), the height of the item expands to fit all the text that is provided, as seen in the cost structure element "Technology & content" in Figure 1.

4.5 Evaluation

The population of the real-world dataset, which we extracted from applications B and S, is composed of over 5,000 business model enthusiasts from around the world. These include entrepreneurs, managers and consultants who have, for the most part, learned to use the BMC by reading the book that presents the method: Business Model Generation [14]. Since the applications are in English it is no surprise that the majority of users are from English-speaking countries. However, as can be seen in Table 3, other countries that have strong communities dedicated to Business Model Generation include Brazil, the Netherlands and Germany. For application B, the presence of China and France can be explained by the fact that a translation of the interface into these languages is available.

Table 3: Top countries listed by users

B	United States, Brazil, Germany, France, China, Netherlands.
S	United States, Canada, Netherlands, Brazil, United Kingdom, Germany

Business model data was extracted from the databases of the applications. After filtering this data 2,132 BMCs were collected using application B and the freely available research artifact over a period of 3 years. For application S, 4,921 BMCs were collected from alpha version subscribers over a one-year period.

The focus was on the use of more advanced features; thus, we based our selection only on what we considered to be valid canvases. Only canvases that contained between 9 and 60 elements were retained. Fewer than 9 elements means that the model cannot be complete, since there are 9 different blocks in the model. On the other hand, more than 60 elements means that there is a misuse of the model in relation to standard practice. Limiting the maximum number also eliminates those models in which users have chosen an incorrect abstraction level or have added too much detail on one canvas to that recommended.

Table 4: Percentage of business models with x colors

X colors	B (n=2132)	S (n=4'921)
1	52.35%	45.44%
2	19.84%	15.40%
3	12.95%	13.39%
4	7.08%	10.40%
5	3.33%	7.80%
6	1.45%	7.56%

In this section, we first analyze and compare color usage, before going on to look at attribute usage and the use of free element positioning. In order to compare color usage, BMCs were split into two groups: a) business models that only use one color, and b) business models that use more than one color.

The first observation we can make from Table 4 is that colors were used in around 50% of canvases. This demonstrates some interest, although the figure should be higher if users really followed best practices. The somewhat higher number of multi-color canvases for models in application S can perhaps be explained by the user interface, which makes it easier to select different colors than in B where the color (representing a new group) has to be first added to the canvas before it can be used.

Single-color models are based on using the maximum number of complete business models; thus, elements should be shown in each of the nine blocks. Of greater interest is the use made of the grouping in multi-color BMCs because it allows us to understand whether or not the colors are used as shown in the theory: to split value propositions, customer segments and groups from each other. To better categorize the types of groups, we define a group type as a combination of the nine blocks which are either populated with an element in the group's color or not. This results in 512 (2 to the power of 9) possibilities.

4.5.1 Business model canvases with a single color

To compare single-color models with multi-color business models we merged all groups of multi-color business models into one, as if it was a single-color type group. If, as expected, coloring was used primarily to add additional information, the merging of business models should give similar results to their single-color counter parts in terms of completeness.

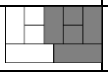
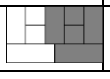
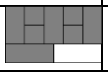
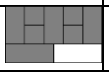
In Table 5 we list the most common types. As can be seen, over two-thirds of the business models were of the "complete" type, with elements in each block. The remainder showed the possible variations of the different types. In application B, for example, there were 341 (66%) different types and in application S there were 475 (92%). This may simply be due to the total number of canvases. The large number of complete BMCs is a good indication that the selection manages to include valid models.

Looking at the complete model (f), the top five most-occurring types were the same for both applications and both types of canvases (single color, and multi-color). Use of the canvas without considering colors was identical for both applications. Furthermore, we can see that business models that do not contain financial data (nf) appeared twice as frequently in application B. This can be attributed to the fact that application S provides several basic features related to profit calculation; thus, there is more incentive to fill out the financial elements.

The other three most popular business model types were shown to be business models that have one block left unfilled. The first one is where no customer relationship (r) has been given and is consistent with our observations at workshops where users also had difficulties in filling in this block. Changes to BMC theory may help in making recommendations. It is also the least used block when considering total element percentages: 8% (Figure 3).

Business models with no partners (p) might be complete and valid, although it is unlikely in our connected world.

Table 5: Most seen types for single color and merged multi-color canvases

B				S			
Single color	**n=1'116**	**>1 merged multi-color**	**n=952**	**Single color**	**n=2'236**	**>1 merged multi-color**	**n=2'685**
f 	68.91%	f 	67.12%	f 	63.55%	f 	71.47%
nf 	3.76%	nf 	4.52%	r 	3.67%	c 	2.61%
r 	2.60%	c 	2.73%	p 	2.77%	r 	2.09%
c 	1.97%	r 	2.31%	c 	2.15%	p 	1.82%
p 	1.25%	p 	1.47%	nf 	1.74%	nf 	1.34%
nl 	1.08%		1.16%		1.16%		0.86%

Business models without a cost structure (c) can be explained in terms of the user putting the cost information attributes directly onto elements in the other blocks; however, further analysis is required to confirm this proposition.

Based on observations from workshops and exercises carried out with students, we expected to find that there would be more models with only the right side (nl) filled out. In other words, we assumed that users would only fill in the client perspective of the BMC. However, this partial model usage seems limited to the group of users in this dataset.

4.5.2 Business model canvases with multiple colors

Comparing multi-colored BMCs gave us an insight into how colors are used in each application. Unsurprisingly, the type that represents a full business model was the one most commonly found, as illustrated in Table 6. The percentages are lower than with a single-color model since, a business model is composed of multiple groups with different colors. Application B produced many more full models, which can be explained by the fact that any element can be in the color used as the main business model, and at the same time belong to additional color groups. With application S, however, there is only one color for each element. By changing its color, the element will be removed from the main color group and added to the new group; thus, it does not have a full group anymore.

Since many types of models resulted in low percentages, these were then further aggregated into four categories: full model, almost full, single block (only one block with the specific color), customer side (right part and eventually the value proposition).

Table 6: Percentage of types by artifacts

Types	B (n=2'819)	S (n=9'693)
Full model	27.31%	10.41%
Almost full	11.42%	3.96%
Single block	7.52%	24.77%
Customer side	4.15%	16.13%

As presented in Table 6, large differences can be seen between the two applications. The reuse of elements in different colors with application B allows the right customer side to be

connected with the resources on which it depends, which are on the left side. This may explain why there are fewer customer side types and more almost full types. From the point of view of application S, there are more customer side types and fewer almost full ones.

Application B's multi-color ranking is almost identical to its single-color ranking, with no financial model type being the second most seen. Surprisingly, for application S, the findings are completely different, with all nine possible types of single block groups ranking in the top most-found types.

The high number of single block types came as something of a surprise. It indicates that people only use one color for one block and that this does not relate to any business information used in the theory.

In both models, left side and resource perspective types were almost non-existent even though they are illustrated in the pattern example given in the book that presents the method: Business Model Generation.

4.5.3 Attribute usage

On paper, BMC users had a tendency to add bullet points and sentences to explain their elements, rather than keywords. To check the usage of text in the applications, we calculated the word count for each element's name. The results are shown in Table 7. Even taking into account a different input system and different text size limits, the word counts were almost identical in both applications. In addition, 70% of the elements were found to have three words or fewer. Thus, the recommendation of using keywords has been followed.

Table 7: Percentage of elements with x words

X words	B (n=65'490)	S (n=156'513)
1	27.94%	30.85%
2	26.61%	27.88%
3	17.50%	16.51%
4	9.10%	9.82%
5	6.12%	6.28%
6	3.67%	3.79%

Additional attributes were not often used: less than 10% of elements had descriptions, and less than 5% had a description that was longer than 15 words. Descriptions were mostly used to add small details such as sources.

Application B offered additional attributes in a selection list, but they were used in less than 1% of the cases. Custom attributes were used even less.

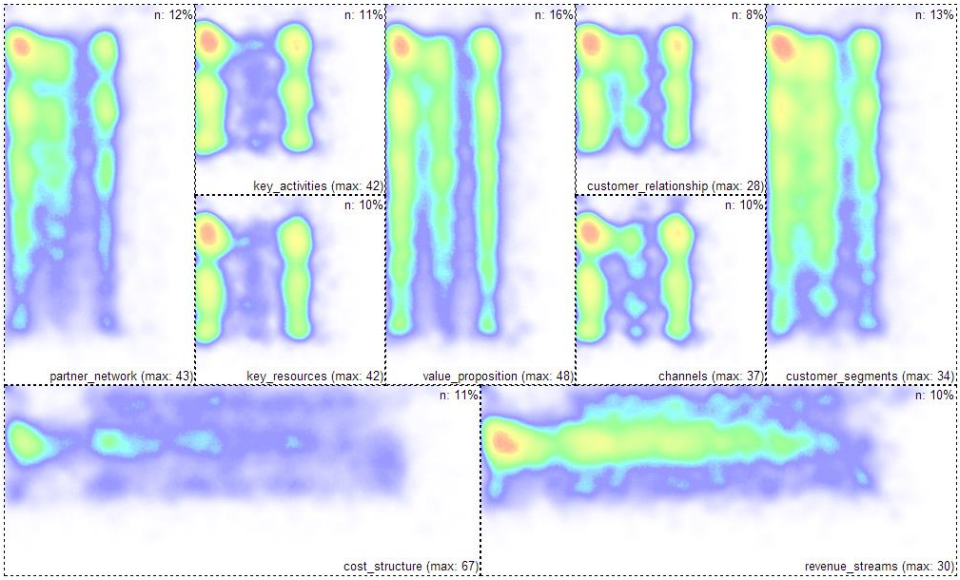


Figure 3. Heat map of element positions (top left corner) n= 163'589

Application S, on the other hand, offered calculation attributes, which we grouped into four categories. As shown in Table 8 they were used fully in one-third of all the business models.

Table 8: Percentage of financial attributes

Type of financial attributes	S (n=4'921)
No financials	54.18%
Only cost structure	6.28%
Only revenue stream	6.64%
Complete financials	32.90%

4.5.4 Element positions

In application B, where there was free positioning of elements, users tended to align their elements in a grid format. We analyzed the position of each individual element by drawing a heat map to represent the density of the top left corner of each element. The result of the 163,589 elements can be seen in Figure 3.

For the horizontal blocks (cost structure and revenue stream), the elements were placed on a horizontal line and for the vertical blocks the elements were placed on a vertical line. Furthermore, three distinct vertical lines can be observed: the middle one is from cases where the user aligned his elements into a single center-column layout, while the two outer ones are from a two-column layout. The spacing between the columns matches the width of an element. For the vertical blocks it can also be seen that there are hotter points showing on the vertical line, spaced exactly by the height of an element.

In each block the hottest point is always in the top left corner, meaning that even for models with few elements, users tended to start adding the first elements to the top left rather than the center. To further verify the usage of a grid layout we computed the delta distance between the closest elements in the same BMC.

Table 9 shows that 50% of all the elements are aligned with their closest neighbor: same top position if in a horizontal block, same left position if in a vertical block, with a tolerance of 5%.

Table 9: Elements matching a grid layout

Block	Elements with same top position	Elements spaced by the width of an element
Cost Structure	51.71%	40.13%
Revenue Stream	46.82%	38.79%
Block	**Elements spaced by the height of an element**	**Elements with same left position**
Value proposition	34.38%	56.27%
Customer Segment	35.71%	50.47%
Partner Network	37.92%	51.03%

4.6 Discussion

This paper's goal is to acquire a comprehensive picture of how real-world use is made of such features as color, attributes and positioning in the current versions of business model design tools. To that end, we collected and evaluated data from two applications. Tests with students and workshops revealed signs that many users view the blocks of the BMC as individual check-lists to be filled out. Consequently, they did not go into detail about the relationship between the elements. According to our data, 50% of users did not use color to code their business model. However, business model completeness in single-color models and multi-color models did appear to be similar. Nonetheless, without the information provided by the grouping of the multi-color system, it is not possible for the tool to provide support for advanced model assessment and validation. Instead of using color grouping to link the elements, links between elements can be specified explicitly. This was tested in the case of application B, where links can be created by dragging and dropping one element onto another. The links can then be shown visually and connected elements are listed in a pop-up format, as shown in Figure 1. However, in the case of application B, link usage was nearly non-existent. It appears, therefore, that inferring information from colors is a better working system which is simple to use and an ideal compromise. To overcome the limitations of a single-color only system, a combination of systems may offer promise. For example, users could easily toggle a color on an element and then use these color associations in the system to extract the different groups and parts of a business model pattern, such as the double-sided business.

Proposition 1: *A CAD tool for strategy should use simple visual indications, such as color tagging, to increase the semantic value of the model*.

Contrary to the use of CAD tools in other domains, support tools aimed at the business level cannot (for now, at least) expect to be used by those who are specially trained in the software. Therefore, it is up to the tools themselves to offer users a more guided approach. As our results have shown, with the low usage of such custom features as attributes and advanced multi-color business models, it is not enough for features to be available and discoverable. Instead, they have to be promoted to the user, especially if there exists best practice in the use of such features. Simply giving an example of its use in theory does not seem to be directly transferable.

Disallowing the entry of multi-line text for element names did help in producing canvases that have mostly keyword entries.

Proposition 2: *A CAD tool for strategy should enforce or suggest good practice beyond implementing its underlying model.*

The lack of use of custom attributes can have different explanations ranging from user interface problems and lack of choice in the list, to legal concerns relating to the sharing of confidential data. It seems most likely that a lack of access to the entered data from another view led to users being unable to see any benefit for its use. For attributes which offered a benefit, as was the case of financial data in application S, usage was high; indeed, it was used in one-third of the business models.

This illustrates that, when an advanced feature provides sufficient added value, users are willing to invest in its use.

Proposition 3: *A CAD tool for strategy should provide an incentive which justifies the need for providing additional information (e.g., numbers).*

In terms of positioning, users had the opportunity to freely choose the elements' location in application S. The majority of them positioned them in a grid layout. We can consider, therefore, that a large part of users did not use positioning to give additional information. As such, it would be possible for them to get by without having to make detailed decisions about the positioning of their elements.

Proposition 4: *A CAD tool for strategy should support a beginner by simplifying his task and letting him focus on the core ideation process.*

A few users recreated the multi-color systems in application S by manually stacking elements of different colors on top of each other with a small shift to give the appearance of multiple colors to the element on top of the stack. Whilst this works visually, it cannot be used by the system to process. Even then, it is cumbersome for the user because if an element is moved, additional colors have to be moved separately and then reordered to stack them correctly. Nonetheless, a system that is left open in this way offers many possibilities for working outside the box.

Proposition 5: *A CAD tool for strategy should allow experts to create their own semantic meaning, such as by visually grouping elements through free positioning.*

A compromise has to be found for the different phases: in the creative phase it should be more open, whilst in the assessments phase, some restrictions are necessary in order to apply validation rules.

4.7 Future perspectives

By considering these propositions and the need to move from design-supporting CAD tools for strategy to their next iteration, which allows for the assessment of business models, we are able to suggest potential improvements. In future, for example, simple rules could be validated which would make it possible to obtain better business models. Specifically, after a defined number of elements have been added, if there are still empty blocks, a wizard with trigger questions and explanations could be shown to the user, rather than the user having to look for himself. In the same way, if there is a complete model, but with only a single color, a wizard could suggest using the color system and show a tutorial which explains how colors can be used to group connected elements together. Another way to trigger thinking about the connected elements, which has been tested in a workshop, is to ask "trigger questions" which require users to think about multiple elements from different blocks to answer the question. With a support tool this could be

combined with colors to tag the elements the user considers for his answer; these could then be validated against rules that are common to the trigger questions.

Promoting the collection of financial data is another topic which is open for improvement. In particular, the notion of cost could be made an attribute on each element and displayed as a summary in the cost structure. Digital tools have the capability to do this; however, it is not easy to replicate it in a dynamic way on paper. Thus, it is not accounted for in theory. These new possibilities will require the evolution of the BMC theory itself if it is to consider how more advanced financial computation could affect the different components.

Of particular interest is the co-evolution of the tool and the methodology that it implements. We can confirm that the customer relationship block is either of less importance than previously thought, or more likely that it needs to be more clearly defined in the methodology. This would bring an improvement to the BMC method based on information from the tool itself. An example can be given to illustrate such co-evolution: when the methodology started using colors, these colors were picked up and interpreted as grouping when the tool was being engineered. This notion can be extended to the concept of layering in CAD software, which in turn has been integrated into the canvas methodology to visually show the evolution of one business model into another. Business model tools can extend their layering system to support this new concept and in turn come up with new additions to business model theory.

4.8 Conclusion

Inspired by design tools from other domains, we have sought to describe what computer aided design of business models could be like in the future. Guided by design science research, we have looked at the path to get there through the iteration of tools over design cycles. Starting with artifacts which replicate the paper-based experience of BMC methodology, we looked at the real-world usage of features which go beyond the basic ‘sticky note experience’ to include color, attributes and positioning.

Our data analysis has highlighted the importance of getting large-scale feedback beyond tests with students or experts. It also clearly showed the need to guide users as to the use of additional features and provide them with clear incentives to invest some time in learning them. We suggested some ways in which they could be implemented - for example, through the use of wizards and rules - although this needs further research and testing. Using the results of our study, the next iteration of tools can be better tailored to the use of practitioners.

Much research still needs to be done in order to bring the necessary improvements to Computer Aided Design Strategy software. As such, it will require strong collaboration between both strategy and IS researchers [21]. We see a high potential for the co-evolution of tools and methodology, providing the opportunity to advance strategy theory as well as knowledge about IS support tools requirements and how these technologies will be adopted by users.

References

[1] D. J. Teece, “Business Models, Business Strategy and Innovation,” Long Range Planning, vol. 43, no. 2–3, pp. 172–194, Apr. 2010.

[2] A. Wegmann, “On the Systemic Enterprise Architecture Methodology (SEAM)” Proceedings of the 5th International Conference on Enterprise Information Systems, pp. 483–490, 2003.
[3] J. Gordijn and H. Akkermans, “Value-based requirements engineering: exploring innovative e-commerce ideas,” Requirements Engineering, vol. 8, no. 2, pp. 114–134, Jul. 2003.
[4] A. Osterwalder, “The Business Model Ontology-a proposition in a design science approach,” Unil, 2004.
[5] H. Bouwman, H. Vos, and H. Timber, Mobile Service Innovation and Business Models. Springer, 2008.
[6] R. J. Boland and F. Collopy, Managing as designing. Stanford University Press, 2004.
[7] A. F. Osborn, Applied Imagination: Principles and Procedures of Creative Problem-Solving 3rd Edition, 3rd Rev. Creative Education Foundation, 1993.
[8] G. Ringland and P. P. SCHWARTZ, Scenario planning: Managing for the future. John Wiley & Sons, 1998.
[9] P. Rittgen, “Success Factors of e-Collaboration in Business Process Modeling,” in Advanced Information Systems Engineering, 2010, pp. 24–37.
[10] S. Gregor and A. Hevner, “Positioning and Presenting Design Science Research for Maximum Impact,” MIS Quarterly, vol. 37, no. 2, pp. 337–355, 2013.
[11] C. Zott, R. H. Amit, and L. Massa, “The business model: Theoretical roots, recent developments, and future research,” papers.ssrn.com, vol. 3, no. September, 2010.
[12] R. Martin, “Design thinking: achieving insights via the ‘knowledge funnel’,” Strategy & Leadership, vol. 38, no. 2, pp. 37–41, 2010.
[13] B. Fritscher, Y. Pigneur “Supporting Business Model Modelling: A Compromise between Creativity and Constraints,” Task Models and Diagrams for User Interface, LNCS 5963, pp. 28–43, 2010.
[14] A. Osterwalder and Y. Pigneur, Business model generation : a handbook for visionaries, game changers, and challengers. Wiley, 2010.
[15] J. H. Gennari, M. a Musen, R. W. Fergerson, W. E. Grosso, M. Crubézy, H. Eriksson, N. F. Noy, and S. W. Tu, “The evolution of Protégé: an environment for knowledge-based systems development,” International Journal of Human-Computer Studies, vol. 58, no. 1, pp. 89–123, Jan. 2003.
[16] M. Al Jallad, “REA Business Modeling Language: Toward a REA based Domain Specific Visual Language,” KTH, 2012.
[17] L. Lê and A. Wegmann, “SeamCAD: object-oriented modeling tool for hierarchical systems in enterprise architecture,” System Sciences, Proceedings of the 39th Annual Hawaii International Conference, 2006.
[18] J. Gordijn, H. Akkermans, A. Koks, and J. Schildwacht, “User manual e3-value editor.”, Vrije Universiteit Amsterdam, pp. 30-35, Apr. 2004
[19] A. R. Hevner, “A Three Cycle View of Design Science Research,” Information Systems, vol. 19, no. 2, pp. 87–92, 2007.
[20] T. Eisenmann, G. Parker, and M. Van Alstyne, “Strategies for two-sided markets,” Harvard business review, Oct. 2006.
[21] A. Osterwalder and Y. Pigneur, “Designing Business Models and Similar Strategic Objects : The Contribution of IS Designing,” Journal of the Association for Information Systems, vol. 14, no. 5, pp. 237–244, 2013.

Chapter 5
Business Model Design: an Evaluation of Paper-Based and Computer-Aided Canvases

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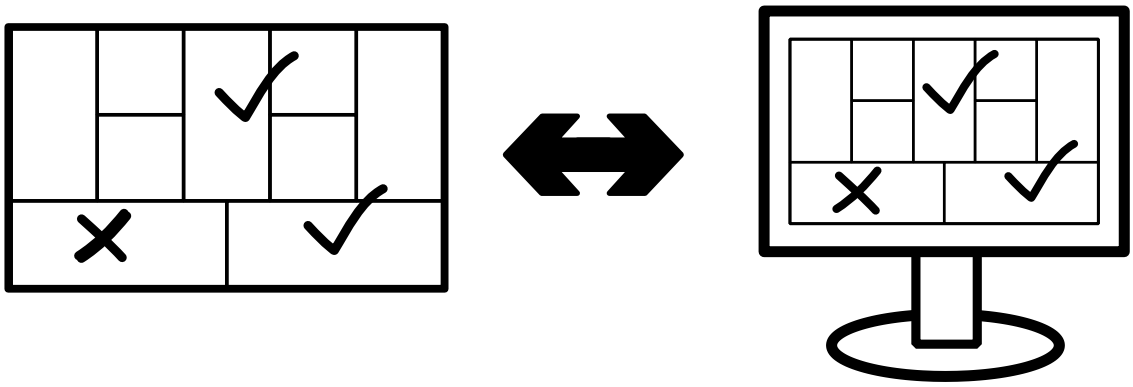

Abstract
In recent years, Business Model Canvas design has evolved from being a paper-based activity to one that involves the use of dedicated computer-aided business model design tools. We propose a set of guidelines to help design more coherent business models. When combined with functionalities offered by CAD tools, they show great potential to improve business model design as an ongoing activity. However, in order to create complex solutions, it is necessary to compare basic business model design tasks, using a CAD system over its paper-based counterpart. To this end, we carried out an experiment to measure user perceptions of both solutions. Performance was evaluated by applying our guidelines to both solutions and then carrying out a comparison of business model designs. Although CAD did not outperform paper-based design, the results are very encouraging for the future of computer-aided business model design.

Keywords: Business Model Canvas; Computer-Aided Business Model Design; Guidelines

5.1 Introduction

In a fast-evolving business landscape, companies need to turn to new methods to help them rethink their business strategy. By using a Business Model Canvas (BMC), they can get a better picture of their current business model, as well as create new ones. These methods are gaining in popularity, leading to the creation of a range of tools to support them. Thus, BMC design has evolved from being a paper-based activity to being one that is supported by custom-built computer-aided business model design (CABMD) tools. Such tools provide functionalities that are similar to the paper experience, but offer additional options such as version handling and calculation. However, in order to give free rein to creativity, the tools tend to be open in nature, making them difficult to use in a structured environment in which software tools are used. This is

especially the case if the application is expected to assist the model itself. Guidelines can help by capturing and encapsulating knowledge that has been collected from best practice. This knowledge can then be offered to users. Elaborating guidelines helps in the design of more coherent business models; in turn, this helps to improve the way in which CAD can support business model design. Nonetheless, all these advanced CAD tools, which are aimed at supporting the BMC, are worthless if they hinder the creative-thinking process enabled by the paper version. However, if evaluation can show that a digital canvas is perceived and performs at least as well as a paper-based canvas, this promises great potential. For example, some features, such as automated guidelines validation, are only possible with digital tools.

The focus of this research can be summarized by the following questions:

- *Can guidelines help to produce a more coherent business model canvas?*
- *How does using a computer-aided business model canvas design tool affect perception compared with using a paper-based version?*
- *How does using a computer-aided business model canvas design tool affect performance compared with using a paper-based version?*

In the next section we present any justificatory knowledge, followed by a short description of our methodology. We then present the guidelines themselves and the way in which they can be supported by CAD. Our evaluation also includes a business model case and an experiment aimed at comparing paper-based design with CAD. The results are presented, along with any lessons learned.

5.2 Designing Business Models

According to Osterwalder and Pigneur (2013) there are three areas where IS research can contribute to strategic management. First, modelling at a strategic level requires a common language and representation. One business model visualization in particular is starting to be widely adopted by practitioners: the Business Model Canvas (BMC) (Osterwalder and Pigneur, 2010).

Second, the strategizing process should be seen as a design activity. Here, design means elicitation and testing; namely, the generation of ideas and their validation.

Third, they put forward the idea that CAD can *"make tasks easier and quicker, while revealing as-yet-unseen opportunities"* (Osterwalder and Pigneur, 2013).

For the purpose of our study, testing in business model terms represents two things: 1) coherence of the business model and 2) commercial viability of the business hypothesis. In this paper, we will focus on the former, since it can be addressed by CAD tools.

5.2.1 BMC Evaluation

The BMC design activity is usually a team effort that involves stakeholders across the company. A recent survey[10] of 1,172 users confirmed that 74% of them carry out design in groups of 2 to 10 collaborators. Moreover, from research undertaken by Reinig (2003: 65), we know that *"the satisfaction users have with the processes and outcomes of the teamwork itself often determines*

[10] Internal survey, Business Model Foundry GmbH 2012

the ultimate adoption and sustained use of collaborative technologies". Therefore, it is important to compare users' perceptions of paper-based BMC with its computer-aided counterpart.

To date, few studies have sought to evaluate BMC design. However, Hoffmann et al. (2012) have shown that paper-based BMC design outperforms two other idea generation methods considerably. They noted that: *"The ability to select the best idea was found to be much higher when groups worked with the business model canvas: 80 per cent of groups selected the best idea"*. Their decision to limit their study to paper-based design was based on the extensive training and potentially expensive support systems required by electronic methods.

In their research, Lucassen et al. (2012) focused on how business model methods can be supported by software. They came to the conclusion that, *"BMC is the preferred method because it effectively models explicit information of both tangible and intangible aspects of the business and communicates this information in a highly accessible manner to parties unfamiliar with the modeling technique"*. However, they did point out that there is still room for improvement, because of a lack of clarity in the modeling process. Furthermore, they pointed out that knowing when the model is sufficiently correct is not explicit. This sustains the relevance of providing better business model design guidelines.

5.3 A Design Science Approach

In this study, we used the methodology put forward in design science research by Gregor and Hevner (2013). First, we explored how CAD can best support business modeling. This was carried out iteratively by building and evaluating prototypes. We also focused on the evaluation of the perception and performance of CAD business model design in comparison with paper-based design. We used existing artifacts such as the BMC and CABMD tools. Our evaluation has one particularity in that we chose to use a commercial instantiation of CABMD software. However, we did propose a new artifact in the form of guidelines, with the intention of making better use of them. The evaluation of this artifact is done by validity. Demonstrating that a coherent business model case can be created by following the guidelines.

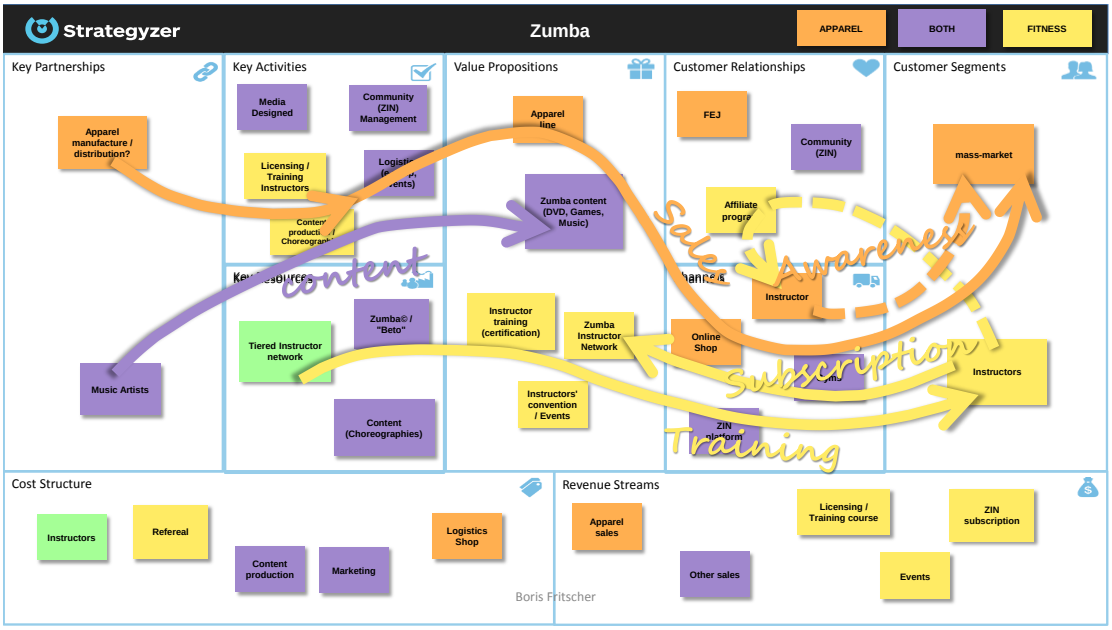

Figure 1. Business Model Canvas of Zumba Fitness.

5.4 Tools for Business Model Design

To help in the design of a BMC we put forward guidelines, aimed at helping both the elicitation of new elements and the testing of coherence. These guidelines could then be transformed into actionable rules for use inside a CABMD tool.

5.4.1 BMC as a Paper-based Artifact

The BMC uses nine building blocks to represent a business model. These building blocks can be further grouped into four perspectives, as shown in table 1. The main perspective is the offer (what we do), which connects the client perspective (who we do it for) and the activity perspective (how we do it). Finally, the financial perspective deals with profit (how much?).

The positioning of these nine blocks is very important. Visually, they form separate groupings, which helps to structure the thought process and facilitate comparisons between the business models drawn using this method. As can be seen in figure 1, the offer is in the centre; to the right is the client perspective and revenue stream, whilst to the left is the activity perspective and cost structure.

Table 1: Business Model Canvas Components.

Perspective	Question	Building block
Offer	What?	Value proposition
Client (right side)	Who?	Customer segment Distribution channels Customer relationships
Activity (left side)	How?	Key resources Key activities Key partnerships
Financial	How much?	Revenue stream Cost structure

There are three guidelines which help in the elicitation of business elements on the BMC.

A. Discover business model elements

Any elicitation technique is applicable. Many users go through the nine blocks one after another and add elements as if it were a checklist. However, this does not harness the full potential of the model, because its strength lies in the connectedness of elements from different blocks.

B. Improve business model through connections

A good BMC has all of its elements connected to at least one other; there are no orphan elements. Additionally, the number of elements inside each block has to be reasonable so as not to overload the visual appearance. This is accomplished by displaying only those elements that perform an essential role in the business model. Furthermore, the connectedness between elements helps in telling the story of the business model.

C. Highlight business model mechanics

By using big arrows on the top of the BMC to depict the flow of interaction, it is possible to visualize the story of the business model. In section 5 we use an example to illustrate the three guidelines.

5.4.2 BMC Coherence Guidelines

Testing a BMC's coherence involves the verification of control points on three levels: elements, building blocks and connections. We propose a set of guidelines for each.

5.4.2.1 Guidelines applying to any individual element

These guidelines help in maintaining a visually understandable BMC.

- There is only one idea per sticky note.
- Ideas are written with keywords, or presented with a simple illustration.
- The meaning of the element is understandable by all stakeholders.
- The element is a key component in explaining the business model; indeed, without it the business model cannot be explained.

5.4.2.2 Guidelines applying to individual building blocks

These guidelines help to identify the right amount of detail for the BMC.

- All nine building blocks of the model are used, or have at least been considered.
- Elements that are too detailed have been grouped into a simpler element.
- Elements that are too generic have been split into more detailed elements.
- The detail level of the elements are adequate (there are not too many detailed elements, nor to few which are too generic).

5.4.2.3 Guidelines applying to connections between elements in different building blocks

These guidelines help with the coherence of the BMC.

- Colors are used on elements to highlight their connections according to the BMC's meta-model (Fritscher and Pigneur, 2010)
- Each color is labeled and has a specific meaning.
- Client perspective is valid:
  - Each customer segment is addressed by one or more value proposition.
  - A channel supports a value proposition-customer segment set.
  - If present, a customer relationship targets a customer segment.
  - In case of multiple customer segments, colors distinguish each business side.
- Activity perspective is valid:
  - Each value proposition is produced/delivered by a key activity, a key partner or offers a key resource.
  - Key resources or key partners support an activity.
- Financial perspective is valid:
  - Revenue stream is generated from a value proposition-customer segment set. (A revenue stream can also be "free").
  - Major fixed costs are listed.
  - Major variables costs are listed.
- There are no orphan elements: all elements are connected to another element (in a different block to themselves).

5.4.3 BMC Computer-Aided Design

Multiple versions of BMC prototypes can be found, as well as commercial versions. Research prototypes emphasize advanced features; however, they lack finesse in user experience. In order to make the best comparison between a paper-based BMC and a digital implementation, we chose to use Strategyzer, a commercial version that is closest to the original paper-based BMC. This commercial software solution not only has a proven user-friendly interface, it has the added advantage of being inspired by the same original artifact ideas as our research prototypes.

Another benefit is that it has calculation features which sit on top of the basic functionality features, showing that integration is possible without compromising the simplicity of the user interface.

When Computer Aided Design (CAD) is applied to the BMC, it can support elicitation by making it easier to move, duplicate and rename elements. Thanks to its digital properties, elements can also be hidden and shown selectively, allowing for multiple views of the same data. This enables the exploration of business model variants, thereby further aiding the elicitation process.

Beyond visual interactions, such software tools can be used to support business model design with features that are tailored to guarantee the coherence of the meta-model on which they are built. Guidelines can be transformed into rules, which can then be tested by the tool. In case of incoherence, a notification is shown on any invalid elements. Such visual flags can, in addition, contain hints on how to fix the problem or, at the very least, offer a reference as to which rule or guideline was violated. The computation is carried out automatically; thus, visual flags appear as soon as something changes.

Guidelines allow a coherence score to be attributed to each model; this score is based on the number of fulfilled conditions.

5.4.3.1 Example Guideline Transformed into Rules and Resolution Hints

Rule 1: There are not more than a specified number (given by a threshold) of customer segment elements with the same color.
Resolution hint: Either merge elements that are too detailed (building block guideline) or change colors of element belonging to a different value proposition to distinguish the segments (connection guideline).
Rule 2: A customer segment has to have a corresponding value proposition element with the same color as itself.
Resolution hint: Create missing elements or add right colors.

5.5 Comparing Computer-Aided Design with Paper-based Design

The focus of our evaluation is to compare a paper-based BMC with one created using a computer-aided design tool in terms of perception and performance. In this section, we first present how we created a business model for Zumba Fitness following our guidelines. We then go on to present the experimental setup, followed by the results and statistics.

5.5.1 Zumba Fitness Business Model

This case is used to illustrate how to apply our elicitation guidelines when designing the Zumba Fitness business model using publicly available information (as shown in figure 1). Zumba Fitness is a company that offers fitness training to instructors (yellow) and sells fitness apparel (orange) to the mass market. Separate colors were used for each type of offering. Elements that are affected by both value propositions are shown in violet.

A. Discover Business Model Elements

The discovery of elements, which can be added to any of the building blocks, can come from internal knowledge, interview, observation or indeed any kind of research method. However, it is crucial to move from one idea to the next without limiting oneself to one block at a time. Our main

source of information for this case study was a six-page report by Inc magazine[11] and a video interview featuring one of the company's founders.

As should be the case for any presentation of the BMC, we will first present the elements as a story, instead of going through the blocks one at a time.

Zumba Fitness offers *Instructor training* to the *instructors* customer segment with the help of their *online ZIN platform* and *gyms*. Giving courses generates *licensing/training* revenues. A second revenue stream from *instructors* is a *subscription* to the *ZIN network*. This offer (value proposition) gives the *instructors* access to new *Zumba content* which they can use in their own Zumba classes. To provide the aforementioned value propositions, a number of key activities have to be performed, including *training*, *ZIN community management* and *creation of new content* (choreography).

Another customer segment is the *mass market*, namely, people who buy apparel from the *online shop*, thus generating *sales* revenue.

B. Improve Business Model through Connections

With any BMC, it is important to check the connections between the elements. This helps to identify any missing elements. It can also lead us to question the validity of elements if no connection to other elements can be found.

Continuing with our example, although fitness apparel is sold, its source is missing. Therefore, for coherence, *manufacturing & distribution* partners had to be added, as well as a *logistics* and *media design* activity, and the cost structure of a *logistics shop*.

The content creation activity produces new *choreographies*, not only as a value proposition, but also as a new resource. However, to produce such choreographies, the company also needed *music artists*; these become a new partner element. The creation of content (*content production*) is also a major cost in the business model. An additional resource, which gives value to their content, is the *Zumba* brand name.

C. Highlight Business Model Mechanics

Business Model mechanics help to visually illustrate major interactions between elements on the BMC. The flow of the interaction is depicted by large arrows, which connect the elements. Thinking about the mechanics and the story behind it will help reveal additional element interaction, which may not emerge when looking only at individual elements.

This case is particularly interesting, because a series of mechanics helps to reveal that instructors are also a channel. Zumba starts by *training/certifying* instructors; a major percentage of these instructors will then subscribe to the Zumba Instructor Network. A certified instructor goes on to give Zumba courses and naturally starts to promote the brand and its apparel. To build on this phenomenon, Zumba offers them an *affiliate program* (customer relationship). Thus, through awareness generation, *instructors* become a channel to the mass market. This supports the second mechanic, which is the *sale of fitness apparel* through the *online shop*. The third mechanic can be found backstage, in the form of generating content.

Having added *instructor* as a channel and an *affiliate program*, it is then necessary to check again for any connections. In turn, this reveals that, to retain coherence, a *referral fee* has to be

[11] http://www.inc.com/magazine/201212/leigh-buchanan/zumba-fitness-company-of-the-year-2012.html

Table 2: Descriptive statistics.

Variable	Mean		Std. Dev.		Min		Max	
Tool	P	S	P	S	P	S	P	S
Perceived Usefulness	2.38	1.83	0.98	0.69	1.25	1.00	5.00	3.50
Perceived Ease of Use	2.36	1.80	1.13	0.73	1.00	1.00	6.00	4.00
Task Outcome	2.27	1.85	0.80	0.72	1.00	1.00	4.33	3.33
Task Innovation	2.17	2.79	0.73	1.10	1.00	1.00	3.00	4.67
Total Elements	23.00	28.82	5.75	6.91	11.00	20.00	32.00	42.00
Correct Elements	16.81	15.64	2.62	3.91	13.00	11.00	20.00	25.00

P: Paper (21 observations), S: Strategyzer software (22 observations)

added to the cost structure. This demonstrates the need to iterate through the mentioned techniques and guidelines until everything is in a stable and coherent state.

5.5.2 Experiment Setup

Our experiment was aimed at designing a business model for the Zumba case using an article and a video interview as information resources. The evaluation was performed during a business model course attended by students from a master's program in IS. The students were all familiar to a similar level with the BMC method and web tool. A total of 43 students participated. They were split into 22 groups in order to have the most groups possible and avoid students having to do the task individually. Having teams of two people is a key component of generating creative ideas (Paulus 2000) and corresponds better to the normal use of the BMC.

Half of the groups were asked to do the design task using a paper-based BMC. The others used the chosen computer-aided business model design software and were not allowed to use paper at all.

Evaluation of the task was carried out in two parts. First, when a group considered their work to be complete, each student was asked to individually fill out a questionnaire to assess their perception of the task. Second, all BMCs were collected and evaluated to assess the performance of the groups' designs.

5.5.3 Results and Statistics

In this section, we present our measures of perception and performance, followed by their statistical analysis.

Table 3: Pearson's correlation between concepts.

	PU	PEU	TO	TI	TE	CE
Perceived Usefulness [PU]	1.00					
Perceived Ease of Use [PEU]	0.54***	1.00				
Perceived Task Outcome [TO]	0.27		1.00			
Perceived Task Innovation [TI]			0.39**	1.00		
Total Elements [TE]	-0.28	-0.26			1.00	
Correct Elements [CE]				-0.32*	0.43**	1.0

P>|t| * 0.001, ** 0.01, * 0.05**

5.5.3.1 Measurement of Perception

For the questionnaire we decided to use questions and scales taken from existing literature (see appendix for the full question list). The concepts of perceived usefulness and perceived ease of use were adopted from TAM (Davis 1989). However, we simplified the questionnaire, reducing the number of questions by removing those with similar meanings, to avoid confusion amongst our non-native English speakers.

A measure of the perceived task outcome was added so that we could test whether there is a difference in perception between the two medias. In addition, this allowed us to make a comparison with the real outcome performance metric. The task outcome was adapted from Briggs et al. (2006). Here, we selected items from their meeting outcome and meeting process questions.

We were also interested in how media type impacts our perception of being able to generate ideas. For task innovation we used questions taken from (Torkzadeh and Doll, 1999).

All answers have a seven-point likert scale, which we coded from 1 (best) to 7 (worst).

In order to analyse the concept, for each question we grouped the answer variables of each metric into a usable concept (latent variables) using Cronbach's alpha. The *perceived usefulness* concept is well defined by its four questions with an alpha of 0.75. For the *perceived ease of use*, we dropped question number 2.3 to get a better alpha of 0.71. For the *task outcome* concept we had to drop question 4.3 to get an acceptable alpha of 0.75. The *task innovation* concept is well described by its three questions with an alpha of 0.92.

5.5.3.2 Measurement of performance

The designed business model's performance was computed by comparing it with the solution developed by two experts who followed the techniques and guidelines presented in the artifact section. A total of 28 points could be achieved for the *Correct Element* measure. The comparison points were not all a direct match; if an element was similar in meaning to the solution, it was also accepted. There were no negative points for additional elements and the same evaluator corrected all of the BMCs. We also took into consideration the metric of the *Total Elements* in order to measure any differences in quantity generation between the media.

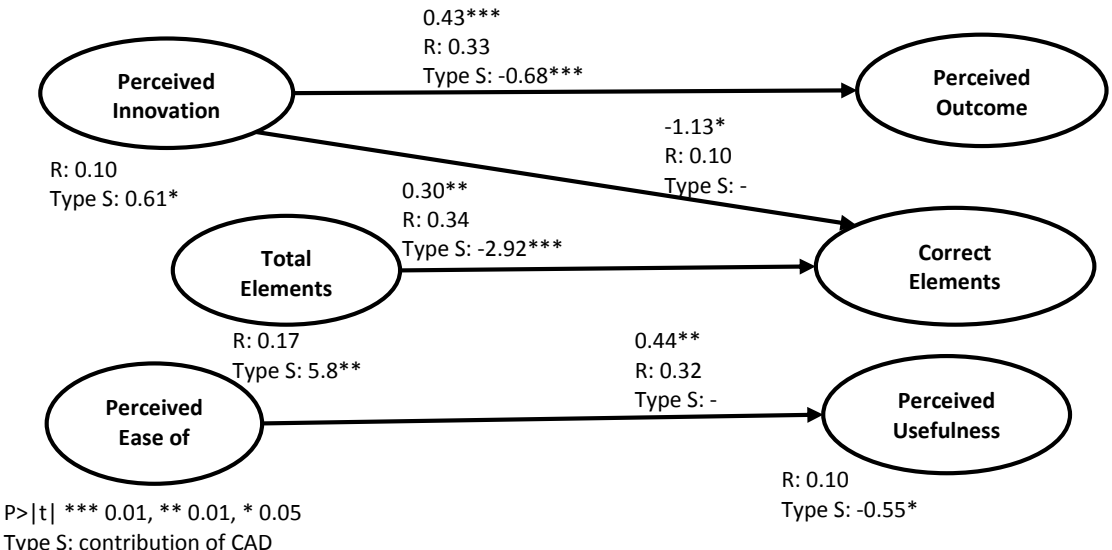

Figure 2. regressions between concepts

5.5.3.3 Descriptive statistics of results

As can be seen in table 2, answers are skewed positively, with a low average score for all the perception constructs. This indicates that overall the students had a very positive perception of the BMC, irrespective of the type. The computer-aided canvas was marginally better than the paper-based canvas on all the perception measures, except for task innovation. It also helped to generate more elements. Correct elements are very similar for both types. Element metrics of the computer-aided canvas showed the greatest deviation, with both the best and the worst number of correct elements.

5.5.3.4 Statistical analysis of concepts

We used the Stata 12 software package to perform our statistical analysis. After verifying the concept's alpha values we looked at the Pearson correlation between them. The matrix, which can be seen in table 3, helped us select the concepts that warranted further analysis with regressions to determine the impact of the type of media used.

The strongest correlation is between usefulness and ease of use, which matches TAM's theory. The correlation between the total elements and correct elements also seems natural. We did not penalize wrong elements, therefore the more there are, the greater the possibility of also having correct ones. Of particular interest is the correlation between task innovation and task outcome, and between task innovation and correct elements, which represents the real outcome. We explore these relations further in the discussion.

5.6 Lessons from the Comparison

A regression analysis was used on the variables for which correlations stood out. The results are shown in figure 2. Only links with significant regression results are shown. Type S is the contribution of using the computer-aided software BMC over the paper-based BMC. As already observed, with the mean values, *perceived innovation* is slightly better with the paper-based BMC, but the R-square value is only 0.10. On the other hand, *perceived innovation* strongly predicts *perceived outcome.* Users of the digital BMC perceived that it helped them do a better job more than did the users of the paper-based BMC. *Perceived innovation* slightly predicts *real outcome* (*correct elements*), without a difference between types.

On its own, *perceived usefulness* is seen as being better with the digital tool. This could be a bias of the population of IS students who are familiar with IT technology and might prefer a technical solution to one that uses paper.

There is no significant difference between the type that affected the influence of *perceived ease of use over perceived usefulness.* This can be seen as a positive result for the software tools, because it does not perform better or worse. Having at least the same ease of use as paper is a key result, which should be reflected upon when considering that the digital tool has the potential of offering additional features, providing usefulness that is not possible on paper.

The computer-aided BMC helps to generate more elements than a paper-based one; however, it also has a negative influence on the number of correct elements. It is easier to generate more elements, but also to generate more wrong elements.

Users who think that the digital tool helps them innovate, think they have performed better; however, in our small setup they obtained similar numbers of correct elements.

In addition to the statistical analysis, we also observed how the teams worked during the design task. One observation that is of particular interest relates to the process of eliciting elements. On the paper-based BMC, a discussion first occurs and then a sticky note element is created and positioned. On the computer-aided BMC, however, which also supports collaboration, elements are added first by each member and then changed to reflect the consensus. This is interesting because recording the decision inside the tool means that it can be utilized to better support the ongoing business modeling collaboration process.

Three weeks after the first task, we carried out a trial experiment with the coherence guidelines using paper. The results were varied and inconclusive, although users did say it helped them improve their model. Problems arose when attempting to test them on paper. In this situation, users have to perform the checks manually; in some instances, they do not take the time to iteratively do it as soon as they change something. Therefore we posit that although we showed that guidelines can be used to create coherent models on paper, it is more appropriate for such guidelines to be implemented and tested inside a prototype tool. Here, they can be recomputed each time a change is detected.

In summary, in our experiment with our test group, the tested CAD tool was as effective as paper-based design for the creation of business models in terms of eliciting elements of the BMC. This indicates that with the help of rules, it might be better suited for testing the coherence of business models than paper-based design.

5.7 Conclusions

To assist BMC design using software tools, we proposed guidelines that help with elicitation and testing in order to produce coherent models. Before implementing such features in a digital tool we needed to confirm that perception and performance on a basic BMC design task are at least similar to those of a paper-based design. With our evaluation we found that the tested digital tools can be perceived as useful, and does not perform any worse than its paper-based alternative. Even if CABMD did not outperform paper-based design, it shows some promising results, because such tools can be extended to offer additional features, thus increasing their usefulness. Features that are much better suited for digital tools include the continuous reviewing of coherence rules to check their validity.

In this paper, we focused on modeling an existing *“as-is”*, business model. Further research is needed to explore options that may enable the exploration of future *“to-be”*, business models. For example, rules could be extended to simulate financial assumption or validate regulatory constraints.

REFERENCES

Briggs, R. O., Reinig, B. A., & de Vreede, G. J. (2006). Meeting Satisfaction for Technology-Supported Groups an Empirical Validation of a Goal-Attainment Model. Small Group Research, 37(6), 585-611.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS quarterly, 319-340.

Fritscher, B., & Pigneur, Y. (2010). Supporting Business Model Modelling: A Compromise between Creativity and Constraints. Task Models and Diagrams for User Interface, (LNCS 5963), 28–43.

Gregor, S., & Hevner, A. R. (2013). Positioning and Presenting Design Science Research for Maximum Impact. MIS Quarterly, 37(2).

Hoffmann, F., Eppler, M. J., & Bresciani, S. (2012). Business Model Ideation: An Experimental Approach for the Evaluation of Team-based Methods. 12th EURAM 2012 European School of Management

Lucassen, G., Brinkkemper, S., Jansen, S., & Handoyo, E. (2012). Comparison of visual business modeling techniques for software companies. In Software Business (pp. 79-93). Springer Berlin Heidelberg.

Osterwalder, A., & Pigneur, Y. (2010). Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons.

Osterwalder, A., & Pigneur, Y. (2013). Designing Business Models and Similar Strategic Objects: The Contribution of IS. Journal of the Association for Information Systems, 14.

Paulus, P. (2000). Groups, Teams, and Creativity: The Creative Potential of Idea-generating Groups. Applied psychology, 49(2), 237-262.

Reinig, B. A. (2003). Toward an understanding of satisfaction with the process and outcomes of teamwork. Journal of Management Information Systems, 19(4), 65-84.

Torkzadeh, G., & Doll, W. J. (1999). The development of a tool for measuring the perceived impact of information technology on work. Omega, 27(3), 327-339.

APPENDIX

The following questionnaire was used for our survey, either using *Strategyzer* or *the paper canvas* as subject.

Based on your short experience with Strategyzer, how would you rate the following statements when thinking about using Strategyzer for future Business Model Design Tasks?
The following seven point Likert scale was used: extremely likely (1), quite likely (2), slightly likely (3), neither (4), slightly unlikely (5), quite unlikely (6) extremely unlikely (7)

1 Perceived Usefulness

1.1	Using Strategyzer to design business model would enable me to accomplish the task more quickly.
1.2	Using Strategyzer would improve my performance in designing business models.
1.3	Using Strategyer would make it easier to design business models.
1.4	I would find Strategyzer useful for designing business models.

2 Perceived Ease of Use

2.1	Learning to operate Strategyzer to design business models would be easy for me.
2.2	I would find it easy to get Strategyzer to do what I want it to do.
2.3	It would be easy for me to become skillful at using Strategyzer to design business models.

The following seven point Likert scale was used for the next two sections: strongly agree (1), agree somewhat (2), agree (3), neither (4), somewhat disagree (5), disagree (6), strongly disagree (7)

Now evaluate your business model design task.

3 Task Outcome

3.1	I feel satisfied with the designed business model.
3.2	I feel satisfied with the process used to design the business model.
3.3	With more time I could substantially improve the designed business model.
3.4	I had enough time to complete the task.

4 Task Innovation

4.1	Strategyzer helps me create new ideas.
4.2	Strategyzer helps me come up with new ideas.
4.3	Strategyzer helps me try out innovative ideas.

Chapter 6
Visualizing Business Model Evolution with the Business Model Canvas: Concept and Tool

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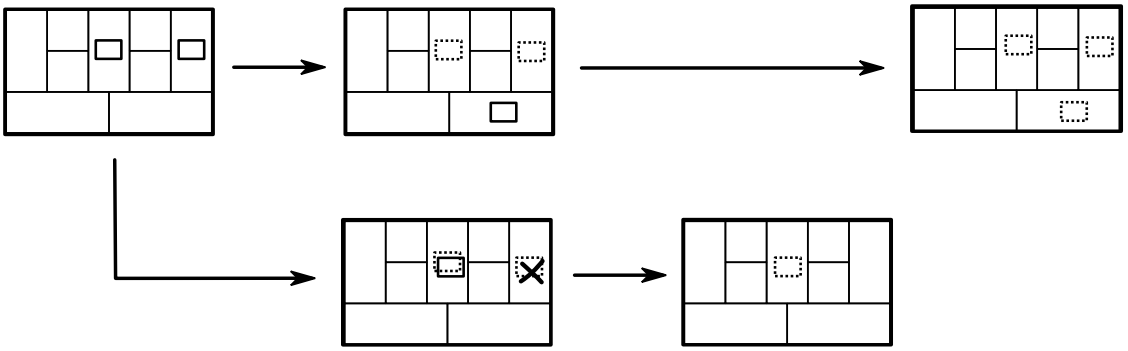

Abstract
The Business Model Canvas (BMC) assists in the design of companies' business models. As strategies evolve so too does the business model. Unfortunately, each BMC is a standalone representation. Thus, there is a need to be able to describe transformation from one version of a business model to the next as well as to visualize these operations. To address this issue, and to contribute to computer-assisted business model design, we propose a set of design principles for business model evolution. We also demonstrate a tool that can assist in the creation and navigation of business model versions in a visual and user-friendly way.

Keywords: Business Model Canvas; Business Model Evolution; CABMD

6.1 Introduction

The Business Model Canvas (BMC) [1] is a visual modeling method that is used to capture the business model of a company. It is defined by nine building blocks. The method involves adding sticky notes to each of these building blocks; these note represent the elements involved in the business model. A completed BMC will highlight the key elements of a business model at a fixed point in time, as chosen by its creator. The BMC has achieved widespread adoption [2]: not only is it used to model the current state of companies' business models, but also any future business model innovation. When a company undergoes changes, these need to be reflected in its business model. Planning for new strategies also generates new business models of possible future states. Currently, every canvas is standalone. Thus, for each canvas a specific time context is chosen: past, present, or a possible future. Even if changes to a business model can be represented by a new BMC, these two canvases are not linked together and there is no indication as to how to compare

them. Identifying the changes that have occurred between the two states is difficult. It is necessary to review each element for both canvases, comparing them one by one to see if they have been added, changed or removed. A more efficient method of highlighting changes between two canvases is needed, one that creates a visual roadmap of a business model's evolution. Only then, will companies be able to better understand business model transformation.

6.1.1 Business Model Canvas

In this study, we chose to focus on the BMC because of the problems raised through its broad adoption, and because its visual and simple-to-use structure aligns with design thinking and managing as designing [3-4]. Proficient users are able to do more than just add elements to a model's building blocks; they can also consider element interactions and multiple models [5]. For more advanced users, however, it is necessary to develop a method for dealing with changes to a business model.

6.1.2 Business model mechanics

An expert BMC user can highlight key business model mechanics and interactions between elements by drawing arrows to connect these elements. Business model evolution affects elements, so any changes to these elements will also have an impact on mechanics. When new elements are added or removed, some mechanics may become more important or less important.

By taking mechanics into consideration during the design of a business model, new ideas can be generated, leading to the exploration of new business models. However, a solution is still required to assist in the handling of multiple models and their transformation.

6.1.3 Business model evolution

Our particular interest is in the transformation that occurs between two discrete evolutionary steps of a business model. In reality, changes occur in a fluid way, on an ongoing basis. We consider the issue of grouping changes into sets of mutations to be outside the scope of this paper. The choice of decomposition into distinct steps is carried out by the designer, who uses his own methods.

A business model's elements will change at some point. At the time of change, the overall business model will be transformed so that it is distinguishably different from its previous version. Each small change can be seen as a mutation of an element, which is either an addition, a removal or a modification. A set of mutations is the difference between two versions of a business model. This provides us with the means to consider, for example, the history of a business model as an evolution through different states or as ticks on a timeline. Changes may occur as the result of internal research and development, or through the continuous improvement of tasks, and reactions to changes in the business model's environment. While this sequential vision works for tracking past and current states of a business model, a more flexible approach is needed if we wish to explore future states, of which there are more than one. Future business models represent possible versions. These have been imagined in response to future changes that have resulted from internal innovation or a reaction to environment changes and can be discovered by, for example, simulation or scenario-based prediction tools. An evolution graph looks rather like a tree, with branches representing the possible future directions of the business model. One of

these branches might become the next current state. Having a better description of the evolution that is required to reach such a possible future state opens up the possibility of evaluating the necessary transitional steps, thereby allowing us to identify the most suitable target for the next evolution step.

6.1.4 Computer-aided business model design (CABMD)

Handling all these mutation steps on paper has its limitations. Marking up changes to previous states requires elements to be redrawn. What's more, hiding deleted elements is difficult. A CABMD tool would be much better suited to the handling of such dynamic design. Context changes require a different selection of visible elements to be displayed. By enabling the previous model to be visible in the background, it is easier to identify which mutations are needed to transform the current business model into a new one. As a result, only the end result, or the transformation can be displayed. Moreover, being able to switch the view in an instant is in the design spirit of prototyping and helps in the iteration of different mutations until the most suitable model has been identified.

Features derived from CAD tools in other domains, such as architecture, process design, and programming, can be used as an inspiration for CABMD. However, special care has to be taken to design accessible tools that do not require special training or a technical background. The main user group consists of business people, who tend to be less technically aware than traditional engineers [2]. Likewise, the tool should have as much built-in flexibility as possible, offering advanced designers constraint validation of the model, whilst still offering some guidance to novice users.

6.1.5 Research questions

The focus of this research can be summarized by the following questions:

What would a formalized set of concepts for mutating from one business model to another look like?

What would a visualization of a Business Model Evolution with discrete steps look like?

What design principles does a CABMD tool need to fulfill in order to support Business Model Evolution visualization and manipulation?

In terms of structure, this paper follows design science research guidelines [6]. First, we present the justificatory knowledge, followed by our methodology. We then discuss the artifact (i.e., the use case and our concepts), before going on to describe a prototype that implements the artifact, followed by an evaluation of that prototype. Finally, we discuss the implications of the methods used and conclude with a look forward at further research on CABMD.

6.2 Justificatory Knowledge

In highly uncertain, complex and fast-moving environments, strategies are about insight, and rapid experimentation [7]. This impacts on the need for business model evolution. Indeed, the adaptability of a company's business model is key to its ability to survive [8]. However, as yet, no visual or technical methods to transcribe these changes on to a business model have been put forward. From a technical perspective, evolution can be interpreted as a series of business model states that are versioned. Ideas and technique for versioning are not new. They have already been

covered extensively in many technical disciplines. However, none of them fit perfectly to the business model evolution tracking needs we have identified.

In fields such as database modeling, schema evolution is well known in relational and object-oriented systems [9]. Solutions exist, but are too technical and not easily adapted to high-level and managerial-level business illustrations.

Versioning of work was first introduced in development environments and has proved successful in handling a variety of change tracking that goes far beyond the initial source files [10]. At its core, versioning serves to guarantee the integrity of the changes, giving the business model an immutable history. However, whilst this works for documenting the history of an evolution, it does not support creative prototyping, where a flexible and dynamic back-and-forth way of idea exploration is required.

6.3 Methodology

This study followed a design science research approach [6]. We identified a need for a structured method to visualize business model evolution using a BMC. To address this need, we elaborated a series of concepts, which were then instantiated with different prototypes in order to iteratively improve and evaluate them.

The iterations to produce the design solution were carried out under a set of constraints because our solution has to be suitable for use with a BMC. Thus, it has to follow the principles of ease of use and of visual design [2] to guarantee that it will be accessible to our target audience of business users, who do not have special CAD tool training.

To get a better grasp of the concept of business model evolution modeling, we started by gathering insights. We also built a use case, which served as the foundation for creating the first visual prototype. The use case was built by carrying out desk research about a company that had been identified as having multiple evolution steps. All the available data was aggregated to build discreet identifiable evolution steps, which were then described textually. In a second stage of the process, key business model components were extracted from each step, giving us a series of BMCs, which could be linked together. This visual prototype was then iteratively evaluated and refined. The key transformation concepts were extracted from it and an insight was gained into their design principles.

The visual prototypes were built using the core tenant by which paper-based design is combined with the possibilities offered by computer-assisted software. We explored the idea of layers for each step of business model evolution by evaluating different prototypes: first with paper experiments, then with illustrations created using a digital painting tool and finally with a custom software tool. Each prototype gave additional insight, enabling us to solve the issue of visually displaying these steps and the transitions that take place during business model evolution.

6.4 Concepts for Business Model Evolution

In this section we describe concepts of business model evolution, starting with the basic operation to transform one business model state into its next version. We then show how the concept of layers can help with visualizing these operations, extending this transition to multiple iterations. We can then examine how this affects the representation of different layers.

6.4.1 Mutations classified

To describe the transformation from one business model version (layer) to the next, it is necessary to look at three mutations: the add operation, the change operation to transform existing elements, and the remove operation, which complements the add operation.

These actions are very similar to those proposed in the Blue Ocean Strategy 4 Actions Framework: Create, Eliminate, Raise and Reduce [11]. In this study, however, we describe how mutations can be used to define the transformation of one business model (previous, layer 1) into a new one (layer 2).

6.4.1.1 Add

Adds a new element to one of the nine building blocks of the BMC. Something new that the previous business model did not utilize.

6.4.1.2 Remove

Removes an existing element from one of the nine building blocks of the BMC, completely discarding something that was used before.

6.4.1.3 Change

Any element that behaves differently or has one of its properties transformed. Instead of considering two distinct cases, such as raise and reduce from the 4 Actions Framework, we used a generic change operation. On a basic level, change could engage the remove and add operations; however, this would not allow existing mechanics to be involved in the changed element without the removal and recreation of both the mechanics and connected elements. The change mutation in operations allows us to trace the origins of the elements and the state where they were introduced to the business model. The change mutation also shows how the business model evolved into its current state.

For some changes, it is helpful to indicate if it was a raise or reduction. This can be specified as an additional indicator, without noting whether it is a positive or negative increase, because this depends on the context.

6.4.1.4 Other mutations

More complicated concepts, such as the notion of splitting one element into multiple elements, or the merging of multiple elements into one, could also be considered. On the other hand these operations can be handled with a combination of remove, add and change operations; for example, by deleting all merged elements and adding a new one, or by deleting all except one and then changing it. The caveat is, of course, that it may lose some evolution information. Although we chose to introduce the change event for these reasons, in a situation where there is merge and split, any added complexity would outweigh the benefits provided.

6.4.2 Visual representation with layers

In order to group mutations into business model states we used the concept of layers inspired by 2D animation techniques. Here, layers are used as a stack of transparent sheets, where each one represents a still image frame of the animation. A new frame is a new layer, which is used to draw over previous areas to illustrate movement through changes. Applied to business model

evolution, the use of this technique is similar to that of drawing on tracing paper. The mutations are applied to the new layer, thus affecting elements that are visible on the lower layers. Here, the redraw is not based on the location of the painting canvas, but on the process of adding, removing or changing business model elements in the nine building blocks. The operations of the current layer are shown normally; the previous layer is shown as faded.

6.4.3 Multiple evolution steps

A business model evolution that involves more than one transformation adds some complexity, which we address here.

6.4.3.1 Tree of Business Model Evolution

Stacking more than one layer shows a chain of evolution for a business model, as well as a series of transformations. Furthermore, it is also possible to avoid stacking all the layers directly on top of each other by sharing some layers and then branching off into another direction, much as branches grow on a tree.

6.4.3.2 Import

However, if there are different branches and one element is to be shared from one branch to another without adding it to the common parent layer, the change operation does not fully cover this use case. Therefore, we have used the concept of import to highlight an element that is used from another layer when there is no common element in a shared parent layer. It was also used in our use case in which two business models were developed in parallel, sharing some elements. This concept is necessary because of dependency problems when there are more than two layers. Other consistency rules which did not require a new concept are covered in the design principles section.

6.4.3.3 Multiple layers aggregation rules

Visually, the best way to understand business model evolution is to compare the difference between two consecutive layers. When there are multiple layers, making such a comparison can be difficult because of visual crowding, especially if there are a large number of change and delete operations across the layers. The best way to compare a layer with the previous layer is to aggregate everything except the two layers that need to be compared. This aggregation creates a simplified previous layer and helps to declutter the visual design. It also means that if an element is removed in the previous layer, it will not show up in the current layer. When changes have been made, only the final changed element is displayed; the most recent change overriding the older ones. All the elements of the previous layers have the same fade level; they do not fade more and more, as if they were layers of paper stacked one on top of the other.

6.5 Use Case: Valve Corporation

We developed a use case based on an American company named Valve Corporation. They started out as a classic video game development studio and transformed themselves into the leading actor of digital video game distribution (Steam[12]). From a business model point of view their case is

[12] http://en.wikipedia.org/wiki/Steam_(software)#History

interesting because we could identify seven evolution steps within twelve years and spanning two business models: game design and distribution platform. The latter emerged from the first one, but is more than just an extension. Identifying the states and their transitions was in itself a challenge. Part of the final prototype tool can be seen in figure 2.

6.5.1 Example of a transition

In 2011, Valve Corporation started experimenting on applying the free-to-play business model concept to one of their more successful multiplayer games, "Team Fortress 2". This meant that they no longer sold the game, but offered it for free to anyone to download and play. The lost revenue from game sales was replaced by in-game micro transaction sales of add-on items for the in-game avatars: new decorative hats, glasses, and weapons. Additionally, they approached independent developers, offering them the possibility of producing new content for the game through a revenue-sharing model.

Key mutations for this transition were two new value propositions: "free game" and "in-game items market". In addition, there were two changes in the customer segments targeted by these new offerings: "gamers" which expanded to include more casual players and "independent developers" which increased in terms of numbers and professionalism, as the developers were attracted by the new revenue possibilities.

6.6 Design Principles for Computer Aided Business Model Design

Supporting a design methodology with CAD tools has several shared advantages: guaranteed consistency of the model, easier visual navigation with multiple representations of the same data, and support for explorative work methods with the ability to move elements around at no cost. In addition, a number of principal benefits can be identified for each concept; these can be implemented by a CABMD tool to support business model evolution.

6.6.1 Transformation principles

P1: Consistency of the supported model

The tool should allow for flexibility while still guaranteeing automatically the consistency of the model it supports. Applied to the business model concept we have the following examples:

- A series of changes has an add mutation as the initial parent element;
- A link always connects two existing elements;
- An import element has a parent element, which is not visible in any parent layer.

Consistency can be guaranteed in different ways, as shown.

- By blocking any operation that would lead to an inconsistent state. For example, to guarantee consistency, one should not authorize the removal of elements involved in a link before the link itself is removed.
- Draw to the attention of the designer the problem to be resolved; the designer can then make a decision. For example, he could choose to cancel the requested operation or decide to remove the element and any relevant links.
- If the solution is obvious, any corrections that are needed to make the model consistent can be applied automatically.

6.6.2 Visual principles

P2a: Visual representation and simple navigation

Any interaction has to be a simple and visual representation of the business model, and must be understandable at a glance. A CAD tool needs to be easily editable and support visual color coding of the elements [2].

P2b: Visual mechanics

Visual mechanics illustrate the influence of elements on each other in the BMC. Semantically, it can have different meanings, depending on the story being represented. Therefore, the implementation of visual mechanics has to be open and allow for a drawing-based system, whilst still enforcing the connection between the start and end elements of the link. Links are limited to connecting elements in the nine building blocks of the same BMC; however, they can span elements of different layers.

P2c: Layers as business model states

In terms of replication, digital layers help to fade previous models in a way that is smarter than using tracing paper. Instead of having the lower layers fade to nothing, each layer can be computed so that it is visually "readable", with the right amount of transparency. In addition, it is relatively inexpensive to use a digital format to improve visuals by displaying the same information multiple times and in different ways.

In Business Model evolution each layer represents a new business model through the aggregation of the previous layers. Instead of putting everything on top of each other, each aggregation (state) can be displayed in a sequential way, as a chain of business models, or can be spaced along a timeline.

6.6.3 Consistency during design dynamics with multiple layers

In this section, we describe the rules that govern the movement of elements whilst the modeler is experimenting with the design, moving elements between layers before reaching a final solution.

P3: Mutation rules on business model elements

Elements that are new (add elements) can be moved to all other element types (change, import, remove), or they can inherit their position from the element they modify. Moving an element's position inside the same building block only has a visual impact. Switching building blocks inside the same BMC changes its element type. If an element is moved into a layer that represents a previous state of the current business model, everything is fine. If the element is moved to a later business model state, which already includes a change element there may be a problem; this depends on the moved element. The elements that are added and changed will occupy the same space. Thus, it is necessary to decide how to merge them or whether or not the move is invalid.

Moving an add element out of the business model inheritance tree or onto another business model line, might leave change elements that do not have a visible add parent. The first change element needs to be transformed into an import. Alternatively, the move will have to be cancelled and the user alerted as to existence of a dependency problem.

To change an element from one building block to another, it is necessary to delete and re-add that element. Alternatively, the original add element has to be moved, because a change can only relate to an element's properties; for example, its name and color.

6.7 Instantiation

The built prototype is a web application (see figure 2). It provides a workspace on which the BMC and its layers can be added. Each layer aggregation is shown on a sequential timeline. Navigation between the states can be achieved by zooming into the workspace and panning around.

The following features support the design principles described in the previous section.

6.7.1 Consistency

The user interface limits element creation on a layer to given operations. On any BMC, elements can be added to any position of any building block. Changed or deleted, however require clicking on an added element from a previous layer.

6.7.2 Visual principles

6.7.2.1 Visual representation and simple navigation

Each element has a set of visual properties that dictate its appearance, such as name or picture, and a set of colors. We chose to use a multicolored tagging system [2], which is recommended for this design. Elements have a fixed size, but can be freely positioned.

Since the visual appearance of an element is computed in real time it is easy to provide options that customize the look of any displayed information. A number of visual choices can be turned on or off: links between BMCs, the mechanics in a BMC, and the previous layer can all be shown. Likewise, customization can be used to show only the new mutations or the final model without any fading. The space between business model states can also be changed to influence its position in the tree, or in order to simulate a timeline over a purely sequential layout.

6.7.2.2 Visual mechanics

Links between elements are created by dragging and dropping one element on top of a second element. The visual appearance of a link can also be changed by specifying its stroke width and dash style in addition to its color. The start and end points of links are confined within the bounding box of their respective elements. A link can have as many intermediary nodes as necessary to draw a custom BM mechanic path between its start and end elements. This allows the BM to express an indirect route, which visualizes the usage of other elements (limited to only visual information).

6.7.2.3 Layers as business model states

A BM can create a new child business model which inherits its elements; here, links are faded. The child model takes the form of a layer that is positioned on top. New transformations are recorded on this layer.

6.7.3 Multiple layers

A business model can have as many children as necessary; each child is a new branch in the tree. A child business model can, in turn, give rise to another child business model, thus creating a chain, with cumulative results for each branch.

An existing element is inherited from its parent chain (either from a direct parent or a grandparent). Such an element cannot be moved directly; instead, it can be marked as removed or changed according to the rules of mutation. A change can optionally specify whether it is an increase or decrease on its impact indicator. A changed element inherits the position of its parent element, but can have its own name, and color. An import is similar to a change, except for the fact that its business model is not in the same business model chain. A deleted element will no longer be visible in any child layers.

All links that involve the element marked as deleted will also be hidden for child business models in this branch. Links can be drawn between new and changed elements, as well as previous ones.

6.8 Evaluation

Each designed prototype during this research was evaluated before its iteration to produce the next one.

First, we used tracing paper to create a paper prototype visualization of the layered business model concept in the use case. We then asked a small group of users who were already familiar with the business model whether they could understand the different visual cues offered by the layers. This confirmed that the visualization in layers is helpful, but showed that the use of paper had its limitations: when stacking a series of physical pieces of paper on top of each other, the underlying elements become faded. A digital prototype can remediate this by offering more selective filtering. Thus, we went on to iterate with the help of a painting application. This allowed us to test different combinations of transparency, color and layout by gathering readability feedback from test users. The display of layers visually helped in the gathering concept and in the design of the business model. These visual layers were then applied to the creation of a software prototype. Although the static painting used a digital format, it made sense to have the additional functionalities offered by a CAD tool in order to selectively show or hide a layer's elements based on a given perspective. The software prototype was first tested to validate if it was in fact possible to design the whole use case with a paper-based prototype. The use case is a complicated business model evolution that takes place over seven steps and involves two business models evolving in parallel. Testing was extended to visualizing student projects in order to validate interactions with the tool. The final prototype was tested by students, who used it in their business model course design project.

6.8.1 Experience setup

Nine groups of students from a master's program in IS produced a business model proposition for a startup company. They created multiple iterations of this business model in order to, participate in the trial. They were asked to recreate their business model iteration with the business model evolution concept, using the prototype provided. Before allowing the participants to use the tool

on their own, a short demonstration was given in order to explain the key evolution concept and related user interface functionalities. Some known limitations of the prototype were also highlighted. The students had already separated their business model into discrete steps for their project. Their task consisted in entering their first version of their business model and then extracting and adding the differences between the first and next business model onto a new layer. This process was repeated for each iteration. Being already familiar with their business model, they could focus entirely on the visualization and mutation operation aspects of the method without having to spend time thinking about identifying the iterations.

6.8.2 Observations

The students were observed during their usage of the tool. They could ask questions about the theory and interface. Once they completed the task, the students had to fill out a survey, which included open questions on topics of usability and the modeling process. They also had to answer four questions from a seven point Likert scale about perceived usefulness.

6.8.2.1 Usability

The students had no problem in adapting to the tool. The short presentation of ten minutes given at the beginning was enough for them to be able to understand the concept and any interactions. All groups finished their business model evolution input in less than an hour. Most of the time was spent discussing aspects of business model evolution that emerged from the modeling, rather than inputting the model into the tool, which itself was fast. Whilst there was some discussion about merging, the add, delete and change operations were all that was necessary to represent all business model transitions.

6.8.2.2 Modeling process

We then asked if the business model evolution exercise helped the groups identify missed opportunities or incorrect transitions from one state to another. Using this information, we identified two categories with interesting correlations. Those groups that reported no additional opportunities or errors from their work, were also the groups who were awarded high evaluation marks for their project by their teacher. Likewise, the groups that received a lower evaluation of their project reported that they did identify ways in which the tool could have helped them with the transitions.

Other feedback related to the enabling of a better global picture using BM evolution visualization:

G05 "Was able to better identify connected elements between iterations"

G10 "See where it came from"

G08 "Gives a good general overview on the evolution of our idea"

G09 "Helped us to view the changes and at which time/iteration they occurred"

G03 "It allowed me to analyze the reasons behind the evolution of our business model. It's also helpful for the storytelling."

6.8.3 Perceived usefulness

All groups perceived that it was useful to track business model history using the tool and reported that they would have used it for their project. This is the task which is most similar to the one they

were asked to do for the evaluation. They also said they were very likely to use it for their next project.

However, perceived usefulness for prototyping alternative business models scored only average. One explanation is that this feature requires advanced knowledge of the methodology and more practice in thinking about alternatives. This is a concept that they only saw briefly during their course; they were not able to put it into practice in their group project. An example that illustrates the difference in modeling capabilities of novices and experts was the way in which one group struggled to model their project history. They tried to explain it in a linear fashion, using three business model evolution steps. On the third layer, they wanted to add the same elements that they had removed on the second one. The tool's coherence validation makes this operation difficult, indicating a possible flaw in the design. An expert BMC user suggested that the second and third layers could be modeled as parallel evolutions, rather like two branches that emerge from the first layer but which explore different directions. This solved the problem and produced a design that is more accurate than that offered by the linear solution.

6.9 Discussion

In this section, we review the different kind of usages enabled by business model evolution and described using layers. We also discuss the impact this has on mechanics and the potential of the layers concept for business model design.

6.9.1 BM Evolution Usages

We discuss four ways that layers are used in a business model.

6.9.1.1 History / Evolution of a business model

Knowing the origins of elements and the influences behind any changes helps to better understand the constraints of the current business model. Moreover, it offers a way to identify an evolution pattern. In our use case, we observed a cyclical back-and-forth movement between the resources and the value proposition. Resources are used to offer a new value proposition (game distribution platform), which in turn create a new resource (sales knowledge). This resource can then be used to evolve the business model offering with new services (micro transactions).

6.9.1.2 Possible alternative future scenarios

Business model evolution should not be seen only as a linear sequence. Each state can have multiple children, which all have different changes branching out of them - much like a tree - allowing them to adapt their business model to different scenarios.

6.9.1.3 Transformation inside a business model

The identification of transformation and visualization with sequential layers can also be used to illustrate the workings of a business model. Instead of transforming from one version into another, one business model is separated into stages (layers). Each stage is not a complete business model, but a component or a timeframe in the execution of the business model. Illustrating the business model in multiple stages help to better understand its mechanics. The more dynamic nature of flows such as financials can be made visible. For example, it can help to visualize the difference

between manufacturing for stock or to order; this was the basic business model pattern for HP and DELL respectively.

In cases where computers are produced and then stored in the retail channel, costs have already been occurred, as can be seen in figure 1. Revenue is only generated in the second stage, when sales occur. Cash flow is negative, as shown by the left to right arrow. In the case of manufacturing to order, however, the revenue is collected first, with costs occurring in the second stage. Cash flow is positive, as shown by the right to left arrow.

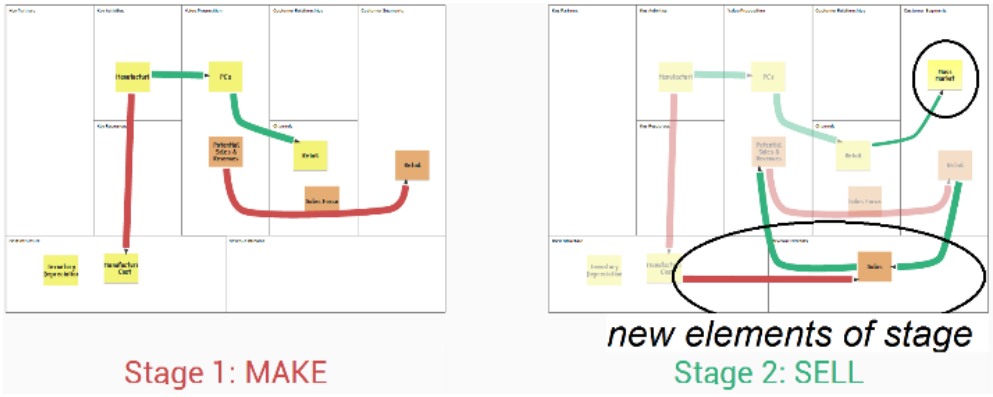

Figure 1. Example of PC manufacturing

6.9.1.4 Transformation between business models

The mutation concept can be used to compare two separate business models without them having to be versions of each other. Having a set of defined concepts for a business model and a set of concepts that specifies how to transform from one state to another gives a common language with which to compare elements. The difficulty lies when making comparisons between the elements. A great deal of visual complexity can also be quickly generated when a lot of elements change. If everything is different, everything will be an addition or a delete. What's more, text-based elements with keywords can be different, but still mean something similar. The inverse is also true; the same keyword can have a different meaning depending on the context in which it is interpreted.

6.9.2 BM mechanics when designing with layers

By highlighting a business models' mechanics using links that flow between key elements, important visual cues can be given, thus making the business model more understandable. To give a more structured meaning to these links, we classified the interaction between the different possible states of mutation for the elements involved. An element can either be unmodified from a previous state, it can be changed or it can be new. Removed elements cannot be linked with a new mechanic. It is important to consider previous elements because the links can have associative meanings that connect multiple elements together into a chain. The following series of combination possibilities can be identified as follows:

6.9.2.1 From a previous element to a previous element

A new link between existing elements cannot be created in the current business model layer. At least one element has to be different from the previous element.

6.9.2.2 From a previous element to a changed element

A change in the destination element makes it more important for business model mechanics, so a new link is created.

6.9.2.3 From a previous element to new element

An existing element targets a new element without having changed. A new value proposition is consumed by an existing customer segment. An existing resource is used to provide a new value proposition.

6.9.2.4 From a changed or new element to a previous element

A changed or new element has a reinforcing influence on an existing element, but not enough to warrant a change in the element itself. However, an element further up in the link chain can be changed. In our use case, new resource modifications influence the multiplayer gaming value proposition.

6.9.2.5 From a changed element to another changed element

A changed element leads to another changed element; they might have already been linked, but the link becomes stronger. In our use case, a change in automatic patching and new game engine influences a change in customer segments to a wider pool.

6.9.2.6 From a changed element to a new element

When an existing element changes, this offers an opportunity for a new connected element. In our use case, a larger number of independent game developers leads to the production of new in-game items.

6.9.2.7 From a new element to a changed element

A new element can have a strong influence on another element to the point of changing it. In our use case, the new distribution platform changes game patching customer support dramatically through the use of automation.

6.9.2.8 From a new element to a new element

When a new set of elements becomes connected, new opportunities can result.

The direction of the link is not always obvious; indeed, depending on the perspective taken, it can be inverted. A link can be read either as something being produced or as something consumed. It is often the case that the illustration of business model mechanics does not follow a strict rule of adopting one vision continuously for the same BMC.

For example, in the use case, a link is shown between the customer segment, the increase in independent developers, and the production of a new value proposition (in-game items). Alternatively, this could be viewed as a new value proposition, which offers independent developers a new way to make more money, and which changes (increases) this customer segment. In the use case, the direction was chosen to show the flow of the produced items that reach the end customer through the game. The opposite direction could have been chosen to illustrate the financial flow. Therefore, strict rules that govern the complete link chain should be avoided during the design phase. Sometimes the directions are also chosen to best fit the explanatory story of the business model.

6.9.3 Other ways of using layers

In this paper we used the concept of layers to group visual elements and to filter parts when stacked. However, there are other ways in which layers can be useful to business modeling. A layer could, for example, add functionality or new attributes to the involved elements (like a trait). In mapping software different layers allow us to see different aspects of the same object: for example, satellite maps, terrain representation, and 3D buildings. Transposed to business models, there could be new layers for indicating the validation status of an element. Layers could also be used to add social consideration. A calculation layer could show cost and revenue information for involved elements.

6.10 Conclusion

In order to address the issue of managing business model evolution, we started by building a use case. Using a case-based approach instead of abstract thinking about the generic problem was crucial to our iteration on the visual concept. It helped us focus on a real situation with concrete problems. The design principles and concept extracted from the use case were then taken to build a new prototype, which was evaluated with different cases to test the concepts. The resulting actions of adding, removing, changing and importing elements when moving from one business model to a new one helps to formalize BM evolution. Building the prototype and successfully testing it demonstrated the feasibility of the concept. Beyond this, the design principles and sample implementation helped in advancing the specification of the domain of computer-aided business model design.

Using the same tool, we managed to support novice users, encouraging them to perform better, while also supporting expert users with more advanced features. However, we also observed that there still is a risk of misusing advanced features. Thus, it is necessary to engage in further research into teaching best practice to users and to identify integrity rules that can be checked.

Further research should extend the evaluation of such tools. In particular, work could be carried out to look into how the tool can help to identify the distinct evolution steps of a business model. Future research could also evaluate how the concept and tool perform with regard to the idea generation task. Furthermore, applying the concept to other strategy methods, would allow generalization and help in strengthening the emerging domain of computer-aided design for strategy.

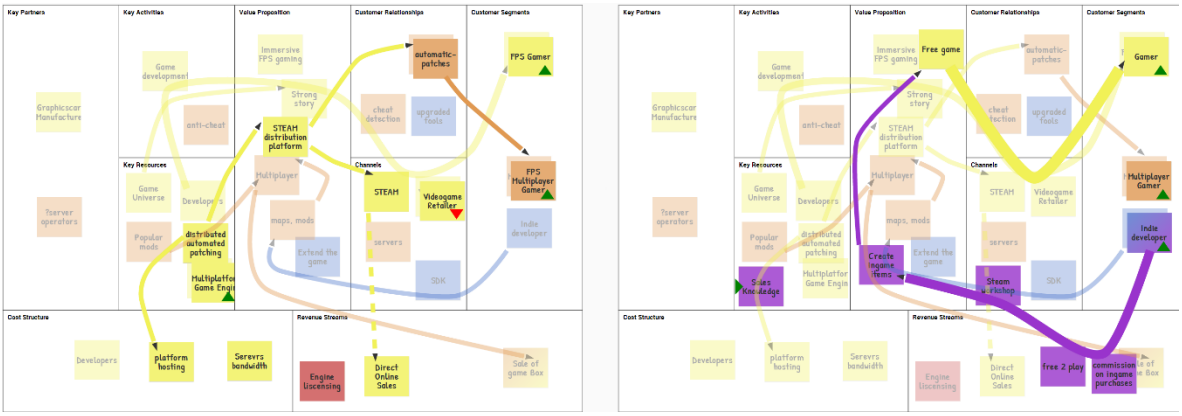

Figure 2. Screenshot of parts of the prototype showing the use case modeled: a video game company that evolved its paid game offering into a free-to-play game with micro-transactions. Operations: add free game, add create in-game items, change indie developer, change gamer.

References

[1] Osterwalder, Alexander, and Yves Pigneur. Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons, 2010.

[2] Fritscher, Boris and Yves Pigneur. Computer Aided Business Model Design: Analysis of Key Features Adopted by Users, Proceedings of the 47th Annual Hawaii International Conference on System Sciences, Computer Society Press, 2014

[3] Boland, Richard, and Fred Collopy, eds. Managing as designing. Stanford University Press, 2004.

[4] Martin, Roger L. The design of business: why design thinking is the next competitive advantage. Harvard Business Press, 2009.

[5] Fritscher, Boris and Yves Pigneur. From Business Model Ontology to Business Model Canvas, (submitted), 2014

[6] Gregor, Shirley, and Alan R. Hevner. "Positioning And Presenting Design Science Research For Maximum Impact." MIS Quarterly 37, no. 2 (2013).

[7] McGrath, Rita Gunther. "Business models: A discovery driven approach." Long range planning 43, no. 2 (2010): 247-261.

[8] Teece, David J. "Business models, business strategy and innovation." Long range planning 43, no. 2 (2010): 172-194.

[9] Nguyen, Gia Toan, and Dominique Rieu. "Schema evolution in object-oriented database systems." Data & Knowledge Engineering 4, no. 1 (1989): 43-67.

[10] Tichy, Walter F. "RCS—a system for version control." Software: Practice and Experience 15, no. 7 (1985): 637-654.

[11] Kim, W. Chan, and Renée Mauborgne. "Charting your company's future." Harvard Business Review 80, no. 6 (2002): 76-85.

PART III - EXTENSIONS

Chapter 7
A Visual Approach to Business IT Alignment between Business Model and Enterprise Architecture

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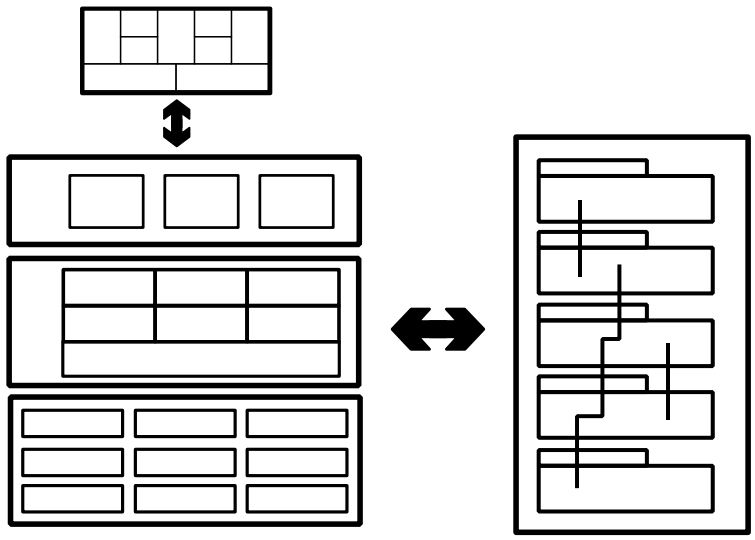

Abstract
In this paper, we put forward an intermediary model that can support the transition between a business model and an IT infrastructure. It is based on a combination of existing models: enterprise architecture and the Business Model Canvas. We show how the proposed intermediary model, which has a strong focus on a business model strategy, can help IT alignment. The intermediary model can help alignment both from a business model focus or an IT infrastructure focus, thanks to a correspondence between both paradigms. Additionally, with a focus on visualization, the intermediary model helps to quickly share a common ground between the parties involved in the alignment. The presentation of the intermediary model is followed by an example of a use case.

Keywords: Business Model, IT Alignment, Enterprise Architecture, ArchiMate, Business Model Canvas

7.1 Introduction

Information technology (IT) is becoming ubiquitous, changing the way people exchange information and extending the realm of possibilities. Changes are occurring not only in information technology itself but also in all the domains that interact with it. Faster computation, together with increased storage capability and bandwidth, make it possible for new services to be introduced; in turn, this offers the potential for new business models, lower barriers of entry, and more competition. Whether dealing with an existing business or a start-up, the key is to design and iterate around its business model so as to not only outperform competitors but also create

new markets by offering differentiated products. New services, such as cloud computing, offer opportunities to experiment with new business models without having to make huge investments in IT infrastructure, but a business model strategy still must be aligned with its processes and any supporting IT applications, regardless of whether IT infrastructure is virtual or physical.

As stated by Van Buuren et al. (2005):

"Enterprise architecture and business modeling methodologies meet in service offering and realization. In general, business models focus on the service value generated by a business, whereas enterprise architecture models show how a business realizes these services. Linking these approaches results in a powerful modeling tool that couples the value exchange between businesses and the costs that are required to realize these services. (p .2)"

A number of studies have shown that strategic alignment between IT and the business strategy plays a significant role in explaining business performance (Chan & Reich, 2007a). These studies define alignment as the extent to which IT activities and capabilities support business strategy (Chan & Reich, 2007b). From the different points of view on alignment, we agree most closely with Chan and Reich (2007b), and we take as given the view that alignment is inherently of value and contributes to organizational success. Like them, we do not take a position regarding whether alignment is a static end goal or instead a dynamic process occurring over time. We believe that alignment should be a joint responsibility of IT and business executives. With that in mind, it is essential that business executives and IT managers communicate on common ground.

Connecting IT activities to a firm's business model not only provides the potential for linking costs to the strategic objectives but also offers a means of identifying key activities and resources that support the business model strategy in question. It also can highlight underutilization of assets, which in turn can provide opportunities for adopting a new business model strategy.

This paper proposes an intermediary model that will assist in transitioning between a business model and an enterprise architecture model. This intermediary model is based on shared knowledge from business model modeling and enterprise architecture. We suggest that for the transition between models to be as clear as possible, it should have a clearly defined visual representation. Our research question therefore is this:

Could a visual intermediary model support IT alignment by helping to transition between a business model and an enterprise architecture?

This paper is structured according to the guidelines of design science research proposed by Gregor and Jones (2007). In the following section, we describe related studies on transitioning between business models and enterprise architecture. We then describe how our research fits into design science methodology. After that, we describe how we constructed the visual intermediary model, which is based on a combination of different models proposed in the literature. We then describe a case study and show how the model can support a discussion on alignment. That description is followed by our observations concerning an evaluation done with students. We conclude with a discussion of how the proposed model could be used in practice and how it could be extended.

7.2 Related Work

In this section, we describe the frameworks and models that individually address parts of the solution: Enterprise Architecture and Business Model. For each, we provide a definition and take

into consideration studies that use them as starting points for a transformation or alignment to the other model. When moving from IT resources to a business model, this represents a bottom-up approach, whereas when aligning from a strategic business model to the IT resources used to support it, it represents a top-down approach.

7.2.1 Enterprise Architecture

"Enterprise Architecture (EA) is a coherent whole consisting of principles, methods, and models that are used in the design and realization of an enterprise's organizational structure, business processes, information systems, and infrastructure" (Lankhorst, 2009, p. 3)

We identified three approaches that can be used to introduce a greater strategic aspect to enterprise architecture: (a) adding new components to the meta-model of existing enterprise architecture frameworks, (b) defining a direct correspondence between enterprise architecture components and elements of a business model, and (c) using a transition model that helps connect the two models.

In their book *Enterprise Architecture as Strategy*, Ross et al. (2006) presented a way of modeling strategy with a high level abstraction of EA components. Their modeling focused on business process, data, technology, and customer types. Although their strategy was similar to a business model, its focus was still largely on *how* value is provided to the customer rather than *why*. Additionally, having a different layout for each example makes it difficult to compare them.

One explorative study (Yu et al., 2006) added an intentional dimension of motivations, rationales, and goals into enterprise architecture. This was done using the i* model. In a similar approach, goals and requirements were added as components of enterprise architecture as a way to introduce ARMOR (Quartel et al., 2009) as an extension to ArchiMate. In this study, "Goals are refined into (alternative sets of) sub-goals, via goal trees. Low-level goals (requirements) are related to the services, processes and applications that implement the requirements" (p. 12).

Using goals helps to relate the reason for a service (why) to its implementation (how). This linkage opens the way for an iterative process, as highlighted when moving from an as-is architecture to a to-be architecture (Yu et al., 2006). In this process, iteration from the reason for a process to its execution is carried out inside the enterprise architecture model until an adequate "to-be" solution is found. Alignment with the starting business vision, which defined the initial reason for the change, has been left for future research.

Chen (2008) used a Service Oriented Architecture (SOA) perspective to present BITAM-SOA, a framework that has the same layers and interface between layers as ArchiMate (infrastructure, applications, process) but directly adds business model elements, customers, value proposition, and cost into the architecture. In our opinion, this direct connection to the service process works in specific cases for SOA services; however, the business elements are more or less requirements and potential consumers of a given service offering rather than being part of a global business model strategy.

In their study, Iacob, Meertens, and Jonkers (2011) offer a direct correspondence between elements of ArchiMate and the Business Model Canvas (BMC) without using an intermediary model. Nonetheless, they did use an augmented model of ArchiMate, having additional quantitative cost information. Their process aggregates components of ArchiMate into all

elements of BMC to reason on the business model strategy supported by the architecture. After we modified the architecture to fulfill new opportunities, and having regenerated a corresponding business model view, a second step allows for a comparison between the business models supported by both an as-is and a to-be architecture. This example provides a good argument for the value of connecting enterprise architecture to a more complete business model visualization in order to rethink architectural changes.

7.2.2 Business Model

Among the many definition of a business model that exist, we use the one by Osterwalder, Pigneur and Tucci (2005):

"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. (pp. 17-18)".

We want a visual representation; therefore, we limited the scope to a model that falls into our definition and has a visual representation, such as the Business Model Canvas or e3-value, the latter of which was used in several articles as a starting point for adopting a process model.

For example, Andersson et al. (2006) described a method to go from an e3-value model to a process model by augmenting the e3-value model with additional information. In a second step, they made use of a pattern library at the process level to construct the resulting processes. A similar transformation has been illustrated (Pijpers & Gordijn, 2007) that augments the e3-value but then goes on to focus on creating a transition model called e3-transition, which forgoes the need to look up a process in a pattern library.

Another study (Andersson et al., 2007) sought to extend the syntax of e3-value in the form of annotations, so as to capture the relationship between goal models and business models. The authors highlighted an open question that arose from their experiment: the difficulty of finding a compromise between keeping the clutter introduced by additional information at an acceptable level, but still having the right amount of (or enough) information. From this perspective, another approach to transforming an e3-value model directly into a coordination model (Fatemi, Sinderen, & Wieringa, 2010) argued that there is a need for a less complicated method, one that does not introduce additional concepts such as ownership rights, custody, or physical delivery, or that makes it hard for others to use these methods in practice.

There is also an object-oriented enterprise architecture method, called SEAM (Wegmann, 2003). We include it here in the discussion of business models because the method has a hierarchical top-down decomposition to go from business down to IT. This model, with its UML-like structure and hierarchical encapsulation, is well adapted to technically skilled people. However, we are looking for something that has a simpler visual appearance and that can be used easily with businesspeople without any specific advanced training. When a diagram has too many arrows or boxes within boxes, it tends to discourage people lacking modeling experience, from understanding them.

7.2.3 Identified Opportunity for a Visual Model

As stated in the introduction to this paper, our goal is to propose a visual model construct that helps to bridge business models and enterprise architecture models. The related work discussed above makes it clear that there are still opportunities to provide a visual and high-level intermediary model between the business model and enterprise architecture. The methods presented above either try to provide a mechanical transformation from one model to the other or focus their attention on business processes.

Enterprise Architecture frameworks like TOGAF (VHP, 2009) defines a Business Architecture layer, but as shown by Winter and Fischer (Winter & Fischer, 2007), they do not always differentiate between business processes and activities. That differentiation is important for a vision of a business model. The same is true for the proprietary method ARIS (IDS Scheer 2005), which has Organizational Architecture and Business Process Architecture but no real business model layer.

Our intent is not to provide a method for transforming a business model into a process model; instead, our objective is to create a way to focus on the strategy while having a better grounding in the activities and IT resources required to support it without going into too many technical details. This should be achieved while keeping a connection with some lower-level elements, in order to be able to take alignment into consideration. Therefore, it is important to be able to identify key components for alignment in relation to the strategy, but not in every step of its adopted execution. Furthermore, compared to the methods used in a goal-based approach, we prefer to be more general, not tracking every single step to the implementation of a specific goal but instead linking the key infrastructure components to a global business vision.

According to Fatemi, Sindersen, and Wieringa (2010), the approach should be as simple as possible; thus, a model should not be augmented with complicated additions if it aims to be useful in practice. We agree with this in principle, but we argue that an intermediary model is still necessary. It seems extremely unlikely that high-level elements can be mapped directly to detailed process level elements, especially when business model and enterprise architecture have different languages and abstraction levels.

We feel there is still a place for a model that is simple and helps in the transition between the very high-level strategic vision of a business model and the processes implementing it. We show how one such model can be constructed later in this paper, following a presentation of our methodology.

7.3 Research Methodology

We chose to perform our research under the Design Science Research paradigm, focusing on an artifact that is at the center of a three-cycle framework (Hevner et al., 2004). These cycles are relevance, rigor, and design:

The Relevance Cycle bridges the contextual environment of the research project with the design science activities. The Rigor Cycle connects the design science activities with the knowledge base of scientific foundations, experience, and expertise that informs the research project. The central Design Cycle iterates between the core activities of building and evaluating the design

artifacts and processes of the research. . . . These three cycles must be present and clearly identifiable in a design science research project. (Hevner, 2007, p. 88)

We used a design cycle for the development, iterating through different versions of our visualization and adapting it after each evaluation. The models used to build our visualization come from publications that are well regarded by scholars. Therefore, the grounding of our artifact in the common knowledge base respects the rigor cycle. The relevance of our work also can be supported: A need remains for better solutions to help with the alignment between business models and IT. This need is increasingly relevant in the light of new opportunities offered by cloud computing, in which business models change quickly and IT implementation can evolve much more rapidly than before. The fact that software developers such as Software AG are beginning to include business model tooling on top of their enterprise architecture modeling stacks (ARIS 2012) shows the interest of practitioners in such a connection. To complete the relevance cycle, the artifact should be evaluated in the real environment. We addressed this topic in the evaluation section.

We also remain cognizant of the necessary components for a design theory in information systems, as proposed by Gregor and Jones (2007). In the introduction to this paper, we stated its purpose and scope. Our constructs came from the description of the frameworks and models from which we composed our new visualization of the enterprise architecture. We present our artifact (both form and function) and describe the principles of implementation in the following section. This is followed by a case study that illustrates the artifact through an expository instantiation. The model's mutability, as well as its eventual extension beyond what is presented here, is discussed in the conclusion. The final component, that of testable propositions, is covered in the evaluation section.

7.4 An Intermediary Model Construction

To design the intermediary model, we had to choose one of the existing business model and enterprise architecture methods as a starting point. This choice was guided by our criterion that the intermediary model be visual and easily understandable.

It is crucial to reduce complexity by using a standardized layout. Such standardization leads to quicker identification of the elements in the model. It also facilitates comparisons between different alternatives because the same kinds of elements will be in the same spatial positions. Having set this requirement, we opted for the Business Model Canvas (BMC) as our business model representation and ArchiMate for the enterprise architecture model reference. Before describing how we connected them, we provide an overview of the models and explain why we choose them.

7.4.1 ArchiMate

The aspect of enterprise architecture that interested us for our intermediary model is the layers, which can be used to align the business model with it. Winter and Fischer (2007) provide an essential list of layers, aggregated from use cases and three Enterprise Architecture (EA) frameworks (TOGAF 8.1, FEAF 1.1, ARIS): Business Architecture, Process Architecture, Integration Architecture, Software Architecture, and Infrastructure Architecture (Winter & Fischer 2007). What is interesting is their clear distinction between Business Architecture and Process

Architecture. If there is such a clear distinction, a business model method could be used directly to create a view for the business architecture layer. The drawback is that, as is the case when using TOGAF, there is no guidance regarding the modeling language to use to represent the elements in the specific architecture.

ArchiMate is another EA framework (Lankhorst, 2004). It separates the domains into three layers: business, application, and technology. This offers a welcome simplification for the high-level analysis we want to create. The drawback is that the business layer is more process focused than is a real business architecture. In reality, each layer has sub-layers that split the internal representation from the external by exposing its services to the upper layer as interfaces. The topmost business layer exposes the enterprise services to an additional layer containing external roles and actors.

As can be seen in figure 1, ArchiMate is open to visual representation, which makes it particularly attractive. In particular, it encourages the use of visual cues, such as colors, to highlight the different modeling layers (Lankhorst, 2005). Moreover, ArchiMate opts for a unique language (UML) to model every layer of the architecture, thus supporting communication when teams responsible for the different layers need to collaborate.

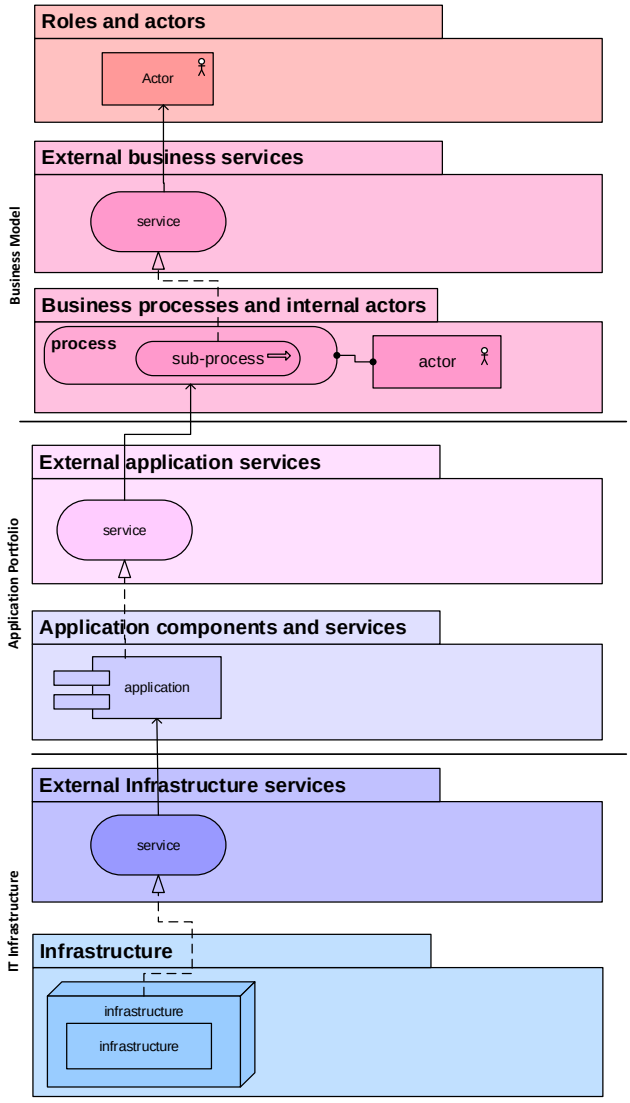

Figure 1. ArchiMate

Even though ArchiMate goes above the business processes layer to expose external business services, it is missing components, such as revenue, costs, channels, and custom relationships, that are used in business modeling to carry out strategic analysis. Furthermore, it is relevant to note that ArchiMate has a focus on infrastructure, with a bottom-up construction. This shortfall in business modeling strategy can be address with the Business Model Canvas (BMC).

7.4.2 Business Model Canvas

We use the Business Model Ontology (Osterwalder & Pigneur, 2002) and its more popular visualization template, the BMC, because it is aligned with our definition of a business model. The fixed and visual layout perfectly matches the requirements we set for a visual intermediary model. Alternatively, e3-value could have been considered, but as shown above, use of e3-value as a starting model already has been tried, with varying levels of success. The value network of e3-value is one of its strong points and a major reason for its use, but the IT alignment focus we examine covers the internal aspects of a company and does not require the value network of e3-value. A more complex e3-value diagram has a lot of arrows and boxes inside boxes which is something that we are trying to avoid.

The Business Model Canvas (BMC) is a representation of an enterprise's business model that consists of nine building blocks. These elements were derived from an in-depth literature review of numerous conceptualizations of business models (Osterwalder & Pigneur, 2002). In this depiction, the business model of a company is a simplified representation of its business logic, viewed from a strategic standpoint (i.e., on top of Business Process Modeling), as shown in figure 2.

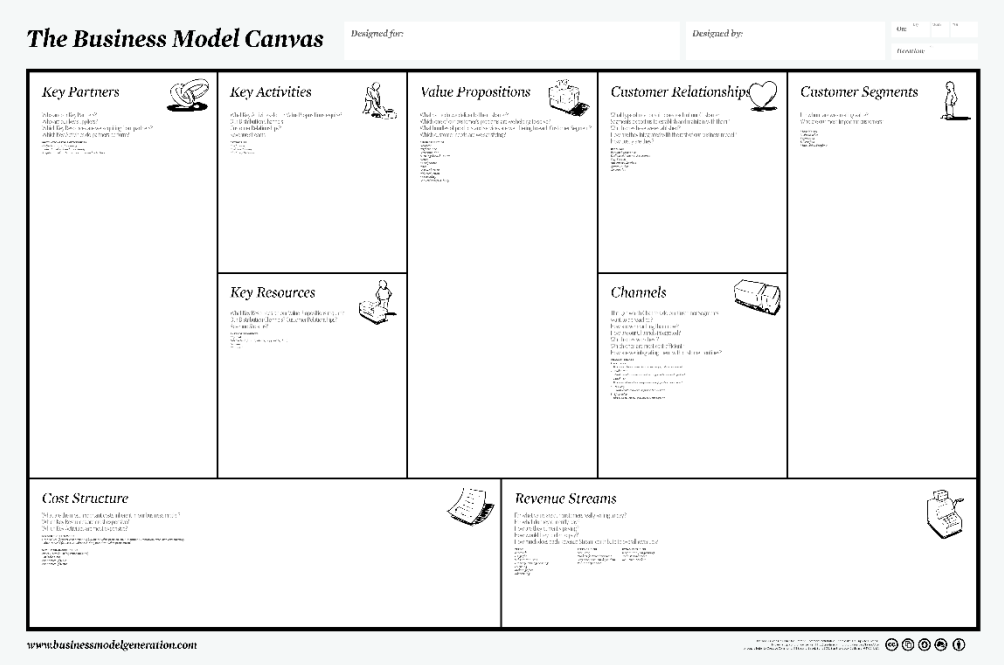

Figure 2. Business Model Canvas (businessmodelgeneration.com Creative CommonsAttribution-Share Alike 3.0)

The main component, which is at the center, is the *Value Propositions*; these describe which customers' problems are solved and why this business's solutions to those problems (products, services) is more valuable than similar ones from competitors. The customers themselves are analyzed in *Customer Segments*. This separation into groups helps to address their common needs, desires, and ambitions (e.g., how single people are similar to each other but different from members of families). *Channels* illustrates how customers want to be reached and by whom they are addressed (Internet, store).

In addition, *Customer Relationships* specifies the types of relationship expected by customers and how they are established and maintained (promotion, support, individual, or mass). In order to be able to deliver the value propositions, the business must have *Key Resources* (staff, machines, proprietary knowledge). These resources are transformed through *Key Activities* into the final product or service (development, production, proprietary process). In most cases, a business also depends on one or more external *Key Partners* (logistics, financial), either for resources or for activities.

Because any business model would not be complete without financial information, the final two building blocks focus on cost and revenue. The *Cost Structure* should be aligned with the core ideas of the business model (key resources, key activities), and *Revenue Streams* must mirror the values assigned by customers in terms of how much they are willing to pay and how they will perform the transaction (one-off fee, subscription).

7.4.3 Correspondence between ArchiMate and BMC

The concepts from ArchiMate and BMC can be combined to provide an intermediary model. Figure 3 shows the correspondence between them. The main objective in creating an intermediary model is to have a layered structure, similar to that of the enterprise architecture framework as found in ArchiMate. This correspondence enables transitions between the intermediary model and the enterprise architecture. Additional, aim is to provide elements from BMC that are missing in the enterprise architecture, so as to strengthen the model with regard to business model considerations. Inclusion of elements from the BMC facilitates transition between the intermediary model and the business model.

The matching of elements has been done at a high level, using the general definitions given to the elements in their theoretical work.

In ArchiMate, the topmost layer concerns external actors, which in the case of the BMC are its customers segments and key partners. ArchiMate does not have a distinct layer for financial considerations such as cost and revenue. The BMC describes business models, so it is no surprise that most of its elements can be compared to elements of ArchiMate's business layer. The activity element of BMC can be considered similar to the external application services, which the application layer exposes to the business layer; however, BMC does not go into much detail about how the activities are implemented. High-level processes can sometimes be considered key activities, but not the complete list of processes. Some of the key resources of ArchiMate's technical layer might emerge in the BMC's resource element, but in general these key resources are at too high a level of abstraction to provide good identification of technical components.

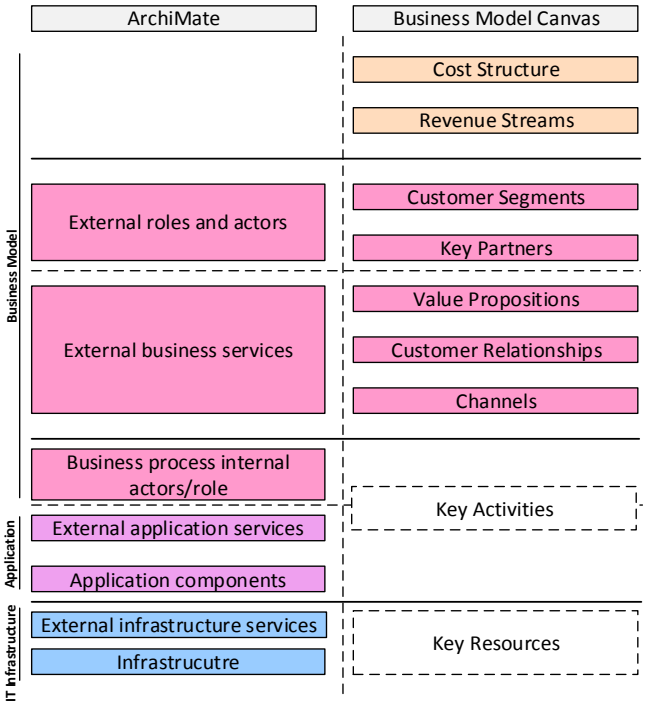

Figure 3. Correspondence between models' elements

It is important to emphasize that the correspondences are only loose ones; for the most part, elements cannot be mapped directly between the two models. The BMC is meant only to show the key elements that are necessary to explain the business strategy. The lists of key activities and key resources do not contain all the activities necessary to generate a value proposition, only the ones that are most important for the strategy. Important activities that are necessary to create the service itself but are considered of an operational value might not show up. This might be the case even if they are considered essential when looking at value creation from an enterprise architecture point of view. Another key point is that the BMC includes, in its key resources, items that are not necessarily physical in nature, such as brands, patents, and know-how. Because of their intangible nature, they are not necessarily visible in the infrastructure portion of an enterprise architecture perspective. These considerations mean that a direct mapping of all elements is not possible because there will always be some filtering or aggregation, depending on the perspective.

The building blocks of the BMC can also be grouped into three more general perspectives: a *financial perspective*, including cost and revenue, that cannot be found in the basic ArchiMate; a *customer perspective*, including value propositions, channels, relationships, and customers, that can be compared to the higher sub-layers of ArchiMate's business model layer; and an *activity perspective*, including partners, resources, and activities, which share common element with the business process layer, but not at the same level of detail. ArchiMate also includes internal actors, which is not the case with BMC. If an actor is to be added to the intermediary model, it might be possible to capture his or her impact on the element affected by his or her behavior. Although this is sufficient at the strategy level, it may be necessary at the architecture level to know who has the right and the ability to affect which components, rather than only observing the result.

ArchiMate's additional distinction of infrastructure, information, and behavior can be related to the BMC in the following ways. Infrastructure can be related loosely to a resource.

Information can be either a resource or a combination of a resource and an activity in the BMC. Behaviors, like actors, are not directly captured in BMC; all that is captured is their impact on an activity.

7.4.4 Application Portfolio and IT Capabilities

To complement the weak matching of the BMC's key activities and key resources with the application and IT infrastructure layers of ArchiMate, we chose to use a classification scheme to structure the matching. A classification helps in structuring elements by forcing decomposition of each element to fit the classification and assists in identifying missing elements; when an element is missing, there will be unused categories. Having fixed categories at each layer forces connections to be made to them, and in modeling, active choices will need to be made when adding connected elements from one layer to the other. Implementing a classification scheme thus forces the modeler to make choices about abstraction and decomposition.

Approaching IT services from a managerial top-down view, Weill and colleagues (Weill & Broadbent, 1998; Weill & Vitale, 2002) define such a classification. They defined four types of objectives for an IT application portfolio: infrastructure, transactional, informational, and strategic. Infrastructure is the basic component that is used by all the other categories. Transactional applications are basic systems that focus on cutting costs and increasing throughput. They can be used by informational or strategic applications. Informational applications provide ways to increase control, have access to better information, and improve quality. Strategic applications are intended to provide innovative services and help generate a competitive advantage.

Decomposing applications into one or more of these categories will help in mapping parts of the applications with the IT resources that support each category. From a managerial perspective, it is difficult to evaluate the role of IT infrastructure when its description is too technical. What is of importance is the capabilities that the infrastructure provides. To further assist in making the connection between the application layer and the infrastructure layer, there is a classification for IT resources.

Weill and Vitale (2002) describe and compare IT resources by providing a classification of IT capabilities: application infrastructure, communication, data management, IT management, security, architecture and standards, channel management, IT research and development, and IT education. This list is based on a comprehensive survey they carried out, and each item has a set of sub-items to aid in assessing the importance of the capability.

Our focus is to offer a high-level perspective on IT infrastructure and applications, suitable for a managerial focus. We use the classification developed by Weill and colleagues (Weill & Broadbent, 1998; Weill & Vitale, 2002), as it suits our needs. It should be recognized that it would be possible to use a more technically focused classification for IT infrastructure.

In the application layer, to facilitate the association of IT applications with the activities they support, it is helpful to classify them first by process activity type. One such classification is carried out in the internal perspective of a strategy map (Kaplan & Norton, 1996, 2004). A strategy map is an evolution of the Balanced Scorecard created by Kaplan and Norton. It provides an alternate view but is very similar to the BMC's description of a business model. The four processes are operations management, customer management, innovation, and regulatory and social activities.

This classification helps to group the BMC's activities more easily and connect them to ArchiMate's business processes.

In the next section, we illustrate how this classification can be arranged visually into a matrix to facilitate showing the alignment between layers.

7.5 Visual Intermediary Model

We structured the visualization using the same layers found in the ArchiMate framework. To facilitate visual comparison, we adopted a fixed layout, with each element having its own position. Being an intermediary model, it includes elements of both the BMC and ArchiMate, adding more details to some elements of the former and aggregating information from the latter. In our opinion, it is important to be able to transition between the two models and the intermediary model. This ability to transition facilitates examination of the strategic vision of the business model in relation to the intermediary model, as well as linking the intermediary model to the enterprise architecture. Enterprise architecture, which in turn might be linked to a low-level process implementation. The ability to transition between models thus expands the range of issue that can be examined, adding abilities to connect higher level strategic attributes with the lower levels attributes of the implementing process. Furthermore, enterprise architecture modeling should offer the ability to leverage the knowledge of transformation and alignment that has already been developed in this field.

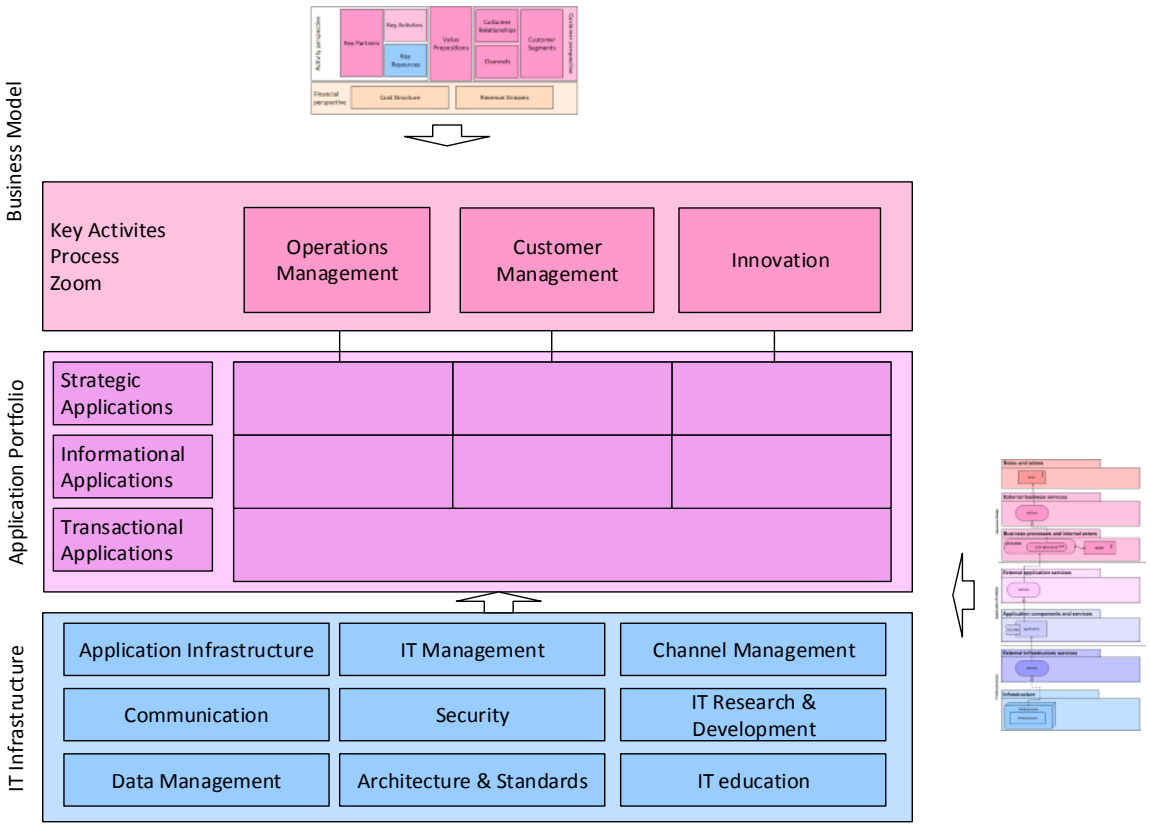

Figure 4. Intermediary model inspired by existing studies (Kaplan & Norton, 1996; Lankhorst, 2004; Osterwalder & Pigneur, 2002; Weill & Vitale, 2002)

Figure 4, based on the correspondences described above, shows the proposed visualization for integrating all the components mentioned. The intermediary model is described from the bottom up. At the base is the technology layer of IT infrastructure, which is decomposed into the nine IT capabilities identified by Weill et al. (Weill & Vitale, 2002). In the middle, the applications found in the application layer make up the enterprise's application portfolio. The connection of IT capabilities to activities is through applications. To assist in identifying these connections, there is a classification into a 3 × 3 matrix. The rows of the portfolio distinguish between transactional, informational, and strategic applications, and the columns state the processes that the application supports in the business layer, either: operations management, customer management, or innovation. The transactional applications usually are combined to form informational or strategic applications before being used by an activity; thus, it is not necessary to classify them into these three categories (as illustrated in figure 4 by the absence of separation of the row for transactional applications). It is not always the case that a strategic or informational application requires a transactional one, since these applications can also directly depend on one or more IT infrastructure services. Additionally, with the emergence of a cloud computing, infrastructure or even application can be replaced by external services such as Platform as a Service or Software as a Service.

For our high–level, managerial focused construct, we decided that infrastructure application could be left out, but it might show up in the IT infrastructure capabilities. This absence of infrastructure application is intended to simplify the visualization and avoid some duplication that might occur if users are not experienced in precise enterprise architecture classifications. For another construction, in which the classification chosen for the IT infrastructure layer is more technically focused, it might be necessary to show a fourth row, for infrastructure applications, in the application portfolio.

The business layer uses the same layout as the BMC so as to benefit from the known layout of its components. To better link the activities, we have added a zoomed view under the BMC (Key Activities process zoom in figure 4) that represents a more detailed decomposition of the key activities into processes. This zoomed view is not an exact hierarchical decomposition; it is only conceptual. It can describe an activity with more detailed keywords or split it up into different parts so as to provide a better understanding of the high-level processes involved. In any case, it is not a complete decomposition into sub-processes as they might be understood in a business process model. These high-level processes are categorized into three types: operations management, customer management, and innovation. Because this is only a zoomed view, all the links within the BMC are still valid, and an activity can be connected to the partners and value propositions it supports. In turn, a value proposition is linked to customer segments through the channels by which customers are reached and customer relationships are maintained.

As described earlier, in the section of the paper describing correspondences, key resources can include the physical IT infrastructure and applications. Although not all the resources involved in all the activities will be listed, key resources should at least highlight the resources that are strategic to realization of the main value propositions. Such a list should be aligned with the links established between infrastructure, applications, and activities in the lower part of the visualization.

Partners might be involved or directly provide activities. In that case, a partner is connected through an activity in the BMC and then linked to the lower parts of the model. It might also be the case that a partner, a relationship, or a channel has a direct connection with an application or an infrastructure component. Most of the time, this should operate through an activity, at least when a zoomed view of the activities is available. If this is not the pathway, then a process might be missing in the model, or there may be a misalignment. Finally, the financial layer takes into account cost and revenues in the business model; it is based on the functions used for each value proposition. Costs are derived from the processes they involve, which in turn base their costs on the applications they involve, which themselves are based on costs of IT services.

7.5.1 Using the Visual Intermediary Model

The proposed visualization can be helpful in various situations, whether as a top-down, bottom-up, or mixed approach. A top-down approach can be useful when planning for a new business model without assigning any existing resources. Visualization can help in evaluating the feasibility of the business model by specifying the applications and resources needed to realize it.

In addition to there being variants of the business model, there will also be variations in the way that it is implemented. These can be explored with our construct without having to build a complicated enterprise architecture model, and while still being able to think about IT resources. Moreover, having a strong link to the business model is useful, because thinking about some implementation points may generate new ideas for new business models.

When choosing to extract the business model from an existing architecture, as in a bottom-up approach, it helps to have a proposed visualization that has classifications for the different layers. Such classifications enable the grouping and abstraction that are necessary to arrive at high-level activities, which are then linked to the other components to form a business model representation. Some elements related to strategy will need to be added from outside the architecture, but the model should provide the right conditions to be able to ask the right questions about the missing elements. Additionally, if some of the existing elements match a business model pattern, this can give further insight into which components are key in such a strategy. For example, if there is clearly a central platform component and a specific customer segment using it, it might be worthwhile to check whether there is a second set of customers to which the platform can or does connect. This would then match the double-sided business model pattern and provide direction for a strategy to reach such a model.

In most cases, there is no clear top-down or bottom-up approach; instead, there are some parts of a business model and some kind of architecture model. Bringing the two together will be an iterative process of changing business model components and of adding missing applications and IT resources to the visualization. A new objective, unused components, underutilized resources or a strategic component may emerge and be highlighted during the process. This process of modeling an as-is situation will help to reveal opportunities and threats, which themselves will act as a starting point for model variants of a to-be model. Further analysis then can be performed more thoroughly in an enterprise architecture model. It should be noted that alignment is not a final step: it should not discourage the seeking out of new opportunities, even if these opportunities will require some non-alignment to realize them.

To highlight different opportunities, it is possible to create multiple versions of the construct that focus on specific elements. It also is possible to draw links between elements to underline an alignment story, as illustrated in the example given in the next section.

7.6 Instantiation Case: Switcher SA

The proposed visualization was applied to the company Switcher SA in order to highlight the alignment between its business model and enterprise architecture. Figure 5 shows the business model and the intermediary model visualization combined as one. We first describe Switcher SA's business model before going on to describe the intermediary visualization and the transition to the enterprise architecture.

7.6.1 Business Model

Switcher SA is a small private Swiss company engaged in the manufacture and distribution of garments. The company places a particular focus on social responsibility throughout the whole value chain, from resource production to the distribution of its products. Its products are garments that are simple, colorful, and of good quality. The company sells them at an affordable price while still being able to guarantee a sustainable and traceable product to its customers. Their customers are not limited to buyers who are aware of sustainability issues; through its high quality and competitive pricing, Switcher has attracted a wide customer base that includes families. Other customers include clubs, enterprises, and events that use colored T-shirts as a base for custom-printed promotional articles.

The company uses three types of channels to reach customers: brick and mortar stores, the printer that carries out customization work, and an online store. The company's relationship with its customers is enhanced through a loyalty program called Switcher Friends, which offers special discounts. The brand is also promoted through event sponsorships. At the business model level, the key resources are the company's brand (well known in Switzerland) and its contacts with partners. Partners who constitute the backbone of the company's products include raw material producers (cotton, dye), garment manufacturers, and logistics companies (transport, storage). Key activities involve management of the value chain, which allows Switcher to guarantee supply to its wholesalers and point-of-sale management for its stores.

7.6.2 Intermediary Model

With regard to IT infrastructure and applications, Switcher has a standard set of IT support for employees as well as Enterprise Resource Planning (ERP) software for supply chain and financial management. In addition, it has the necessary resources for maintaining a point-of-sale system and an online store. It is worth mentioning that the special strategic application known as the *Switcher Color System* supports operational aspects by guaranteeing that all garments have the right color dye across all the suppliers. It therefore plays an important role in guaranteeing product consistency and quality.

The proposed visualization is particularly helpful in analyzing such a connection. By way of illustration, we focus on the implication of the value proposition of traceability for the lower levels. Going from top to bottom in figure 5, it is possible to see how the value proposition of a responsibly produced garment (ethics, traceability) is delivered, through the ability to trace each

step of the production process. Traceability is made possible only by an innovative traceability management process, which depends heavily on a custom ERP application (Kookaburra Software) at the application portfolio level. Offering this application requires a custom ERP at the IT infrastructure level; this had to be developed in-house (IT research and development). Furthermore, the channel that allows customers to consult tracking information is made possible by a special website (respect-code.org).

Based on this analysis, we can identify the custom ERP (Kookaburra Software) as a key resource in the business model, because without it, one of the main value propositions could not be realized. Moreover, a custom ERP requires an activity of IT development. We therefore can justify the need for IT development in relation to the value proposition. Previously, the IT development might have been considered as an unnecessary cost at a strategic level.

7.6.3 Enterprise Architecture

To demonstrate the link with ArchiMate, we show in figure 6 a partial representation of Switcher SA's enterprise architecture. The view focuses on the traceability service and the main architecture components connected to it. This is a first step to a more zoomed-in view, which could then be further drilled down to reach a detailed process description. Although most of the business model components disappear, the business processes get more detailed, and links are drawn between elements. It can also be observed that ArchiMate provides a distinction between internal and external services, which are connected by interfaces. This is a distinction that our intermediary model does not provide, in order to be more abstract.

In our focus on traceability, we chose to consider the client side. Thus, we highlighted components from which the client can retrieve information. Another focus could have been on how the information is retrieved from the partner and put into the system for later retrieval. The elements corresponding to those mentioned in the intermediary model are given in boldface type. We will discuss them from top to bottom and comment on the new distinctions introduced by this more detailed view.

Partners and customers are at the top of the diagram and are grouped into one layer. The customer is directly connected to the external business service that provides the value proposition and not the general properties of the value proposition itself. The traceability management process is composed of sub-processes of the control and reporting of Corporate Social Responsibility (CSR). In addition to the more detailed description offered by the sub-processes, there is also information on actors' responsibilities in a process. We illustrate this here by adding the CSR Officer. At the application layer, we can observe the distinction between external and internal services. With regard to this ArchiMate model, it is possible to observe that the required applications and IT infrastructure, which were highlighted, have more dependencies into other components, without which the service in question would simply not be feasible. For example, the custom ERP (Kookaburra) depends on other applications that feed it the needed information. The more detailed low-level IT infrastructure also is added to this model.

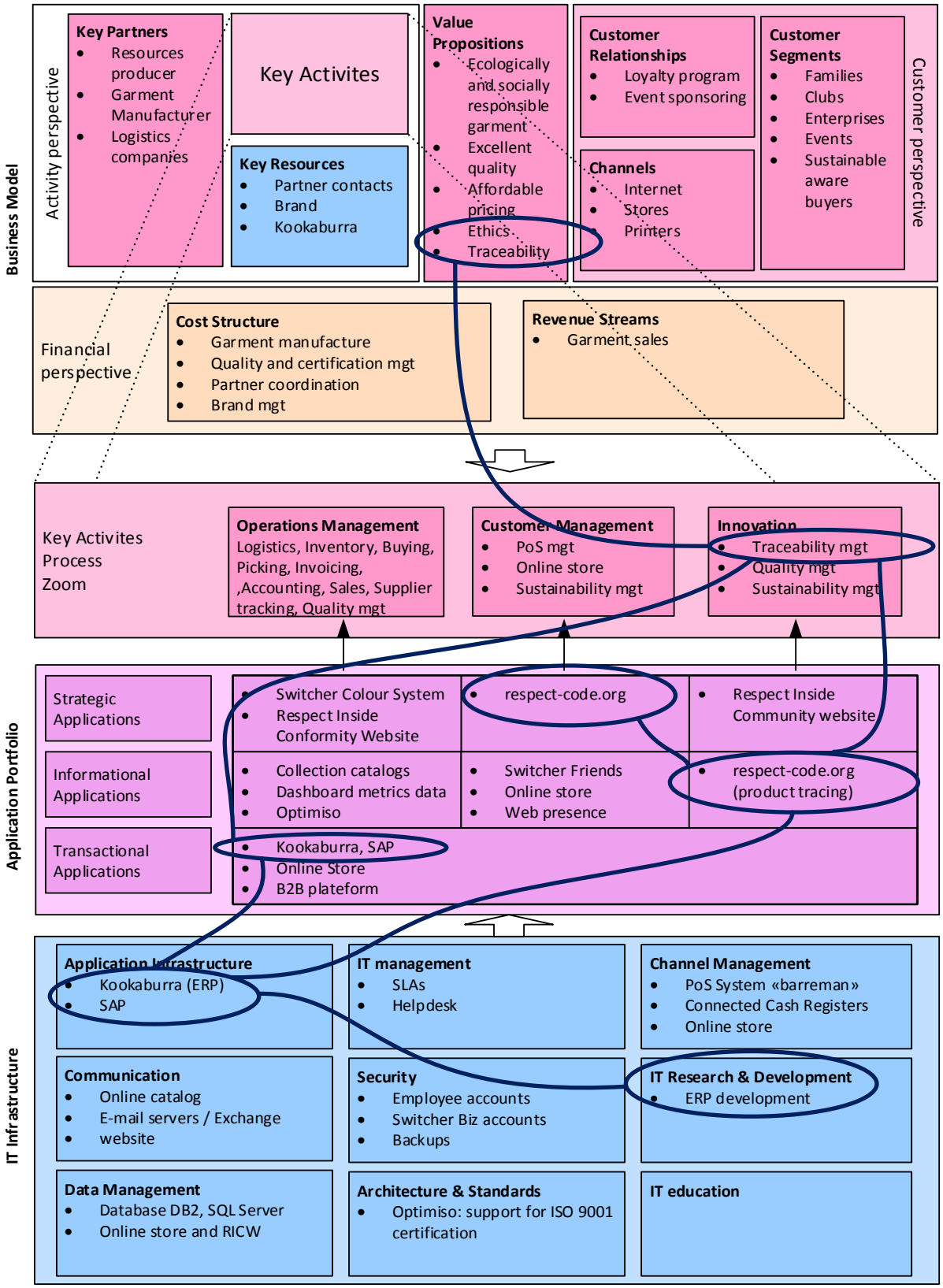

Figure 5. Switcher SA Business Model Enterprise Architecture

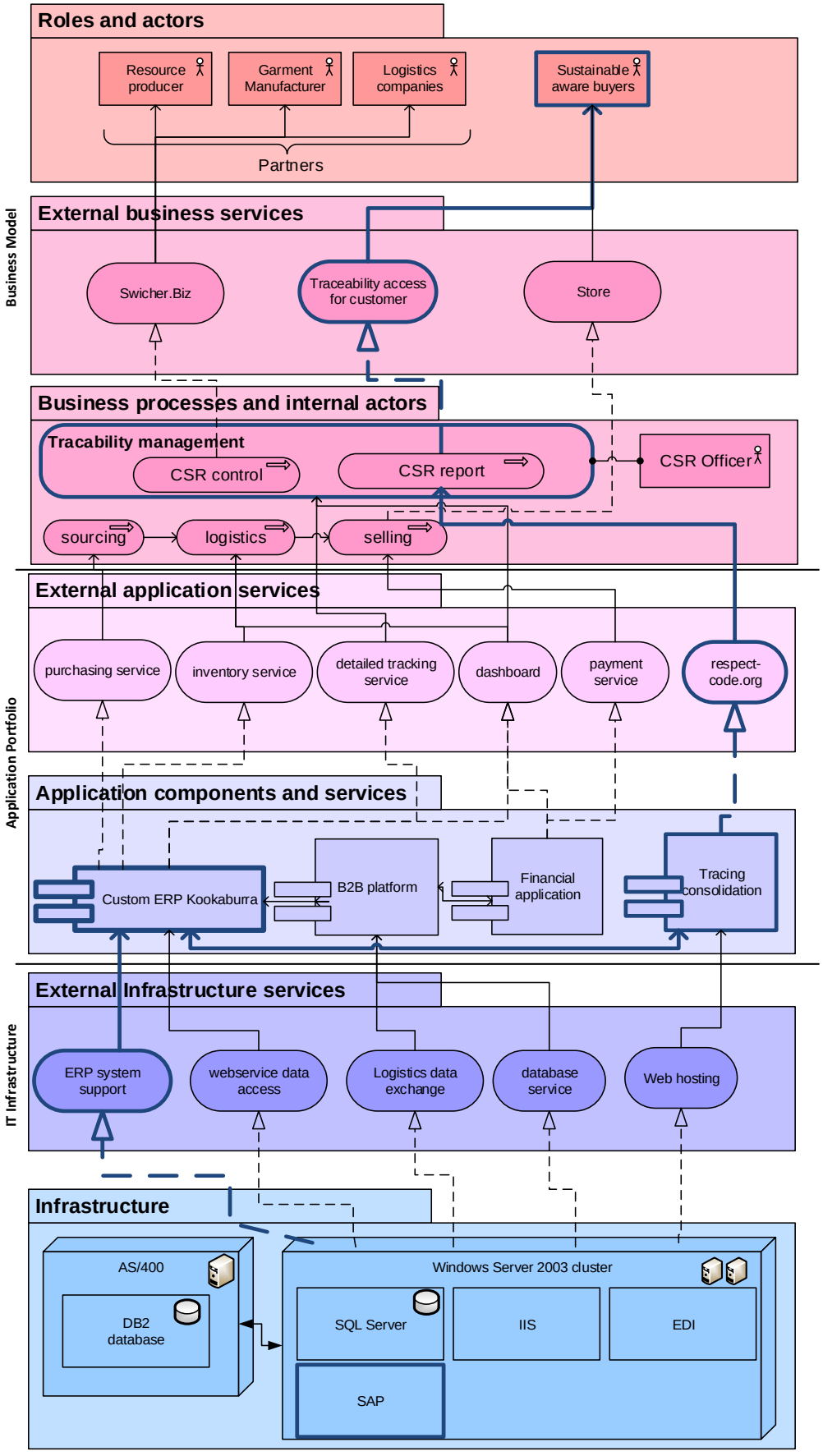

Figure 6. Switcher SA ArchiMate partial extract for traceability

7.7 Evaluation

Design science research iterates on the artifacts it builds, improving through feedback gained from evaluations. In our early iterations, we applied our intermediary model to use cases to gain insights into the ease of identifying and connecting elements for each defined element in our model. We also presented the intermediary model in e-business and enterprise architecture master level courses, and we collected feedback on the legibility of the visualization by doing a small exercise after the presentation. These tests resulted in iterations, the result of which was a switch from a custom layout of the nine elements of the Business Model Ontology to the current representation of the Business Model Canvas. This change reduces the time to read the model for anyone who is familiar with BMC visualization. Another change was switching the order of the layers in the application portfolio. Initially, as a result of poor foresight, the order was transactional, informational, and strategic. This simple mistake of having transactional applications directly under key activities made it harder for some testers to identify the application. During this first iteration, we also observed that users either struggled to categorize a transactional application into one of three subcategories (operations, customer, innovation) or simply added it to all three of them. After we put the layers in a more logical order (strategy, informational, transactional) and removed the sub-categorization for transactional applications, students had less difficulty in completing the application portfolio. This further convinced us that a fixed placement of elements in business visualization is important, because it simplifies comparison of different versions and across different companies. The concept positions need to be learned only once. Because we reuse terminology from business modeling and enterprise architecture, user already know at least half of the model's element.

The model was also evaluated in use, during a course on e-business presented to a mixed group of students from the University of Lausanne. Students participating were from master's programs either in information systems or in management. Groups consisting of four or five students had to create business models, an intermediary model, and an ArchiMate model of a real company and write a report detailing their findings. The companies chosen by the nine groups were all SME's and were not limited to e-businesses companies: one public utility, one large sporting event, one manufacturing enterprise, three web services, two web portals, and one financial services company.

Students worked on the assignment during the 12 weeks of one semester. It had three deliverables: (1) business-model focused, with a first version of the business model of the chosen company; (2) alignment focused, where students had to develop the intermediary model and the ArchiMate model and discuss alignment; and (3) environment focused, describing the environment in which the company evolves.

Of the nine groups, eight had their enterprise architecture model closely match their business models, through the use of the intermediary model. This marked an improvement over the previous year, when the students developed the enterprise architecture and the business model separately without trying to match them through an intermediary model. One caveat to this result is that the choice of company was up to the groups of students, so that it is difficult to say whether one set of companies was easier to model than the other. The one group that failed to match the enterprise architecture closely to the business model did not develop the

intermediary model correctly on a one-page visualization; these students treated each layer separately and seemed to struggle with the connections between them.

Another insight gained with this test was that even though the models were of better quality and showed connections from the business model to IT infrastructure, it is still difficult to provide a good analysis of the alignment. Only three of the eight groups that had a workable intermediary model managed to articulate a clear profile of alignment or misalignment for their company. This led us to propose the visual tracing, which we illustrated using the Switcher case study. In a future evaluation, we intend to examine whether asking for such a tracing can help trigger students to start a better, more productive discussion of alignment. One future step will be performing an evaluation using more in-depth cases. In addition, we will take into account feedback from the professional community that uses enterprise architecture and business models.

We used the Switcher SA case to gain some insights about the intermediary model. Before applying the intermediary model to the case, we attempted to model the business model and the enterprise architecture separately. Trying to merge the two models presented two problems. First, adding some elements from ArchiMate into the business models (IT resources into resources, and processes into activities) produced elements with technical terms that are not familiar to many businesspeople. Second, for some abstract external business service activities, we had trouble identifying the corresponding concrete implementation process in the ArchiMate model.

Creating the intermediary model forced us to use more consistent wording of the elements, acceptable to both businesspeople and technical people. Reaching the right compromises for the wording helped to improve the classification used in the layers and to select the right abstraction level for each element. This helped in developing the correspondence between the intermediary model and the ArchiMate model. Unnecessary technical detail was not added to the business model; on the contrary, such key assets as Kookaburra Software were highlighted. The importance of IT development staff was also identified, a fact that might have been missed if there had been no classification to guide us.

The previous exercice led us to observe that there are three type of transitions to evaluate separately: top-down, bottom-up, and mixed-mode. For the top-down approach, it will be interesting to evaluate the range of variation that can be generated using a given identical starting business model. In terms of control, testing will also allow us to examine whether using a pattern library to guide the addition of elements at the lower layers helps or hinders in the search for an architecture that can efficiently support the overarching business model. Testing for the bottom-up approach will be more difficult. As yet, there is no formal process for identifying which elements should be considered for filtering or aggregation before they are added to the intermediary model. Additionally, for an architecture that supports multiple business-model focuses, several versions will have to be produced and then merged together or split according to different business considerations. This evaluation therefore will require several iterations if we are to gain useful insights into how to approach the modeling and alignment problem in a more formal way. The potential for better identification of key resources or discovering new business opportunities based on existing resources should justify the time required for such an evaluation.

Finally, it is difficult to envisage a test to evaluate a dynamic approach to mixed-mode iteration if the above two evaluations have not been undertaken. An iterating approach touches

on the topic of comparing different versions of a model and determining its evolution, a topic that we consider to be outside the scope of this paper but a worthy subject of future study.

7.8 Discussion and Conclusions

Comparing IT services and a business model and seeing how they are connected helps to highlight the interactions between them. This offers a possibility of assigning a cost to each value proposition. It also enables identifying the alignment of the business strategy with the infrastructure supporting it. Having access to information on connectedness allows to prioritize assets according to their strategic importance. This evaluation, in turn, could be used to identify opportunities for outsourcing non-core services. It also could help to create new business models, providing new value propositions that would capitalize on underutilized assets.

We addressed the research question of whether a visual intermediary model support IT alignment by helping to transition between a business model and an enterprise architecture? As a solution, we put forward an intermediary model that takes components of both paradigms in order to have a common ground. Through a use case, we showed how this model can connect to the business model vision as well as to the enterprise architecture. Because we constructed our intermediary model using formalism from both domains, it provides a common basis to start a discussion with parties from both paradigms. The proposed model is agnostic regarding the direction of study: it can be used from a top-down view, moving from a business model strategy to an architecture supporting it, or it can be used in a bottom-up view, starting from the enterprise architecture and extracting the business model it can support. Offering this mixed view, containing both a business-focused and an IT-focused view, helps the alignment of business strategy and technical IT infrastructure.

Our intermediary model construction contributes to finding a correspondence between BMC and ArchiMate components. We demonstrate a way to match elements, using a matrix/pivot of two classifications where the correspondence is weak. ArchiMate was used for our demonstration instantiation, but any model that supports the layers used by the intermediary and can map to its components can be used as destination target for a transition between them. The process of finding corresponding elements and the visual focus of the intermediary's model presentation are the key sources of the value added by our construction.

Our visualization will be useful to practitioners as a tool that, with its visual one-page layout and classification at each layer, offers a way to find common ground for managerial and technical people. This provides a starting point for discussing alignment and assisting collaboration.

ArchiMate provides a more IT-centric view, with technical details that must be abstracted to transform it into business visualization. In addition, the business visualization elements must be extended with additional information if they are to be used t to build an ArchiMate model. Therefore, an intermediary model could result in the creation of multiple variants of the related ArchiMate model or business model. This is not necessarily a problem; indeed, it could lead to the development of new opportunities as well as helping to identify areas that require more attention when considering alignment.

Further use cases should be tested to see how the method can help in identifying misalignments. It might also be possible to define a more systematic way to transition between models, although such a method would have to handle the variability of these multiple models.

By choosing to use a fixed layout for the visualization, we made it possible to compare different models and thus start addressing the need for more “formalized means of representations as well as procedure model to allow a structured and comparable visualization of business models” (Burkhart, Krumeich, Werth, & Loos, 2011, p. 15). Our proposed visualization and its technique of zoom/pivot focus on IT applications and activities. The visualization should be applied to other components of the business model canvas in a formalized and visual way. One possibility is to address the customer segment with a more detailed model of customer profiles and insights.

7.8.1 Further Work

Creating an intermediary model to help with IT alignment is an early step in addressing the opportunities to using IT as a strategic asset. The interconnected nature of such a model provides the possibility of exploring a variety of domains. We briefly describe three. First is an approach using patterns to further structure the internal alignment possibilities between an IT model and a business model. Second, we could expand on the internal focus covered in the current iteration of the intermediary model, looking for possibilities to add the external environment. Third, we can look for opportunities to leverage the identified connections in practice, through the use of computer assisted design tools.

7.8.2 Applying Patterns

Beyond making it possible to visualize the business model on a one-page canvas, the BMC also allows us to highlight and compare business model patterns and BMCs (Osterwalder & Pigneur, 2010). A business model pattern describes some components of a business model and their relationships in a way that can be applied to other similar situations (freemium, double-sided, unbundling, long tail). As with patterns in other fields, once a pattern or situation is recognized, it is possible to identify components that are missing.

Weill and Vitale (2002) used the notion of pattern to classify the importance of the IT capabilities they defined for each situation. It may be possible to compare the implications of patterns at the IT infrastructure level, as well as the strategic business model level, to further help with alignment.

For example, Switcher SA acts as a value net integrator. According to the IT capabilities pattern, this role requires important channel management systems. This is the case for Switcher SA. The company has an important investment in a point-of-sale system, which aligns to the business model strategy of owning stores to reach niche customers interested in responsibly produced garments.

7.8.3 External Factors

In its current form, the proposed model focuses on enterprises’ internal factors. With the need for to have more collaboration between companies and the growing importance of external factors such as social and regulatory constraints, the model should be augmented. At the business layer, the environment map described for the BMC (Osterwalder & Pigneur, 2010) could help in identifying external influences using its four components (key trends, market forces, industry forces, and macro-economic forces). These components of external influences, as with the

internal components, could be aligned to the fourth unused process category of the strategy map: regulatory and social processes. Alignment with the lower layers might be more difficult because these concerns seem to impact on every component of the schema and cannot be resolved simply by adding one more column to the visualization. The proposed model already provides good insights into a large part of internal considerations.

7.8.4 Computer-Assisted Design

Selectively focusing on a specific part of a business model, as well as the need to compare different implementation possibilities for it, raises the issue of managing these multiple models. We argue that one way to manage them is to use a computer-assisted design tool. Such a tool could help, for example, in making sense of differences between different versions of the model by providing visual hints such as changing the size or color of the different components. A digital version has additional benefits, such as adding information to elements without overloading the visualization, because its visibility can be toggled. With a digital version of the model, it would be possible to connect elements with each other, as we did for the alignment tracing in the Switcher case. With such a tool, the defined links could help to compute total costs for different parts of a business model. This, in turn, could enable a rough estimation of a business model's viability based on the chosen connected implementation.

References

Andersson, B., Bergholtz, M., Grégoire, B., Johannesson, P., Schmitt, M., & Zdravkovic, J. (2006). From business to process models-a chaining methodology. *CAiSE2006*, 211–218.

Andersson, B., Bergholtz, M., Edirisuriya, A., Ilayperuma, I., Johannesson, P., & Zdravkovic, J. (2007). On the alignment of goal models and business models. REA-25. A Celebration of the REA Enterprise Model, Geerts, G., University of Delaware. Departament of Accounting & MIS.

ARIS, (2012), ARIS Business Strategy, retrieved February 12, 2012, from http://www.softwareag.com/corporate/products/aris_platform/aris_strategy/business_strategy/capabilities/default.asp

Burkhart, T., Krumeich, J., Werth, D., & Loos, P. (2011). Analyzing the Business Model Concept A comprehensive Classification of Literature. *Business*, 1-19.

Chan, Y. E., & Reich, B. H. (2007a). IT alignment: what have we learned? *Journal of Information Technology*, *22*(4), 297–315.

Chan, Y. E., & Reich, B. H. (2007b). IT alignment: an annotated bibliography *Journal of Information Technology*, *22*(4).

Chen, H. M. (2008). Towards service engineering: service orientation and business-IT alignment. *Hawaii International Conference on System Sciences, Proceedings of the 41st Annual* (pp. 114–114). IEEE.

Fatemi, H., Sinderen, M. V., & Wieringa, R. (2010). Value-Oriented Coordination Process Modeling. *8th International Conference on Business Process Management, BPM 2010* (pp. 1-16).

Gregor, S., & Jones, D. (2007). The anatomy of a design theory. *Journal of the Association for Information Systems*, *8*(5), 312–335.

Hevner, A. R. (2007). A Three Cycle View of Design Science Research. *Information Systems*, *19*(2), 87-92.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *Management Information Systems Quarterly*, *28*(1), 75-105.

Iacob, M., Meertens, L., & Jonkers, H. (2011). From Enterprise Architecture to Business Models and back. *doc.novay.nl*.

IDS Scheer, (2005). Enterprise Architectures and ARIS Process Platform, Saarbrücken.

Kaplan, R. S., & Norton, D. P. (1996). Linking the balanced scorecard to strategy. *California management review*, *39*(1).

Kaplan, R. S., & Norton, D. P. (2004). *Strategy maps*.

Lankhorst, M. (2004). Enterprise architecture modelling—the issue of integration. *Advanced Engineering Informatics*, *18*(4), 205-216. doi:10.1016/j.aei.2005.01.005

Lankhorst, M. (2005). Enterprise architecture at work: Modelling, communication and analysis.

Lankhorst, M. (2009). Enterprise Architecture at Work: Modelling, Communication and Analysis, Springer.

Osterwalder, A., & Pigneur, Y. (2002). An e-business model ontology for modeling e-business. *15th Bled Electronic Commerce Conference* (pp. 17–19). Bled, Slovenia.

Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying business models: Origins, present, and future of the concept. *Communications of the association for Information Systems*, *16*(1), 1–25.

Osterwalder, A., & Pigneur, Y. (2010). Business model generation : a handbook for visionaries, game changers, and challengers. Wiley.

Pijpers, V., & Gordijn, J. (2007). Bridging business value models and process models in aviation value webs via possession rights. *System Sciences, 2007. HICSS 2007. 40th Annual Hawaii International Conference on* (pp. 175a–175a). IEEE.

Quartel, D., Engelsman, W., Jonkers, H., & Van Sinderen, M. (2009). A goal-oriented requirements modelling language for enterprise architecture. *Enterprise Distributed Object Computing Conference, 2009. EDOC'09. IEEE International* (pp. 3–13). IEEE.

Ross, J. W., Weill, P., & Robertson, D. C. (2006). Enterprise architecture as strategy: Creating a foundation for business execution.

van Buuren, R., Gordijn, J., & Janssen, W. (2005). Business Case Modelling for E-Services. *BLED 2005 Proceedings*, 8.

VHP. (2009). TOGAF Version 9 (TOGAF Series) (p. 700).

Weill, P., & Broadbent, M. (1998). Leveraging the new infrastructure: how market leaders capitalize on information technology. Harvard Business Press.

Weill, P., & Vitale, M. (2002). What IT infrastructure capabilities are needed to implement e-business models. *MIS Quarterly Executive*, *1*(1), 17–34.

Wegmann, A. (2003). On the Systemic Enterprise Architecture Methodology (SEAM. *Proceedings of the 5th International Conference on Enterprise Information Systems*, 483–490.

Winter, R., & Fischer, R. (2007). Essential layers, artifacts, and dependencies of enterprise architecture. *Journal of Enterprise Architecture*, (May), 1–12.

Yu, E., Strohmaier, M., & Deng, X. (2006). Exploring intentional modeling and analysis for enterprise architecture. *Enterprise Distributed Object Computing Conference Workshops, 2006. EDOCW'06. 10th IEEE International* (pp. 32–32). IEEE.

Chapter 8
Privacy-Friendly Business Models for Location-Based Mobile Services

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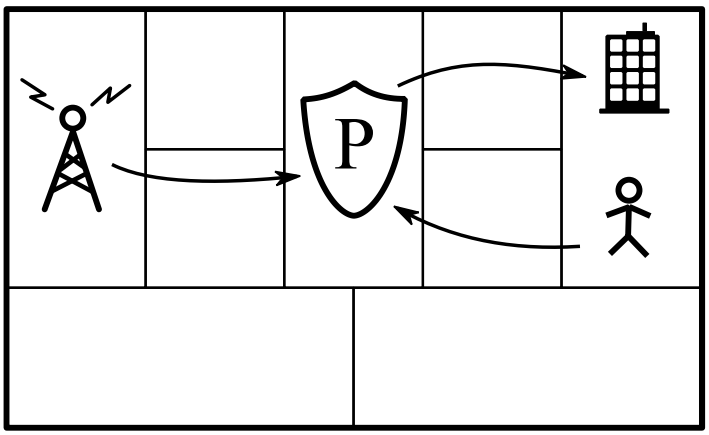

Abstract
This paper presents a theoretical model to analyze the privacy issues involved in business models for location-based mobile services. We report the results of an exploratory field experiment in Switzerland that assessed the factors driving the net payoff to users of mobile businesses. We found that (1) the personal data disclosed by users has a negative effect on user payoff; (2) the amount of personalization available has a direct and positive effect, as well as a moderating effect, on user payoff; and (3) the amount of control over a user's personal data has a direct and positive effect, as well as a moderating effect, on user payoff. The results suggest that privacy protection could be the main value proposition in the B2C mobile market. From our theoretical model, we derive a set of guidelines to design a privacy-friendly business model pattern for third-party services. We discuss four examples to show how the mobile platform can play a key role in the implementation of these new business models.

Keywords: Privacy, Location-based services, Business model, Design science, Information systems, Personal data disclosed, User's payoff, Personalization available, Control over user personal data

8.1 Introduction

New regulatory requirements, such as the guidelines given by the Organisation for Economic Co-operation and Development [33], and consumer concerns are driving companies to consider more privacy-friendly policies, often conflicting with their desire to leverage customer data.

On one hand, close proximity of potential customers and access to their real intentions regarding purchases of services has a real value for mobile location-based service providers, whose market revenues are expected to reach more than $12.7 billion by 2014 [19]. On the other

hand, the collection of data about consumers is constrained by their privacy right, which we refer as “the right to be left alone; the right of a person to be free from unwarranted publicity; and the right to live without unwarranted interference by the public in matters with which the public is not necessarily concerned” (*Black’s Law Dictionary*, as cited in [21]). Improper or non-existent control over disclosure can be the root cause of privacy issues and concerns about the privacy of personally identifiable information. The challenge for companies therefore is to reduce user data collection to the lowest sustainable level possible while providing a profitable service.

Much research to date has focused on understanding the relationship between user privacy concerns and the willingness to disclose personal information to online companies (e.g., [28], [14]). In this sense, user privacy concerns are found to be one major predictor of the willingness to provide personal information. We argue that previous research focuses only on user choice to either withhold or release personal information. This decision is one component of user payoff, which we consider as “the degree to which a mobile user perceives as fair the benefits he or she receives in return for the release of personal information” [41]. if user's payoff is not assured, datasecurity is in peril [2].

In the rest of the paper, we focus on location-based services offered in the Business to Consumer (B2C) market, such as navigation, information, advertising, tracking, and billing [18]. We exclude emergency services from our analysis because users of those services deal differently with privacy concerns [40]. Location-based applications open new opportunities for business models in the mobile sector. Hence, we primarily address an audience mainly composed of stakeholders in mobile services who seek guidelines to develop privacy-friendly business models. We also wish to raise the interest level of the broader audience of information system researchers and practitioners who are concerned with the impact of business model practices on the design of the IT artifact [6]. Our research question is this: How should one design a privacy-friendly business model that can sustainably maximize(s) the payoff to the user of a location-based mobile service user?

The remainder of the paper proceeds as follows. In the next section, we review some of the related work in privacy and location-based services that addresses our research question, and we define a set of research sub-questions to fill the remaining gaps. The third section presents the methodology we use to address these sub-questions. The fourth section introduces our theoretical model and presents empirical evidence to support it. In the fifth section, we implement our theoretical model to derive a set of guidelines to obtain privacy-friendly business models. Section 6 presents a set of possible instantiations of our guidelines using real companies as potential candidates. In the final section, we discuss the implications of our analysis, draw some conclusions, and propose further possible research.

8.2 Literature Review

In this section we briefly highlight a set of well-known works that help us in answering our research question. For a more complete literature review of privacy management technologies, we suggest reading [11]. After outlining the remaining gaps in the literature, we derive a set of research sub-questions that remain to be answered.

The success of the privacy management solution relies on the development of technology and regulations to protect personal information [1]. Privacy is a dynamic and dialectic process of

give and take between and among technical and social entities in ever-present and natural tension with the simultaneous need for information to be made public [35]. We therefore understand the mobile user and the service provider as both competing and cooperating to gain access to a valuable resource (mobile user's data) [30].

Research aimed at surveying and classifying solutions to managing online privacy was also conducted in order to evaluate the different factors influencing collaboration and their various impacts [25], [27]. It has been found that different types of privacy assurance have different impacts on people's willingness to disclose personal information; for example, the existence of a privacy statement induces more subjects to disclose personal information, but that of a privacy seal does not [25]. It has also been proved that monetary incentives had a positive influence on disclosure whereas information request has a negative influence, suggesting that firms do not collect consumer data unless they intend to use them. In addition to that, cross-cultural analyses show that young English people have more concerns about privacy than French people, resulting in greater perceived risks about data disclosure [27].

Among prior studies focusing on the online business sector, none has examined the specific domain of mobile business settings. Regardless of the fact that there are some similarities between online and mobile businesses, location-based mobile services have their own unique features that make them different from online businesses. We therefore derive the following research sub-question:

R1: What is the specificity of privacy management in the location-based mobile B2C market?

Much research has been dedicated to understanding the relationship between users' privacy concerns and their response behaviors (e.g., to develop software such as Smokescreen [10]). This research reveals that Internet users' information privacy concerns are a major antecedent to the willingness to provide personal information to online companies. Previous research shows the influences between perceived justice and procedural justice, as well as perceived justice and distributive justice [28], [41].

Previous research has also suggested that control over personal data is an important component in creating a good relationship with customers. For example, most people want to have more control over the use of personal data to restrict unwanted commercial advertisements [36]. Issues of information control are essential in increasing the likelihood of consumers contributing information to online firms [42].

Another important issue is the value of personalization. According to [8], service personalization is said to depend on two factors: 1) a company's ability to acquire and process customer information and 2) customers' willingness to share information and use personalized services. They develop a model to predict consumers' usage of online personalization as a result of the trade-off between those consumers' perceived value of personalization of services and their concern for privacy. Those studies do not, however, provide guidelines for the design of a business model for mobile services. Therefore, our second research sub-question is:

R2: Which business model components allow a high level of mobile users' payoff while keeping the collected data to a minimum?

Finally, comprehensive analyses of consumer privacy concerns and Internet-related business have proposed [27] four different clusters of users: well-intended, negotiator, unconcerned, and

reticent. These analyses suggest that when considering the approach to e-commerce, we should also respect the different groups of Internet users. Such results appear to not have strong statistical relevance. Hence, our third sub-question is:

R3: How should the differences in payoff among privacy risk–neutral and privacy risk–averse mobile users be addressed?

In the following section, we illustrate how we intend to address our research sub-questions to answer our initial research question.

8.3 Methodology

Based on the relevant literatures, we create an artifact in the form of a model [29] to express the relationship between user payoff and the extent of personal data disclosed.

We adopt a design science research methodology, and we refer to existing guidelines for design theories [20]. The theories for design and action "give explicit prescriptions on how to design and develop an artifact, whether it is a technological product or a managerial intervention" [20]. Therefore, we advance in three steps, as illustrated in the figure 1.

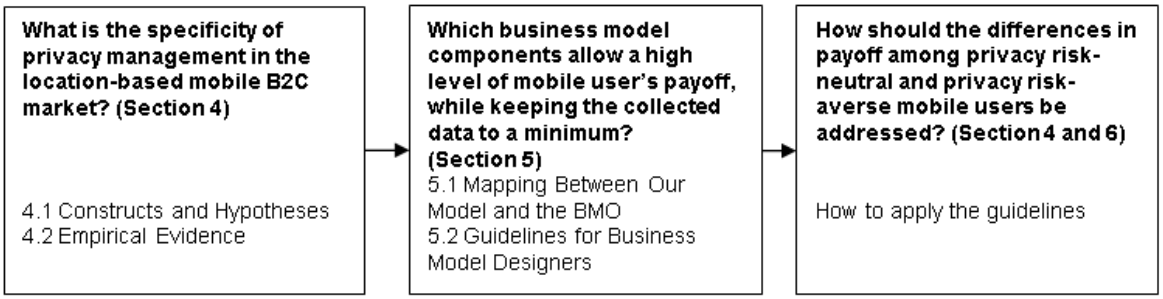

Figure 1: Model of user's payoff

An information system design theory (ISDT) should define its purpose and scope, that is, the boundaries of a theory. In our case, our theory concerns data management for privacy risk reduction of location-based services. The second element of an ISDT is the representations of the entities of interest in the theory, that is, constructs. The principles of form and function define the structure, organization, and functioning of the design product or design method. The justificatory knowledge provides an explanation of why an artifact is constructed as it is and why it works.

Accordingly, in section 4 we introduce a model composed of four constructs and derive hypotheses concerning the interaction among constructs. In doing so, we ground our claims on existing theories of control [12], as well as perceived justice and equity theory (used in [41]).

The evaluation strategy of testable propositions uses surveys as an ex post artificial type of evaluation [37]. The resulting outcomes provide answers to the first sub-question.

Our second sub-question concerns the means by which the design is brought into being—a process involving agents and actions. To address this sub-question, section 5 starts by mapping our constructs with the constructs of the Business Model Ontology (BMO) [34], a tool often used by startups and multinational companies to represent their business models. Because our model has only four constructs and the BMO is composed of nine elements, we rely on an existing type

of business model (the “infomediary pattern”) to fill in the blanks and derive a set of guidelines for business model designers to obtain privacy-friendly business models.

To properly answer our third sub-question, we need to test the feasibility of the proposed guidelines. Hence, section 6 presents a set of instantiations of our business model pattern. Whereas a theory is an abstract expression of ideas about phenomena in the physical world, instantiated artifacts are things in the physical world. Thus, we illustrate four examples of application for our guidelines by naming four existing companies as possible candidates.

8.4 Model

In this section, we present our theoretical model, following the guidelines to describe a theory [43]. We start by presenting the constructs and by augmenting our hypotheses using the references we introduced in the literature review. Then we show the correlations among components, which we derive from our test results.

8.4.1 Constructs and Hypotheses

Our model is composed of four constructs, the definitions of which are derived from previous research summarized in table 1.

Table 1: Definitions of each construct of our model

Construct	Definition	Source
Personal data disclosed	Degree to which a mobile user perceives personal data being disclosed by the mobile service companies	[41]
User's payoff	Degree to which a mobile user perceives as fair the benefits he or she receives from mobile service companies in return for providing personal information	Ibid.
Personalization available	Degree of fairness that a mobile user perceives from mobile service company treatment of information privacy	Ibid.
Control over user personal data	Degree to which a mobile user perceives whether mobile service companies give him or her procedures for control of information privacy and make him or her aware of the procedures	Ibid.

Because previous studies have already focused on the effects of antecedents, we focus on the effects among antecedents. We refer to [41] and claim that the “Degree to which a mobile user perceives as fair the benefits he or she receives from mobile service companies in return for providing personal information” (i.e., “user payoff” in our model) is found to be one major predictor for “personal data disclosed,” which we define as the degree to which a mobile user perceives whether personal data is disclosed by the mobile service company. Therefore, we propose a model of user payoff as indicated in figure 2.

H1: The personal data disclosed has a negative effect on user payoff.

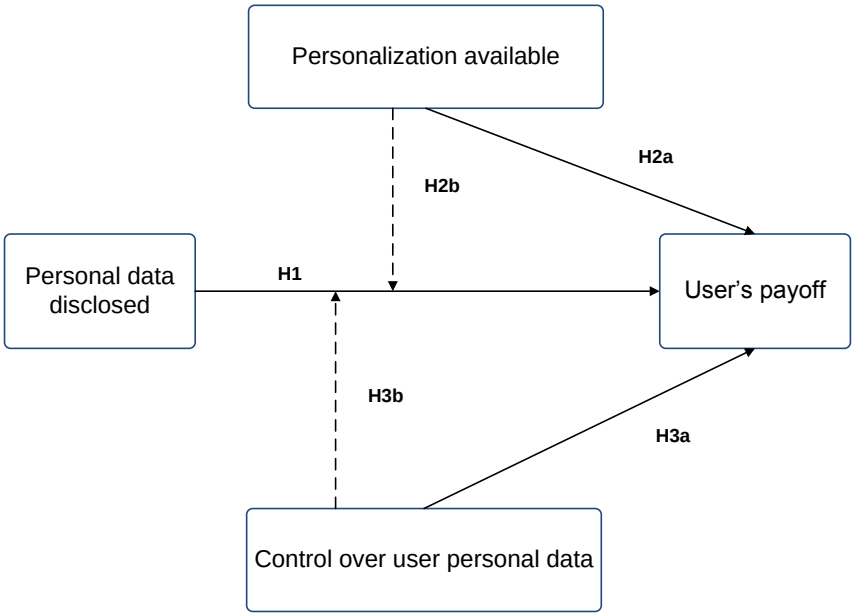

Figure 2: Model of user payoff

In exchange for user data, the m-commerce provider could offer a service, which is either standard or fully customized. We introduce the concept of service personalization, which we define as the degree of fairness that a mobile user perceives relative to mobile service company's treatment of information privacy. As we previously mentioned in the literature review, service personalization depends on customer willingness to share information and use personalized services [8]. It is natural to expect a positive relationship between the amount of personalization available and users' benefit.

H2: The amount of personalization available has (a) a direct and positive effect and (b) a moderating effect on user payoff.

Because consumers take relatively high risks by submitting personal data to the mobile service provider, data controls over user personal data using privacy metrics [22] are a useful tool to decrease user concern for privacy risks. Lack of such controls decreases mobile user trust in the provider [12] and lowers the perceived payoff. Hence, we propose that:

H3: The amount of control over user personal data has (a) a direct and positive effect and (b) a moderating effect on user payoff.

8.4.2 Test Design

In our study, we want to test the effect of the data disclosure, service personalization, and data control over user payoff. We test the effect of such constructs in two steps.

Because we are dealing mostly with perceptions, we test the effect of our model using scenario-based surveys. This form of assessment has been successfully implemented in previous studies on information system security [5].

As illustrated in table 2, we designed 2^n different scenarios, where n is the number of constructs in our model that we want to test and 2 is the number of values that each construct can take (0 = Low or 1 = High). All subjects are to receive scenario 0 (step 1), which tests the initial user's payoff:

Your mobile phone operator (e.g., Swisscom) offers you a new service – a discount zone. With this service, you can get exclusive information and access to exclusive personal time and location-limited discounts on a diversity of products and services (e.g., books, pizzas, electronics, cinema, etc.) near your current location. For example, if you are interested in acquiring an iPad, Swisscom will automatically send an SMS to your mobile phone when there is a 'special and exclusive' discount for iPads near your location.

"There are two ways to register for this service: a paid yearly subscription that gives access to the full service, or a free registration. To get free registration, you must provide additional information, including your name, gender, and country of residence. Your data are stored according to privacy laws and sold to discount providers."

In step 2, we split the overall sample into sub-groups. Each sub-group will get a variation of the initial scenario and be asked to express the new user's payoff.

Table 2: Our scenarios

	Data disclosure	Service personalization	Data control
Scenario 0	0 (Low)	0 (Low)	0 (Low)
Scenario 1	0 (Low)	0 (Low)	1 (High)
Scenario 2	0 (Low)	1 (High)	0 (Low)
Scenario 3	0 (Low)	1 (High)	1 (High)
Scenario 4	1 (High)	0 (Low)	0 (Low)
Scenario 5	1 (High)	0 (Low)	1 (High)
Scenario 6	1 (High)	1 (High)	0 (Low)
Scenario 7	1 (High)	1 (High)	1 (High)

As table 3 indicates, each variation of the scenario operationalizes one construct of our model and is derived from previous works.

Table 3: Operationalization of variables for the scenarios

Construct	Variable	Sources
Personal data disclosed	Low: Name, gender, country of residence, High: Name, gender, country of residence personal phone number, current debt, checking & saving balance, and other investment	[25]
Personalization available	Low: None High: "You have the possibility to customize your personal preferences to get the discount information you desire."	[4]
Control over user personal data	Low: None High: "You still can see which data are sold to the discount providers and set a limited amount of options regarding such disclosure."	[28]

To measure the user's payoff, we derive three items from previous studies. A set of control variables is included as well, as shown in table 4.

Table 4: Operationalization of variables for the survey

Construct	Variable	Sources
User's payoff	1) In this case, my need to obtain the discount opportunity provided by this service is greater than my concern about privacy 2) My interest in the discounts I can obtain from this service overrides my concerns of possible risk or vulnerability that I may have regarding my privacy 3) My interest in obtaining this discount service makes me suppress my privacy concerns	[14]
User's familiarity with LBS	A) I am familiar with Smartphones B) I am familiar with mobile services using my location	--
User's perception of country risk	C) I believe that regulations in my country require personal data to be properly protected	[27]
User's perception of Internet risk	D1) When I share data with a mobile service I believe that there is enough protection and that privacy risk is low D2) When I share data with a mobile service I believe that there is a safe environment to perform economic transactions D3) When I share data with a mobile service I believe that there is a safe environment to perform tasks related to work or private life	[27]
User's techniques for privacy protection	E1) Concerning my personal data, I always share my real identity E2) Concerning my personal data, I always use a pseudonym E3) Concerning my personal data, I always give false information E4) Concerning my personal data, I do not answer personal questions if they are not mandatory	[27]

8.4.3 Results

We invited a group of subjects to fill out a survey concerning privacy issues in a location-based mobile service context. The descriptive statistics of the sample are presented in table 5. Our sampling frame consisted of 187 bachelor's students at the business faculty of a Swiss university who attended the course in information systems. The sample is representative for the overall population of smart phone mobile users in Europe.

The subjects were between 19 and 24 years of age, and 70 percent of the sample was male. This corresponds well with the recent figures on smart phone users in Europe: 27% between 16 and 24 years of age and 67% male, according to Forrester Research, Inc [26].

From previous research, we derived two items to test for cultural effect. We can compare to the English sample of [27] that had the same sample distribution.

Table 5: Descriptive statistics

Subject's background	
Gender	male: 70.06%
Familiarity with smart phone	mean = 5.431, *SD* = 1.820
Familiarity with location-based service	mean = 4.180, *SD* = 2.067
Global concerns	mean = 3.402, *SD* = 1.372
Concerns for mobile sector	mean = 3.168, *SD* = 1.185
Main constructs	
User's payoff	mean = 3.768, *SD* = 1.559
Personal data disclosed	high: 53.48%
Personalization available	high: 58.29%
Control over personal data	high: 56.68%

Table 6 presents information on the correlation coefficients between all the constructs. We observe a relatively high correlation coefficient between global concerns for privacy and concerns in the mobile service sector (0.656). Because both variables deal with attitude to privacy risks, it is natural to expect a positive linkage between them. We did not otherwise observe any significant proof of multicollinearity among our variables.

Table 6: Correlation among variables

		1	2	3	4	5	6	7	8	9	10	11
		gender	**fsp**	**fmsl**	**gp**	**mss**	**apdd**	**payoff1**	**payoff2**	**data**	**pers**	**control**
1	**gender**	1.000	-	-	-	-	-	-	-	-	-	-
2	**fsp**	-0.234	1.000	-	-	-	-	-	-	-	-	-
3	**fmsl**	-0.294	0.585	1.000	-	-	-	-	-	-	-	-
4	**gp**	-0.049	0.135	0.217	1.000	-	-	-	-	-	-	-
5	**mss**	-0.106	0.184	0.185	0.656	1.000	-	-	-	-	-	-
6	**apdd**	-0.078	0.119	0.017	-0.006	0.158	1.000	-	-	-	-	-
7	**payoff1**	-0.119	-0.061	0.009	-0.021	0.031	0.126	1.000	-	-	-	-
8	**payoff2**	-0.179	0.077	0.212	0.084	0.148	0.108	0.488	1.000	-	-	-
9	**data**	0.113	-0.085	-0.163	-0.026	-0.084	0.031	-0.099	-0.673	1.000	-	-
10	**pers**	-0.108	0.089	0.099	-0.036	-0.058	0.036	0.016	0.096	-0.177	1.000	-
11	**control**	-0.111	0.116	0.177	0.242	0.221	-0.037	-0.001	0.176	-0.188	-0.229	1.000

Notes:
fps: familiarity with smart phone;
fmsl: familiarity with mobile services using my location;
gp: global concerns for privacy;
mss: concerns in mobile service sector;
apdd: authenticity of personal data disclosed;
payoff1: user payoff in scenario 0 (base scenario);
payoff1: user payoff in other scenarios;
data: personal data disclosed;
pers: personalization available;
control: control over personal data.

To test the relationships between variables, we conducted several regression tests using the statistical software STATA 9. The ANOVA test proves that there is no significant effect of scenario

0 over payoff, $F(6,164) = 0.83$, $p = 0.547$, adj $R^2 = -0.0057$. Therefore, we include this control group in our final model. Accordingly, the sample size doubles in the regression equations. Table 7 presents the outcomes of our four steps; in each step, we tested a different regression. In all regression models, the dependent variable is user payoff.

In the first step, we simply focus on the impact of data disclosed. We introduce control variables such as gender, familiarity with smart phones, and user's familiarity with location-based services and authenticity of disclosed data.

In the second step, we add personalization available as another main independent variable. We also consider the potential interaction effect between the new variable and data disclosed, which we named "data*pers." The third step concerns the control over personal data, and the interaction between data and control (data*control). The final step includes all these three main independent variables and their interactions. The results are shown in table 7.

For each step, we measured the adjusted *R*-squared. Table 7 indicates whether the inclusion of additional variables increased the overall explanatory power of the model.

Table 7: Regression models

Dependent variable: user's payoff				
	Step 1	**Step 2**	**Step 3**	**Step 4**
data	-2.004***	-1.789***	-2.210***	-1.876***
pers		0.600**		0.624**
control			0.559**	0.562*
data*pers		-0.777**		-0.706
data*control			-0.306	-0.202
pers*control				-0.436
data*pers*control				0.228
gender	-0.404**	-0.396**	-0.378**	-0.373**
fsp	-0.096	-0.091	-0.097	-0.092
fmsl	0.091*	0.086	0.082	-0.084
authenticity	0.227**	0.093**	0.227**	0.231**
_cons	3.566***	3.438***	3.487***	3.343***
Adj. *R*-squared	0.287	0.297	0.296	0.297

Notes:
***p** < .1; ****p** <.05; *****p** < .01;
data: personal data disclosed; **pers:** personalization available; **control:** control over personal data;
data*pers: interaction of personal data disclosed and personalization available;
data*control: interaction of personal data disclosed and control over personal data;
pers*control: interaction of personalization available and control over personal data;
data*pers*control: interaction of personal data disclosed, personalization available and control over personal data;
fsp: familiarity with smart phone; **fmsl:** familiarity with mobile services using location;
authenticity: authenticity of personal data; **_cons:** constant.

As table 7 indicates, the extent of data disclosed always has a significant effect on user payoff ($p < .01$ in all four steps), which is negative (-2.004 in the first step). In other words, it appears that mobile users sacrifice certain benefit or increase their concerns for risk when the service asks for their personal information. Thus, **H1 is strongly supported.**

Service personalization has a significant effect on user payoff ($p < .05$ in steps 2 and 4), which is positive (0.600 in step 2). This fits well with previous results [41], which found a value at 0.60 as well. Interestingly, we find a significant negative interaction effect of personalization available on the relationship between data disclosed and payoff (-0.777 in step 2), though such an effect is not strongly significant ($p > .05$ in steps 2 and 4). Thus, **H2a is supported** but **H2b is not supported**.

Control has a positive (0.599 in step 3) effect on user payoff, although there is not always a relevant significant effect on user payoff ($p < .05$ in step 3; $p < .01$ in step 4). We found no relevance for the moderating effect of control over user payoff with the whole sample. Therefore, **H3a is weakly supported** and **H3b is not supported**.

Recalling [27], we confirm that gender was an effect on user's payoff. We also expect that people who show generally low risk aversion have different opinions on their payoffs as opposed to those who are highly risk averse. Thus, we divide our sample into two clusters accordingly. We adopt the median cluster method based on two variables: subjects' global concerns for privacy and concerns in the mobile service sector. We exclude sample observations that are equal to the value of the median. We conduct regression analysis for both clusters, and the results are indicated in table 9.

We find that for people who have a relatively high level of concern about privacy when providing personal information (risk-averse users), neither personalization available nor user control over personal data plays an important role in determining payoff, this interpretation extends previous analysis on why privacy policies on website are often not shown in the first page [7]. For people who have a relatively low level of concern about privacy when providing personal information (risk-neutral users), both variables are demonstrated to be an essential indicators. In the last column of table 8, we observe that the only variable that has a significant impact on payoff is data (-1.481, $p < .01$. **Hence, H2 and H3 are rejected for risk-averse mobile users.** However, there are significant effects of personalization available and user's control for risk-neutral users. In particular, personalization being available has a significant positive direct impact on user payoff (0.912, $p < .05$) and a significant negative moderating effect on the relationship between personal data disclosed and user payoff (-1.364, $p < 0.1$). User's control over personal data has a strong positive impact on user's payoff (1.132, $p < .01$). **Thus, for risk-neutral mobile users, H2 and H3a are supported.**

Table 8: Regression for risk-neutral and risk-averse users

Dependent variable: user's payoff		
	Risk-neutral users	**Risk-averse users**
data	-2.435***	-1.481***
pers	0.921**	0.443
control	1.132***	-0.290
data*pers	-1.364*	-0.703
data*control	0.089	-0.781
pers*control	-1.226	0.611
data*pers*control	0.993*	0.563
gender	-0.636**	0.001
fsp	-0.259***	0.010
fmsl	0.089	0.120
authenticity	0.386***	-0.021
_cons	3.846***	3.477***
Adj. *R*-squared	0.449	0.216

Notes:
***p** < .1; ****p** <.05; *****p** < .01;
data: personal data disclosed; **pers:** personalization available; **control:** control over personal data;
data*pers: interaction of personal data disclosed and personalization available;
data*control: interaction of personal data disclosed and control over personal data;
pers*control: interaction of personalization available and control over personal data;
data*pers*control: interaction of personal data disclosed, personalization available and control over personal data;
fsp: familiarity with smart phone; **fmsl:** familiarity with mobile services using location;
authenticity: authenticity of personal data; **_cons:** constant.

There is also a moderating effect of user's control on the relationship between personal data disclosed and user payoff, but such an effect is not significant. Hence, **H3b is not supported for risk-neutral mobile users.** We also observe from table 8 that the adjusted *R*-squared is 0.449 for risk-neutral mobile users, indicating that the overall explanatory power of the model is increased within this group, as opposed to the one that includes all observations (table 7).

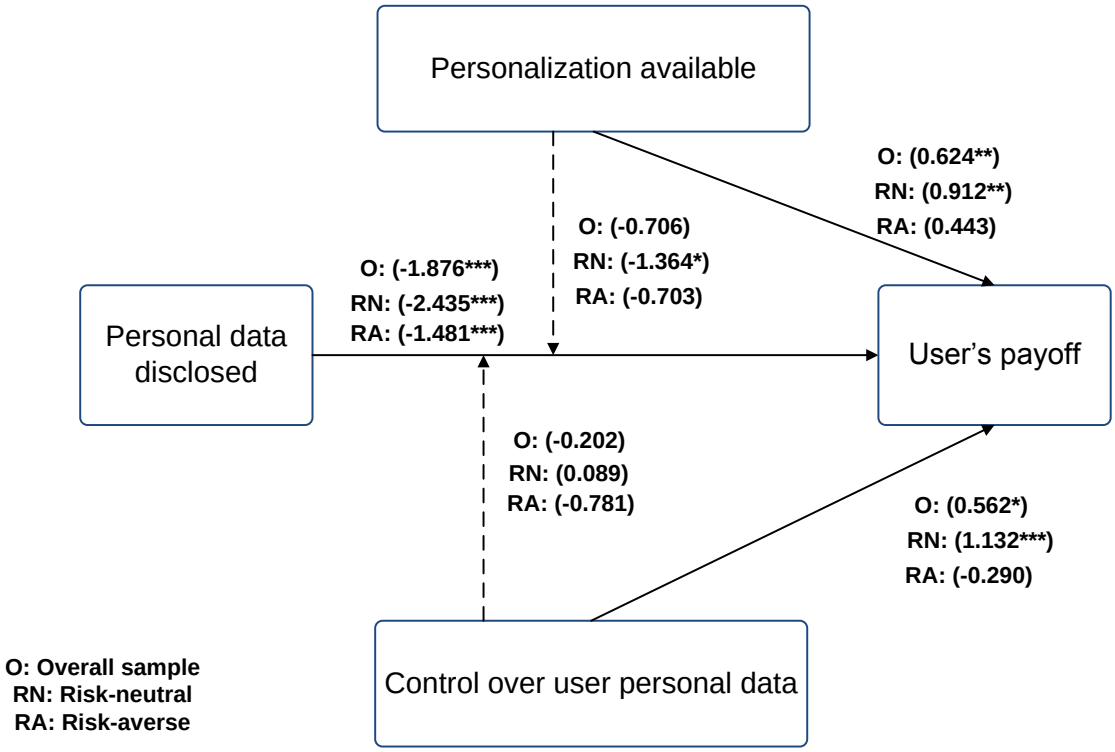

Figure 3: Test model of user payoff

Notes:
***p** < .1; ****p** <.05; *****p** < -01

In figure 3, we describe how our results demonstrate that although there is always a trade-off between user payoff and the extent of personal data disclosed, other factors play different roles in determining user payoff across different groups of customers.

8.5 Implementation of the Theoretical Model: The Trusted Infomediary Pattern

In this section, we derive guidelines to design privacy-friendly business models. We start by mapping the concepts of the theoretical model tested in the previous section onto the nine building blocks of the Business Model Ontology [34]. Then we complete the business model of a third-party agent, which has a value proposition structure around privacy protection, using the description of an infomediary [21].

8.5.1 Mapping our Model on the Business Model Ontology (BMO)

A business model canvas or ontology (BMO) can be described by looking at a set of nine building blocks. These building blocks were derived from an in-depth literature review of a large number of previous conceptualizations of business models. In this depiction, the business model of a company is a simplified representation of its business logic viewed from a strategic standpoint (i.e., on top of Business Process Modeling), which is explained in detail in the following table 9.

Table 9: Regression for risk-neutral and risk-averse users

Business model constructs	Description of the business model constructs (from [34])	→ mapping to our model
Value proposition (VP)	The bundle that create value for a specific Customer Segment	User payoff
Customer segment (CS)		2 types of user
Distribution channel (CH)	How a firm communicates with/reaches its CS to deliver its VP	LBS
Customer relationship (CR)	Types of relationships a firm establishes with a specific CS	Personalization
Key resources (KR)	The most important assets required to make a BM work	Disclosed data
Key activities (KR)	The most important things a firm must do to make its BM work	Control
Partner network (KP)	Suppliers and partners that make the BM work	--
Cost structure (C$)	All costs incurred to operate a BM	--
Revenue streams (R$)	The cash a company generates for each CS	--

At the center is the **Value Proposition**. It describes which customer problems are solved and why the offer is more valuable than similar products from competitors (product, service). Previous studies have already related perceived customer value to privacy risk [9]. The customers themselves are analyzed in the **Customer Segment**, separated into groups to help identify their needs, desires, and ambitions (e.g., singles, families). In our model, there are two types of mobile users, identified as customer segments: those neutral in respect to privacy risk (52% of the tested sample) and those averse to privacy risk (48% of the tested sample). Thus, the value proposition can be derived by the user's payoff: the risk-neutral users seek personalized service, whereas the risk-averse users seek data control.

Distribution Channel illustrates how the customer wants to be reached and by whom (Internet, store). The boundary conditions of our model define that it applies to Location-Based Services; therefore, the distribution channel can be considered to be a mobile device with location-based services.

Customer Relationship specifies the type of relationship the customer expects and how it should be established and maintained (promotion, support, individual or mass). Our model has a construct concerning service personalization that maps well to this business model component because it allows a personalized relationship between user and provider. To be able to deliver the value proposition, the business must have **Resources** (staff, machines, secret knowledge), which in our model is the disclosed data of the user. The firm transforms these resources through **Key Activities** into the final product or service (development, production, secret process). The construct concerning data control of our model seems to fall into this category.

Figure 4 describes how our model maps with the BMO. The numbers on the arrows refer to the values we obtained in table 8. According to figure 4, the segment of privacy risk–neutral users seeks personalized service composed of a personalized customer relationship and a control over personal data. The other segment of mobile users (i.e., the privacy risk–averse) looks for privacy risk mitigation, which can be obtained by a service that collects few personal data.

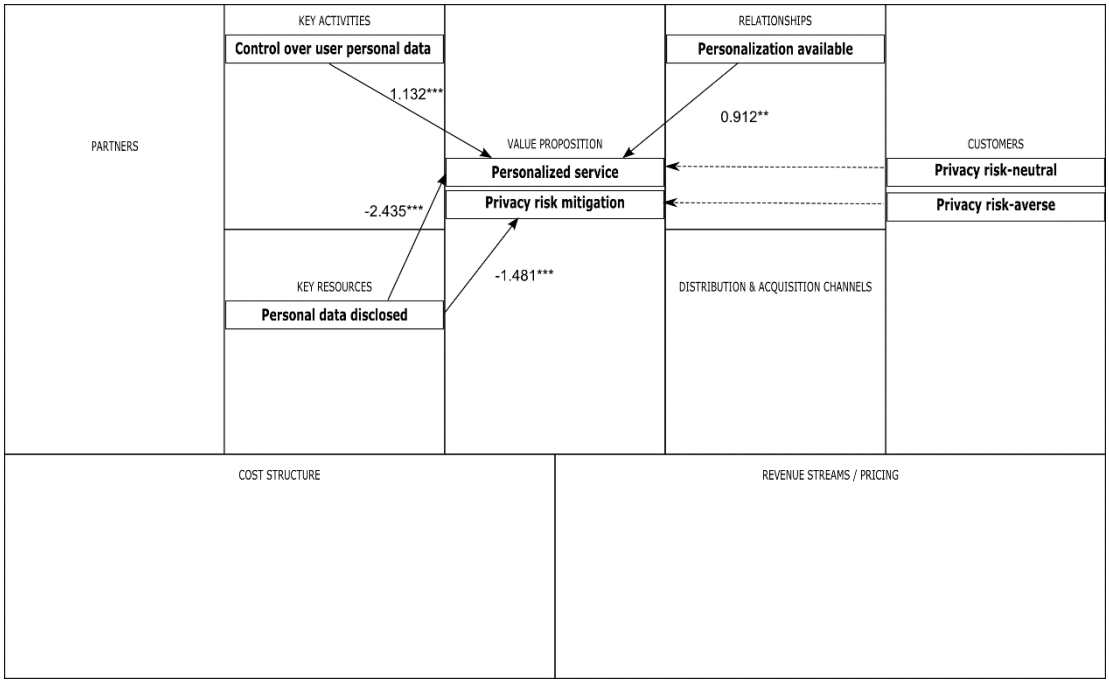

Figure 4: The theoretical model represented using the BMO

Most businesses also depend either for resources or for activities on an external **Partner Network** (logistics, financial), which can provide better quality or a lower price for non essential components. Any business model would be incomplete without financial information. Hence, the last two building blocks focus on cost and revenue: **Cost Structure**, which should be aligned to the core ideas of the business model (key resources, key activities), and **Revenue Streams**, which mirror the value the customers are willing to pay and how they will perform the transaction (one-time fee, subscription).

These elements happen to be missing in our model. In the next section, we obtain a profitable business model by referring to existing business model patterns.

8.5.2 Applying the BMO to Derive a Privacy-Friendly Business Model Pattern

A pattern is commonly referred to as a solution for a problem in a recurring context. Using the business model ontology, one can represent a set of business model patterns [34]. Each business model pattern addresses a different goal. It assigns values to components of a business model and specifies relationships to be applied to similar contexts.

For our purposes, we introduce the pattern of the infomediary as a special case of a multi-sided business model [16]. Infomediary is a term invented by [21]. It was previously referred to as “boundary spanner” or “information broker” and adapted to the e-business. The infomediary is a trusted third party that helps consumers and vendors connect. The role of our infomediary is to become the custodian, agent, and broker of customer information.

The third party has distinct sets of client segments, which need each other and which cannot get together easily on their own. The infomediary helps them connect through a specific platform. The main cost of a double-sided business is maintaining and developing the platform. As for the revenues, one segment can be subsidies in order to generate enough interest for the platform from the second party, which will then pay for the service.

Figure 5 illustrates the effects of the infomediary pattern introduction on the components of our business model, which we describe here in detail.

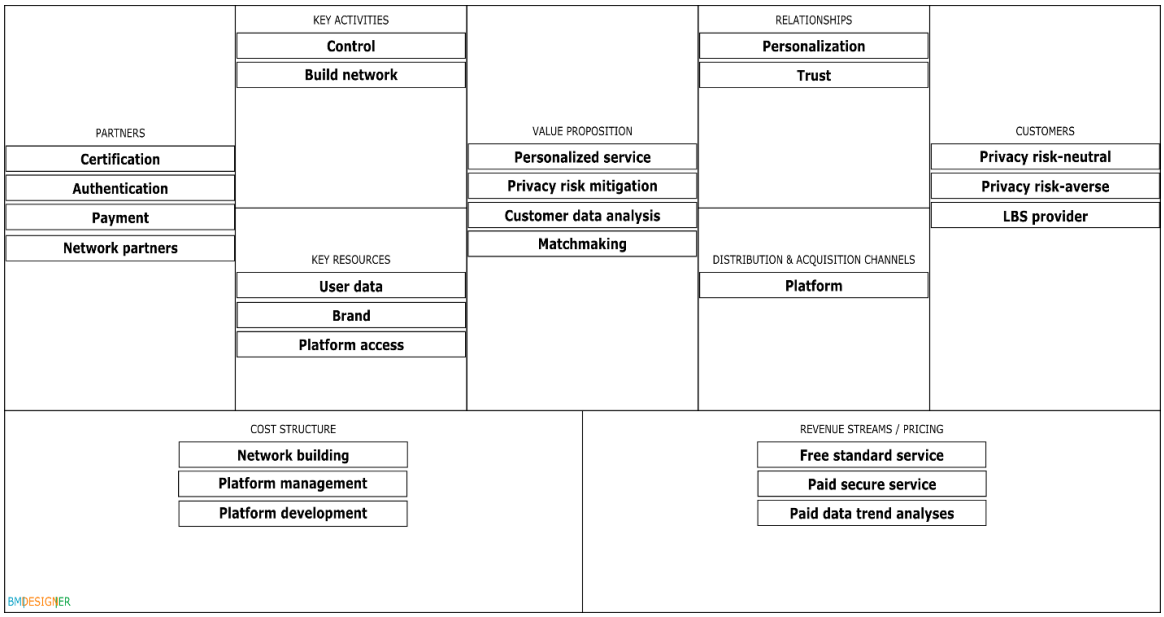

Figure 5: Business model for privacy as value proposition

Customer segments: A third customer segment is added to the two existing ones: m-commerce service providers willing to add privacy management to their services to differentiate their offer or tap into the pool of risk-averse users.

Value proposition: According to the three different customer segments, we identify three main value propositions:

- *Service personalization for privacy risk–neutral users*: By aggregating customers with the same interest, the infomediary can negotiate better deals. The user receives only advertisements based on a personal opt-in profile. The user can get better recommendations based on that individual's personal protected aggregated profile. The user can opt in to receive certain advertisements, and in some cases even get paid for exposing parts of a personal detailed profile.

- *Privacy risk mitigation for privacy risk–averse users*: The infomediary acts as a proxy for the transactions and the delivery in order to hide the customer from the business. The LBS provider's data profiling is minimized, and the user's data collection for Location-Based Services is reduced. The third party also displays reports for each user profile, as an overview of the collected information, to help the customer choose services.

- *Customer data analysis for LBS providers*: Trend analyses of privacy risk–neutral users can be exchanged with the LBS provider for money. And to users who opted-in, the infomediary can forward target advertisements on behalf of a business. In return, the business gets a better return on advertisements because all the recipients theoretically should be in the target segment.

Matchmaking among different customer segments is an additional value proposition that distinguishes the multisided business model pattern.

Customer Relationships: The key to attracting risk-averse users is to promote the importance of privacy protection, as well as to build a very strong trust relationship with the customer. The privacy agent has to show users that it knows the high value a user has for personal data and also must prove it cares a great deal for keeping the data safe. This relationship is very similar to that of a bank and its customers. One way to achieve this is by being transparent. For the risk-neutral users, a personalized service increases user's payoff.

Channels: Service can be personalized either by means of a platform, which could be either an application of the mobile devices or the Internet. For the risk-averse, user's data can be stored in a safe and remote database and retrieved by secure connection.

Revenue Streams: The risk-neutral users get the services for free, to gain from the freemium effect [1]. LBS providers pay risk-neutral users for their data trend analyses, which is the greatest part of the third-party income. Risk-averse users are more likely to pay to get their service, and so they subsidize the controls offered to the risk-neutral users.

Key Activities: The key activity of a mutli-sided business model is to build and promote a network of users of its platform. To ensure compliance with the users' policies, the privacy risk can be mitigated by implementing and maintaining a set of controls according to security frameworks such as CobiT and ISO 270001, together with privacy guidelines [32].

Key Resources: The most important element for the third party is user data and control over access to the data sharing platform. An additional resource is represented by the brand value, which allows a trusted relationship with the three customer segments.

Key Partners: The third party must be audited and certified by an external partner. The third party also must have partnerships with mobile device manufacturers or network operators in order to realize and deploy the product (Network Partners). To offer additional services or implement additional privacy protection, the third party might also need to be in relationship with identity and payment providers.

Cost Structure: Network building and Platform Management and Development activities are costly services.

The third party can always be circumvented by mobile users interacting directly with the LBS provider, but these providers implement privacy only by policy. The LBS provider promises not to abuse the data, whereas the third party can implement real privacy by architecture through the platform.

8.6 Business Model Instances of the Trusted Infomediary Pattern

There is a range of possibilities for technical implementation of privacy protection, intended here as algorithms, data storage, and policies. Centralized personalization is seen by some researchers as a major trend in the telecommunications world, whereas others expect most personalization to take place on the end-user terminal for reasons of usability, response time, and privacy [39].

The literature review of the last ten years of research in privacy-enabling technologies done by [11]allows assessment of the limits of a trusted third party and supports a claim that it is possible to "crowd source" [24] both identity provision and attribute certification [44]. However this approach does not fully explain how to get rid of a trusted third party. Hence, we consider a combination of centralized and decentralized privacy control solutions. Figure 6 shows the

centralized and decentralized implementations of privacy protection. Different customization degrees of the (centralized) IT infrastructure of the service provider and of the (decentralized) software on user's mobile device are illustrated. This way, we obtain four possible outcomes in our matrix, which we illustrate by using four possible market players as examples.

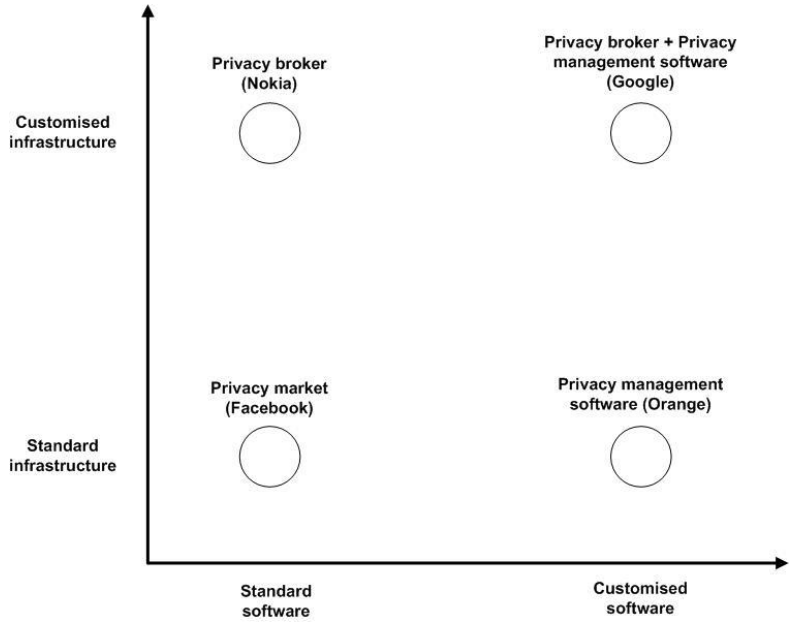

Figure 6: Four instances of a privacy-friendly business model (Infrastructure = centralized; software = decentralized)

Alliances among parties can maximize their payoff by cooperating, even though they have diverging goals [15]. On one hand, a firm that cannot avoid this kind of co-opeting relationship [30] in non-core competence areas can best adapt by decentralizing the largest amount of information collected and by letting other firms do most of the key activities. On the other hand, a firm that cannot avoid this kind of relationship in core competence areas can best adapt by centralizing information about the relationship through establishing an inter-organizational structure (the platform) to share information.

8.6.1 Privacy Broker

Table 10 illustrates the business model adaptations required for the privacy broker. Mobile network operators such as Nokia are good candidates for deploying a privacy broker because they already possess location information and have direct access to the telecommunication infrastructure. For mobile network operators, location-based services represent an additional stream of revenue generated from their investments in fixed infrastructure [38].

For GPS-enabled terminals, the location of the intelligence shifts toward the handset. This may reduce the role of operators and increase the opportunities for service providers, as accurate location-based information becomes available at no cost. Therefore, adding privacy protection services can become a key differentiator for mobile network operators [39].

Over half of users would be happy if their CSP (Communication Service Provider) would fulfill the role of supervising permission policies [32]. Moreover, providing new LBS-like location

sensitive billing might be a very attractive aspect of current phone billing possibilities. The biggest difficulty is the creation of relationships with m-commerce providers.

Table 10: Adaptations required for the privacy broker

BMO Component	Adaptation Required
Key Resources	The platform is composed of a broad range of components between mobile applications, middleware, and server-based software, depending on the technologies chosen to implement the privacy protection (for an example the reader can see [23]).
Cost Structure	The cost of developing the platform. Costs relative to the infrastructure and its maintenance, which can be especially high in the case in which it has to scale for enormous demands for real-time transactions.
Revenue Streams	A fee over secure transactions paid by risk-averse users.

8.6.2 Privacy Manager Software

Table 11 shows the business model adaptations required for the privacy manager software. Operating system providers of mobile devices such as Orange Telecom are in a good position to influence privacy protection on their platforms. They have direct access to the raw sensor of the phone and can define what information is exposed to applications through their Application Programming Interfaces (APIs). Moreover, they have the possibility of integrating the privacy middleware directly into the operating system and thereby targeting the whole market at once.

In addition, they might have an easier job integrating user friendly profile management into the system. Providing a privacy system can further help to expand the dominance of their operating system market share.

Table 11: Adaptations required for the privacy manager software

BMO Component	Adaptation Required
Key Resources	The key resource in a decentralized solution is middleware developed for the user's device. Such software is meant to implement a set of policies according to a predetermined algorithm to assure user location privacy (for an example, the reader can see [17]). The user can download the application by phone and let the software manage the phone applications according to the user's privacy policies. This approach relies on existing solutions on the market, such as the dynamic settings manager for Android called Locale1. One can add a set of so-called security profiles that collect data from phone input sources, use security metrics to assess the context risk, and apply privacy best-practices to enforce security actions depending on the risk profile.
Cost Structure	Development for the device is costly, especially because there are many different platforms, as well as the fact that they evolve rapidly. However, there are no fixed infrastructure costs and once device platforms stabilize, maintenance costs, should also diminish.

8.6.3 Can We Combine Privacy Broker and Privacy Manager Software?

Google appears to be an ideal candidate for becoming a centralized service for managing user privacy profiles. Google already offers single sign-on user authentication and has a mobile phone operating system (Android), which includes location applications (Latitude). Consumers use Google to handle private information such as emails (Gmail) and documents (Google Docs). In addition, the company has already implemented some aspects of an infomediary with the Google

health offering, as well as a dashboard that gives users an overview of all available services and settings.

Google is in a special position where it can choose to implement either a privacy broker model around the server infrastructure or integrate a privacy manager into the Android operating system. This gives the company the unique opportunity to also choose a mix of both alternatives. The solution could be more independent (phone-based middleware) or deliver real-time centralized server–based privacy mediation.

The caveat is that Google is a private company and its main business model is to sell targeted advertising, which might conflict with privacy protection ideals.

8.6.4 Privacy Market

In a privacy market, the customer can sell his, her, or its personal data. A practical case of a privacy market is Allow Litd [3]. This London-based firm takes advantage of a recent English regulation that obliges a company to erase all users' data collected without their consent. Once a client signs in with Allow Ltd, the company scans all firms' databases looking for the client's personal data. Once the personal data are found, the firms are requested to remove those data unless they pay a small price, 70% of which goes to the client.

This type of service provider supports the management of the user's sale of the property right over data. For this kind of task, the use of a privacy mirror (as those illustrated by [31]) seems to be appropriate.

Facebook appears to be a good candidate for the privacy market. In the last five years, its privacy policy has increased from 1,000 words to some 5,900 words. We see this effort as an attempt to get consent over user's partial loss of control of property rights over the data (Facebook uses a non-exclusive license of the user's data). As of now, the user loses control over personal data in exchange for some services, but we envisage that in the near future, the firm could pay for its users' data.

8.7 Discussion and Conclusion

In this paper, we introduced the business model of a trusted third party to protect privacy while enabling location-based services. We ground our claims on a model developed specifically by incorporating existing works. The empirical data we collected extended previous knowledge in privacy management. We referred to business model ontology to derive a set of guidelines for business model designers and identified possible variations to our pattern of the privacy friendly business model inspired by the infomediary business model. We presented some market players who are potential candidates to provide instantiations of such a privacy protection service.

According to our findings, we answer our research questions by addressing three sub-questions as follows:

R1: What is the specificity of privacy management in the location-based mobile B2C market?

Our empirical evidence in section 4 strongly suggests that collected data reduces user payoff, whereas the combination of service personalization and data control increases user payoff. We confirm previous evidence [41] of a relation between service personalization and user payoff, and extend it with the notion of control in the B2C market. We also found two clusters that behave

slightly differently from what has been seen for Internet privacy [27]. Our model is both simple (four constructs) and representative (adj. R^2 between .22 and .45).

R2: Which business model components allow a high level of mobile user payoff, while keeping the collected data to a minimum?

Using the empirical data of our test, we suggest that business model designers should follow the infomediary pattern and then define the degree of software centralization according to how much data should be collected and how much control should be left to the user. According to the type of firm involved, a privacy broker or privacy manager software, or both, is to be preferred.

R3: How should the differences in payoff among privacy risk–neutral and privacy risk–averse mobile users be addressed?

Our test underlines the existence of two types of mobile user with privacy concerns. Although both customer segments care about the personal data they disclose, privacy risk–neutral mobile users seem to be more attentive to a combination of data control and service personalization in exchange for their data.

The privacy risk–averse users obsess about the data, and therefore a pay-per-use Single Sign-On service that safely protects their data and acts as a proxy to other services seems more likely to be profitable.

Our proposed model is to be considered as an initial step toward conceive a tool to support strategic decisions, and it has its own limitations. Concerning evaluation of the model, the business model guidelines have been instantiated, but their impact on provider's performance has not been tested empirically. Hence, our proposed models for the service provider must be considered as initial intuitions.

On a more general level, we assume that privacy will become a technological trend. Privacy issues have reached widespread public awareness only in the last few years, and growth of these issues is yet to come. The definition of privacy guidelines within a common framework has just started, and there are no widely adopted solutions integrated by platforms. As long as there is no standard and no real added value or perceived added value to enforcing privacy, there is always the possibility of going directly to a vendor and using raw data from the phone sensors.

We feel that this paper offers some interesting [13] contributions to the field:

- We defend the view of those who believe that privacy should not be seen only as a cost. We propose and show evidence that it could be a value proposition of a business model in the B2C mobile market to complement product customization and risk reduction.

- We suggest that secure service personalization for customers and data access for the company can co-exist sustainably (by means of a third party - to be tested later).

- We present more than one way an enterprise can position itself in relation to its competitors with regard to the trade-off between data control and service personalization. We argue by a set of instantiations that the mobile platform can play a key role at multiple levels (OS, device manufacturer, and operator) in the implementation of these new business models.

Supposing that no third-party actor emerges, some firms might implement some elements from our proposed pattern to add privacy risk mitigation into their value proposition and gain new customers. In the long term, this kind of firm would no longer require a third-party actor.

Accordingly, one could decide to remove our initial assumption regarding the existence of a third-party actor. In that case, the best strategy for a firm is to internalize the third party, if it involves its core competences. This again might raise strategic issues about service integration and business model unbundling.

Further work should address issues such as the possibility of leveraging our proposed privacy business model pattern in other economic contexts, involving incomplete agreements and lack of trust among involved parties.

Acknowledgments

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References

[1] C. Anderson, Free: The Future of a Radical Price, First Edition, Hyperion, 2009.

[2] R. Anderson, Why information security is hard—an economic perspective, in Proceedings 17th Annual Computer Security Applications Conference, USA, 2001, pp. 358-365.

[3] J. Angwin and W. Steel, Web's hot new commodity: Privacy, The Wall Street Journal, 2011.

[4] N. F. Awad, and M. S. Krishnan, The personalization privacy paradox: An empirical evaluation of information transparency and the willingness to be profiled online for personalization, MIS Quarterly, vol. 30, no. 1, pp. 13–28, 2006.

[5] M. Barrett, K. Garrety, and J. Seberry, ICT professionals' perceptions of responsibility for breaches of computer security. Faculty of Informatics-Papers, 2006, pp. 383.

[6] I. Benbasat and R. W. Zmud, The Identity Crisis Within the IS Discipline: Defining and Communicating the Discipline's Core Properties, MIS Quarterly, vol. 27, no. 2, pp. 183-194, 2003.

[7] J. Bonneau and S. Preibusch, The privacy jungle: On the market for data protection in social networks, Economics of Information Security and Privacy, pp. 121–167, August 2010.

[8] R. K. Chellappa and R. G. Sin, Personalization versus privacy: An empirical examination of the online consumer's dilemma, Information Technology and Management, vol. 6, no. 2, pp. 181–202, 2005.

[9] K. W. Chew, P. Shingi, and M. Ahmad, TAM Derived Construct of Perceived Customer Value and Online Purchase Behavior: An Empirical Exploration, in Proceedings Project E-Society: Building Bricks, Boston, vol. 226, pp. 215–227, April 2007.

[10] O. P. Cox, A. Dalton, and V. Marupadi, Smokescreen: flexible privacy controls for presence-sharing, New York, 2007, pp. 233–245.

[11] G. Danezis and S. Gürses. (2000) A critical review of 10 years of Privacy Technology, in Proceedings of Surveillance Cultures: A Global Surveillance Society?, London, UK. [Online]. Available http://homes.esat.kuleuven.be/~sguerses/papers/DanezisGuersesSurveillancePets2010.pdf

[12] T. K. Das and B. S. Teng, Trust, control, and risk in strategic alliances: An integrated framework, Organization Studies, vol. 22, no. 2, pp. 251-283, 2001.

[13] M. S. Davis, That's interesting! Towards a phenomenology of sociology and a sociology of phenomenology, Philosophy of the Social Sciences, vol. 1, no. 4, pp. 309–344, 1971.
[14] T. Dinev and P. Hart, An extended privacy calculus model for e-commerce transactions, Information Systems Research, vol. 17, no. 1, pp. 61-80, 2006.
[15] M. J. Dowling, W. D. Roering, B. A. Carlin, and J. Wisnieski, Multifaceted relationships under coopetition, Journal of Management Inquiry, vol. 5, no. 2, pp. 155–167, 1996.
[16] D. S. Evans and R. Schmalensee, The industrial organization of markets with two-sided platforms, Competition Policy International, vol. 3, no. 1, pp. 151-179, 2005.
[17] J. Freudiger, M. Manshaei, J. P. Hubaux, and D.C. Parkes. (2009). On Non-Cooperative Location Privacy: A Game-Theoretic Analysis. [Online]. Available http://infoscience.epfl.ch/record/140427/files/ccs179-freudiger3.pdf
[18] G. Giaglis, P. Kourouthanassis, and A. Tsamakos, Towards a classification framework for mobile location services. In: B. E. Mennecke, T. J. Strader, ed. Mobile Commerce: Technology, Theory, and Applications, Idea Group Publishing, 2002, pp. 67–85.
[19] B. Gibson, and W. Holden. (2010). Mobile Location Based Services. Applications, Forecasts & Opportunities 2010 - 2014. Juniper Research. [Online]. Available: http://www.juniperresearch.com/shop/products/whitepaper/pdf/Juniper%20Research%20MLBS10%20White%20Paper.pdf
[20] S. Gregor and D. Jones, The anatomy of a design theory, Journal of the Association for Information Systems, vol. 8, no. 5, pp. 312–335, 2007.
[21] J. Hagel, and M. Singer, Net Worth: Shaping Markets When Customers Make the Rules. Harvard Business School Publishing, Boston, MA., 1999.
[22] D. S. Herrmann, Complete Guide to Security and Privacy Metrics: Measuring Regulatory Compliance, Operational Resilience, and ROI (1st ed.). Auerbach Publications, Boca Raton, FL, USA, 2007.
[23] D. Hong, M. Yuan, and V. Y. Shen, Dynamic privacy management: a plug-in service for the middleware in pervasive computing, in Proceedings of the 7th international conference on Human computer interaction with mobile devices & services, New York, 2005, pp. 1-8.
[24] J. Howe (2006). The Rise of Crowdsourcing. Wired. [Online]. Available: http://www.wired.com/wired/archive/14.06/crowds.html.
[25] K. Hui, H. H. Teo, and Lee, S. The value of privacy assurance: an exploratory field experiment, Management Information Systems Quarterly, vol. 31, no. 1, pp. 19–33, 2007.
[26] T. Husson. (2010) Profiling Your Best Mobile Customers. Forrester Research, Inc. [Online]. Available www.forrester.com
[27] C. Lancelot Miltgen, Disclosure of personal data and expected counterparties in e-commerce: a typological and intercultural approach. Management Information System, vol. 15, no. 4, pp. 1-49, 2010.
[28] N. K. Malhotra, S. S. Kim, and J. Agarwal, Internet Users' Information Privacy Concerns(IUIPC): The Construct, the Scale, and a Causal Model. Information Systems Research, vol. 15, no. 4, pp. 336–355, 2004.
[29] S. T. March and G. F. Smith, Design and natural science research on information technology, Decision Support Systems, vol. 15, no. 4, pp. 251-266, 1995.
[30] B. Nalebuff, and A. Brandenburger, Co-opetition: Competitive and cooperative business strategies for the digital economy, Strategy & Leadership, vol. 25, no. 6, pp. 28–35, 1997.
[31] D. H. Nguyen. Privacy mirrors: Understanding and shaping socio-technical ubiquitous computing. Technical Report, 2002.
[32] Nokia Siemens Networks. Privacy survey 2009. Nokia Siemens Networks Corporation, 2009. [Online]. Available:

http://www.nokiasiemensnetworks.com/sites/default/files/document/SDM_PrivacyStudy_Brochure.pdf

[33] Organisation for Economic Co-operation and Development, OECD guidelines on the protection of privacy and transborder flows of personal data. OECD Publishing, Paris, France, 2002. [Online]. Available: http://www.oecd.org/document/18/0,2340,en_2649_34255_1815186_1_1_1_1,00.html

[34] A. Osterwalder, and Y. Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Wiley, Indianapolis, 2010.

[35] L. Palen, and P. Dourish. (2003). Unpacking privacy for a networked world. In Proceedings of the ACM Special Interest Group on Computer-Human Interaction (SIGCHI) conference on Human factors in computing systems. Presented at the Conference on Human Factors in Computing Systems, Florida,USA. [Online]. pp. 129–136. Available: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.117.7183&rep=rep1&type=pdf

[36] J. Phelps, G. Nowak, and E. Ferrell, Privacy concerns and consumer willingness to provide personal information, Journal of Public Policy & Marketing, vol. 19, no. 1, pp. 27–41, 2000.

[37] J. Pries-Heje, J. Venable, and R. Baskerville. (2008). Strategies for design science research evaluation. In Proceedings of the 16th European Conference on Information Systems (ECIS 2008) (Galway, Ireland, 9-11 June 2008). National University of Ireland. [Online]. Available: http://is2.lse.ac.uk/asp/aspecis/20080023.pdf

[38] B. Rao, and L. Minakakis, Evolution of mobile location-based services, Communications of the ACM, vol. 46, no. 12, pp. 61–65, 2003.

[39] M. de Reuver and T. Haaker, Designing viable business models for context-aware mobile services, Telematics and Informatics, vol. 26, no. 3, pp. 240–248, 2009.

[40] H. Sheng, F. F. Nah, and K. Siau, An experimental study on ubiquitous commerce adoption: Impact of personalization and privacy concerns, Journal of the Association for Information Systems, vol. 9, no. 6, pp. 344–376, 2008.

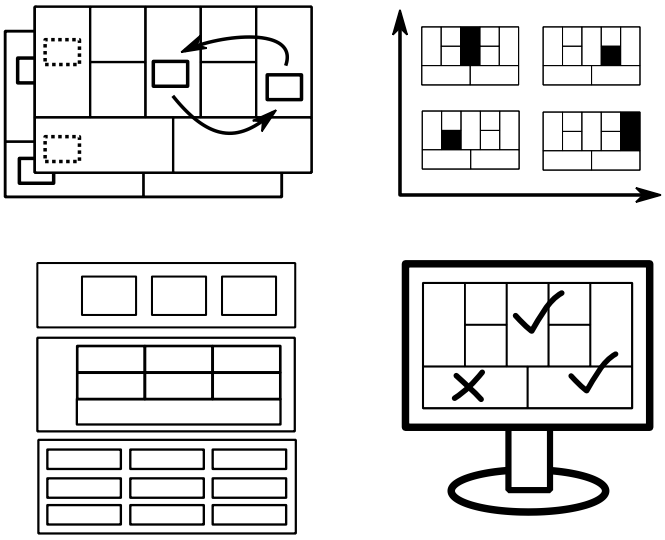
[41] J. Y. Son and S. S. Kim, Internet users' information privacy-protective responses: A taxonomy and a nomological model. MIS Quarterly, vol. 32, no. 3, pp. 503–529, 2008.

[42] K. A. Stewart and A. H. Segars, An empirical examination of the concern for information privacy instrument, Information Systems Research, vol. 13, no. 1, pp. 36–49, 2002.

[43] R. I. Sutton, and B. M. Staw. (1995). What theory is not. Administrative Science Quarterly, 40(3). [Online]. Available: http://www.jstor.org/stable/2393788

[44] H. Yu, P. B. Gibbons, M. Kaminsky, and F. Xiao, Sybillimit: A near-optimal social network defense against sybil attacks, In IEEE Symposium on Security and Privacy DBL, 2008, pp. 3-17.

Chapter 9
Further Work



9.1 Limitations

Computer-aided Business Model Design is in its infancy. A large part of research into this subject has devoted itself to the handling of the elicitation of business model elements. Whilst the evaluation of business models has been addressed, there is clearly a lot yet to be explored.

The concepts presented in the prototypes are new to the domain of business model; thus, in this thesis, the focus of evaluation was principally to demonstrate their validity. Follow-up testing with stakeholders was limited to conducting small-scale experiments; the exception to this was for one case in chapter 4. As CABMD matures, bigger evaluations should be tried out. However, they will have to address two factors, which limited this research. First, the strategic value of business models makes people less inclined to share them. Second, the complexity of interactions between the features required to offer a useful solution to business model design makes it difficult to evaluate any individual contributions. Additionally, measuring creativity and innovation does not have an obvious comparison metric.

This research chose to use the BMC as a support model; however, this did limit the context to a one-page fixed layout visual canvas.

9.2 About Technical Development

All the prototypes were built using web technologies. These technologies have the advantage of enabling features that facilitate prototyping and offer simple deployment. At the start of the research, many features were experimental. In recent years, however, the browser and JavaScript libraries have evolved at a fast pace. HTML and CSS both offer a way to build simple interfaces. JavaScript provides a flexible programming language. The nature of the web stack makes it ideal

for prototyping work. Reloading a page is an instant compile and run cycle. In addition, browser developer tools allow changes on a page to be previewed in real time without the need for reloading.

The introduction of the data-binding concept in modern JavaScript frameworks like KnockoutJS and AngularJS further helped in creating interactive prototypes that do not involve a great deal of boilerplate coding. Synchronization between a model and a view was taken care of by the bindings. This allowed us to focus on the business logic of the concept to be tested. Currently, the latest innovation of data-binding with cloud services further allows us to automate non-value adding tasks such as authentication and persistence layers.

By its nature, the web platform for deployment offers a multi-platform environment, although this is sometimes limited by the browser compatibility of experimental features.

Explorative work aimed at supporting a method by testing new features is, however, risky; indeed, there is a real danger of feature creep. This is particularly the case because features can combine to offer more value, creating an endless supply of additional paths to explore.

Another problem that was encountered is that sometimes a feature was ready, but its user interface was not. However, it was not always possible to test a concept's usefulness with an end-user without having to first address the user's interface usability. This cost a lot of time and did not, in the end, directly benefit the research.

9.3 Further Work

A major opportunity for continuing this research is to explore how rules can help to make CABMD more useful. In addition to rules that help in the assessment of business model coherence, different types of rules can also be developed.

For example, offering helpful hints when some building blocks are empty could teach best practice to users. This may help resolve the identified problem that some users seem to have with filling out the customer relationship block.

Rules that prompt the user to fill out additional information could then be used to offer better validation. With additional data, calculation concept can be further extended to provide multi-year or multi-scenario projections. Some business model patterns could be modelled as rules on different attributes, hinting at what is missing for a model to support a given pattern.

In this research, focus is on one company's business model. The visual approach used to support business model evolution may be a starting point to address multi-model interactions, such as a value network with the BMC. Layers are also good candidates for providing the BMC with additional information such as social or legal concerns.

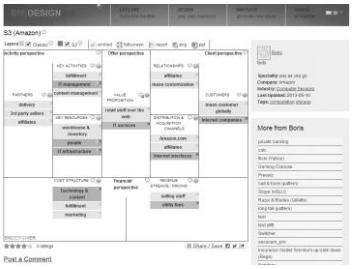
Not all features have an academic value. When presenting a BMC, best practice is not to display everything at once, but to highlight elements one at a time, following a story. The dynamic nature of storytelling is an ideal candidate for CAD tool support; however, it may be that it would be better created by a commercial entity rather than the research community.

Research on Computer-Aided Design tools for Strategy has a great deal of potential. However, by its very nature, it sits at the cross-section of multiple disciplines. An interdisciplinary team that can bring in knowledge from requirement engineering, information systems, strategy, and user experience is therefore needed.

It is hoped this kind of research can be extended to other strategy methods and help move strategic thinking forward, beyond the basic four quadrant tools currently used.

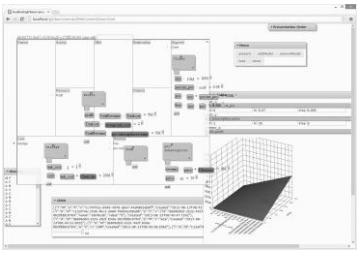
PART IV - Appendix

Appendix A
Prototypes Factsheets

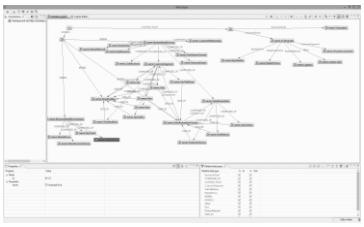


A.1 Business Model Designer
Computer Aided Business Model Design: Color tagging, fixed layout and global scale

A.2 Business Object Modeler
Multi-model CAD: touch inspired workspace with flexible layout

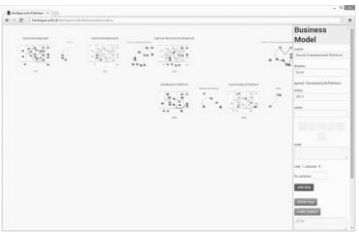


A.3 Business Model Calculation
BOM experiment with custom attributes for calculation and financial what-if

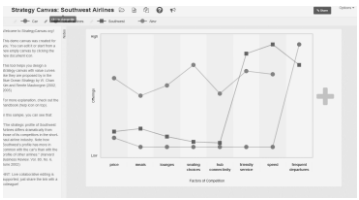


A.4 Business Model Diver
Dive (zoom) into connected sub-models powered by graph database storage

A.5 Business Model Rules
Validate rules on busniess model elements interactions based on best practices



A.6 Business Model Layers
Visualize BM evolution and BM story outlining with a layered approach



A.7 Strategy Canvas
Realtime business object collaboration on simple data

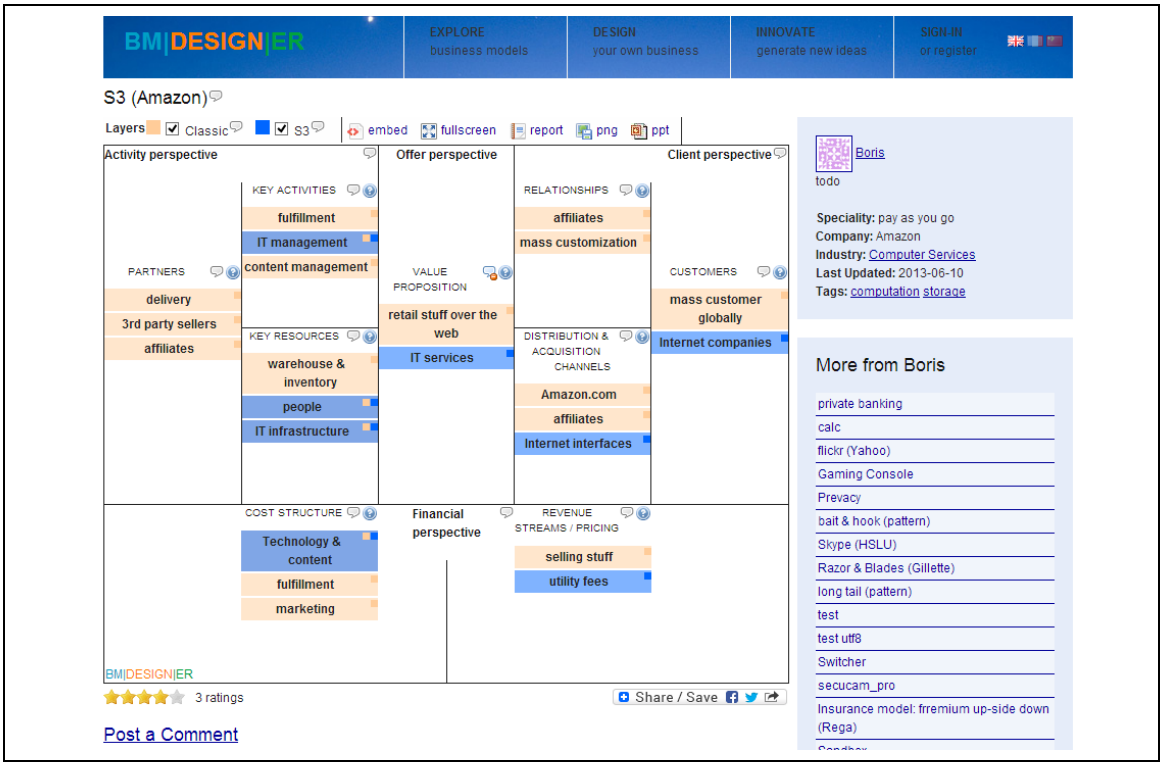
A.8 Business Model Text
Business Model Story writer with auto-suggest and element creation from text

A.9 Business Model Types
Visualize business model's color grouping data

http://www.fritscher.ch/phd/

A.1 Business Model Designer

Explore computer-aided business model design at a global scale. Test usage of features like color tagging, custom attributes and social sharing.



Features

- Create Business Model Canvas
- Elements sorted in lists
- Multi-color tagging
- Toggle visibility of tagged items
- Add custom attributes to elements
- Link elements and display links
- Multilingual (English, French, Chinese)
- Sharing of business model
- Embeddable
- Star-rating
- Commenting
- Classify by industry and tags
- PowerPoint Export

Technology

jQuery
frontend

Grails
backend

Spring Security
authentication & authorization

MySQL
persistence

Publications

Task Models and Diagrams for User Interface Design (pp. 28-43), Springer Berlin Heidelberg, 2010

Proceedings of the 47 Annual Hawaii International Conference on System Sciences, Computer Society Press (Ed.), 2014

Ideas

Two major objectives drove the creation of this prototype: large scale public usage as a sharing platform and tracking of advanced feature usage by these users.

To achieve the first goal, the system has to be usable by a broad public, it had to be far more than an academic prototype and almost be like a finished product. Social features have been integrated such as commenting, rating and sharing business models. Beyond sharing a link to the business model, also a way to embed it into a third-party website is offered. The goal is to provide ways to share and compare business model and share discussion about which business model work in which industry.

For the second objective, the prototype offers a number of features, it uses a simple list based system to add elements, but also offers the possibility to tag each one with different colors. In addition to the colors more semantically strong links between elements can be drawn. For each building block, a series of default attributes are available in an advanced element creation screen. Furthermore, there is the possibility for each user to define his own attributes. The idea behind providing advanced features without a strict guideline on how to use them was to observe the use made of it. Since the design of a business model is a creative task constraining too much the user might hinder his creative process.

Evaluation

A stable version of the prototype is publicly available as a website since early 2009 at bmdesigner.com. As of 2014 over 8’000 user accounts and business models have been created. The public sharing and social features have not been used at all. Users showed a great apprehension sharing their business models publicly. Although bad for creating a public databases of business models, this illustrate the high strategic value users put in this simple one page business model canvas.

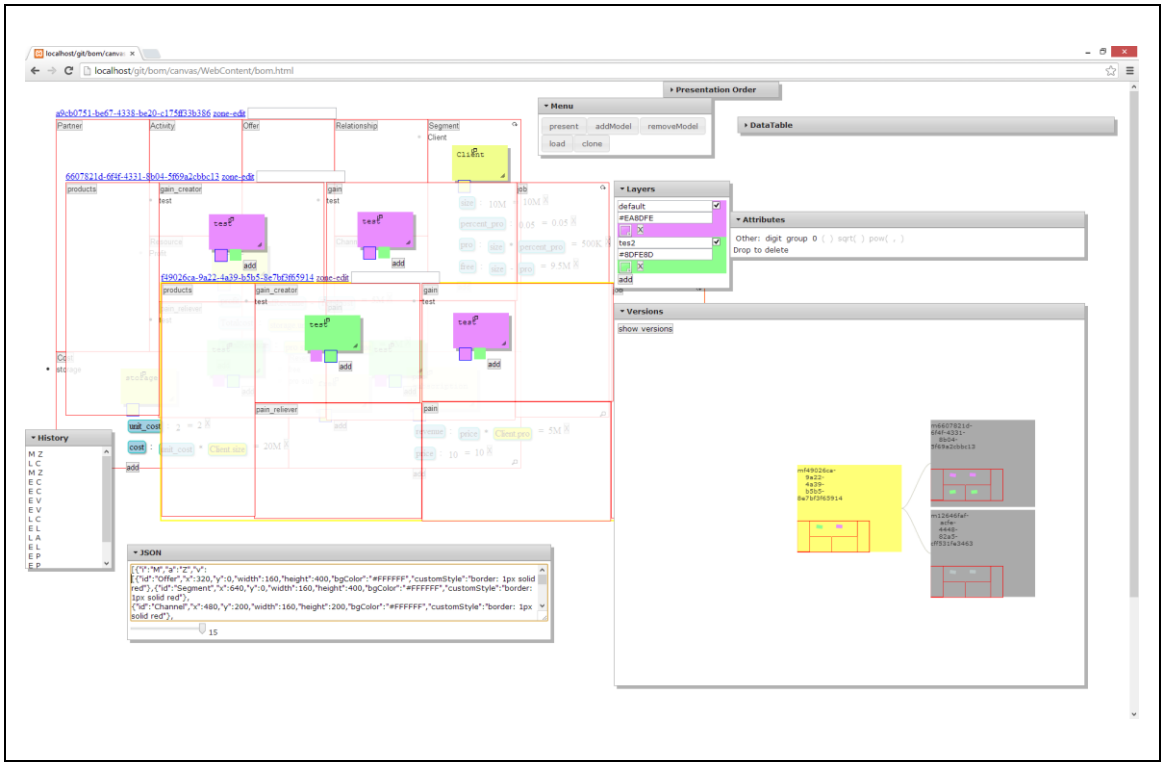
The second objective was more successful. An analysis of color tagging and attributes has been published in HICSS (Chapter 4) and brought a series of proposition on how tools should use them. Advanced features need guidance and have to illustrate their usefulness to the users for them to be considered.

Future Potential

Although it was not possibilities to crowd source a database of public business model, it may still be possible to gather some insight from analyzing the data. Some aggregation have been tried when analyzing feature usage, but further analysis through clustering might provide some insights on generic models or patterns. However, being a public freely accessible website, there are also a large part of unfinished canvases which need to be filtered.

A.2 Business Object Modeler

Explore a touch inspired workspace of building blocks with element, where everything scales and rotates. Track edit history and experiment on sequentially displaying elements.



Features

- Multi-color tagging
- Multi model types
- Model editor
- Workspace to handle multiple models and version at a time
- Move elements between models
- Zoom, change size of models and elements
- Version snapshotting (protected from editing)
- Real-time collaboration
- Edit and present mode
- Paint order of appearance of elements
- History of all edit actions
- Replay history

Technology

jQuery
frontend

Knockout (JS)
MVVM data binding

Local Storage
persistence

Publications

None directly, but experience lead to the creation of Business Model Layer prototype and its publication (Appendix A.6).
Support for calculation experience (Appendix A.3)

Ideas

Explore interactions inspired by a touch based tabletop experience. Workspace with canvases which can be moved around, resized, rotated. This also applies to elements which can have different sizes and orientation. In the workspace, multiple canvases can be displayed at the same time, allowing to compare them or move elements from one to the other.

Model states can be saves as snapshots and loaded into the workspace. This enables to display the evolution of the business model in the workspace, a concept which was further explorer in the business model evolution prototype in appendix A.6.

A second idea is to keep track of all the editing actions: create, edit, move, delete. This offers the possibility to provide a history log, but also to playback the whole design session. Combined with the snapshot version, this enables the exploration of an alternate path on a copy of a model from a previous state. Having track and playback of all the actions also opens the possibility of remote viewing and live collaboration.

Remote viewing is utilized to provide a different perspective on one of the business model in the workspace to offer a presentation mode. In this mode elements of a business model canvas appear sequentially following a predefined order. To provide this order a story paint mode has been created in which each element is clicked in the order in which it will have to appear. A variant for making the elements appear in the presentation mode is using the live collaboration and toggling the individual visibility of each element from the workspace. This can be used when the elements have to be shown in a custom order which cannot be determined in advanced. Presentation mode also explores the drawing on top of the canvas, which eventually lead to business model mechanics.

This prototype also features a model editor to define custom meta-model of canvases which are built with building block that support elements.

Evaluation

Evaluation was limited to testing the feasibility of the concept. The prototype was used as a platform to experiment with the implication of using features such as edit history, touch interactions and visual presentation. It showed that offering too much freedom of rotating and sizing elements and canvases in any direction become too complicated to interact with and might distract from reading the model's information.

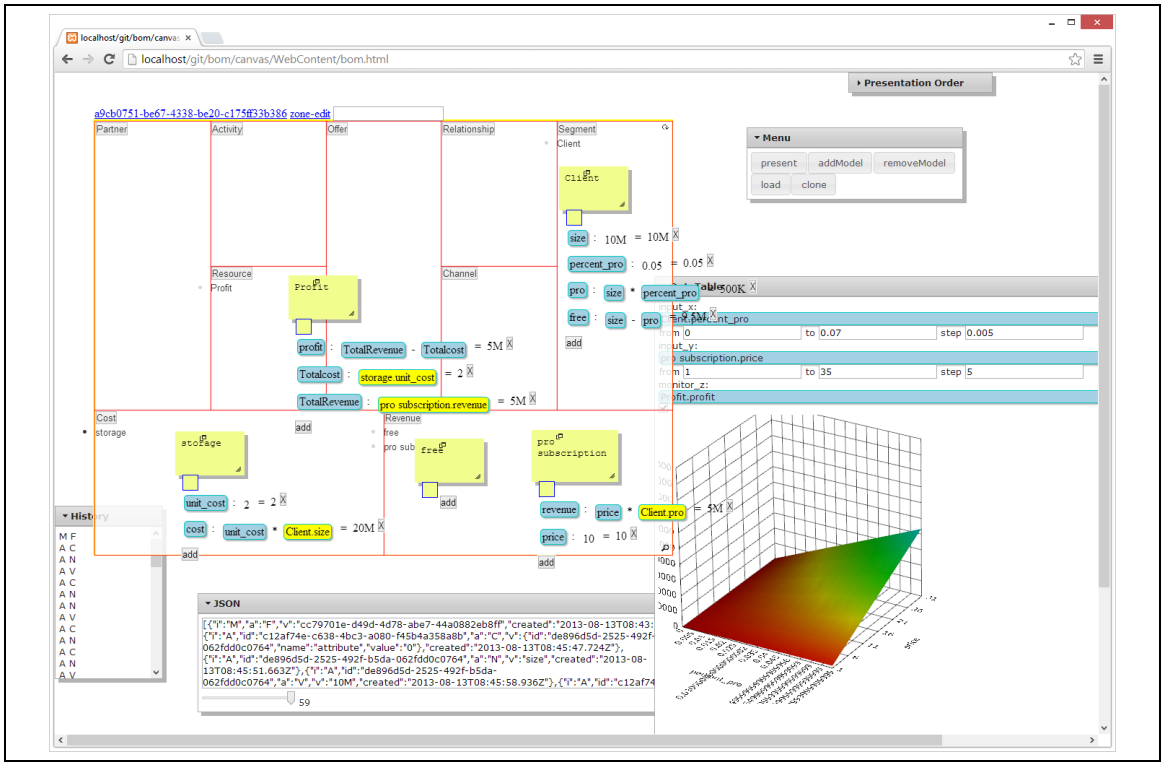
Future Potential

Beyond using the edit history in its raw form it would be interesting to have automated ways to group them into more pertinent action which could for example relate to business model evolution operations.

Exploring how to assist presentation of the business model and its story could be further explorer by combining the visual aspect of this prototype with the text based approach of prototype in Appendix A.8. This could lead to a story mode presentation wizard for business model to help pitch it.

A.3 Business Model Calculation

Explore calculation and simulation done on top of a business model with its elements holding the data. Simple, user friendly and interaction inspired by touch interface.



Features

- Based on top of Business Object Modeler prototype

Calculation

- Elements have additional attributes
- Attributes are like variables
- Attributes can contain values or formulas
- Formulas are created by drag and drop interactions
- Formulas can reference another attribute
- Cyclical references are detected

Simulation

- Calculation can be used to simulate rang of values
- 2 dimensions can be change at the same time
- The values of the monitored result field are displayed on a 3D graph

Technology

jQuery
frontend

WebGL Surface Plot
3D chart display

Knockout (JS)
MVVM data binding

Local Storage
persistence

Publications

Currently only a proof of concept

Ideas

On top of a business model, a visual layer could be used to perform calculation with its elements. In order to allow for formulas, attributes have to be added to elements. Requiring a business model element as basis for calculation guarantees that all the key elements of a business model involved in the numbers are present. It offers the benefit of taking care of the layout, since it is given by the elements 'position. In contrast to a worksheet where a good part of thinking has to be dedicated to how to layout the elements onto the two dimensional grid.

Building on top of the prototype from the previous appendix, the visual and touch based interaction paradigm was also applied to calculation. Using attributes as variables in formulas is done by drag and dropping them into the new formulas. Operators and formulas parts can be selected from drop down menus. Numbers can be abbreviated with unit like K and M for thousands and millions. These features are intended to keep editing as lite as possible.

The advantage of a computer-aided tool is the continual checking and computations which can be performed. As soon as a formulas changes everything is recomputed and cyclical reference error are also detected and displayed to the user. Moreover, it is possible to do more than one computation which leads to the simulation aspect that can be offered. Instead of evaluating the current value, the user can decide on up to two variables which he wants to vary between two thresholds, similar to Microsoft Excel's data table feature. However, instead of displaying the range of possible results in table format, a 3D graph is used to visualize which combination of parameters provides the best result.

Evaluation

Calculation with predefined formulas was evaluated with groups of students doing a modeling task of a case. This confirmed the need for a more flexible system like the one explored in this prototype. The current iteration has a number of limitation which make it hard to test with users. The interface is not user friendly and space for formulas is limited. For example, there is no specific region for the profit. Additionally, basic intermediary formulas cannot be hidden.

From early feedback the 2D visual graph maybe too complex to understand,

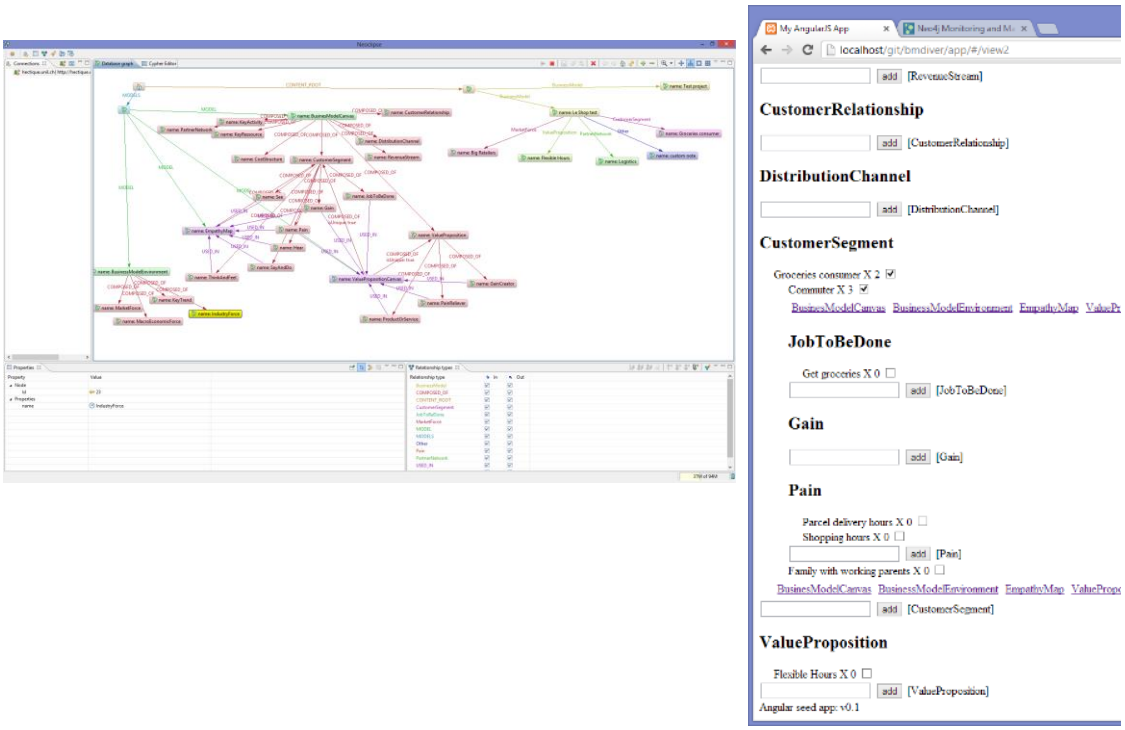
Future Potential

User interaction and interface needs to be improved. Once it is possible to de-clutter the interface by hiding basic calculation focus can be drawn on the import business mechanics. One way to facilitate this goal is to provide a number of formulas templates as starting point, which then can be adapted.

Multi-year calculations and how to handle them with formulas has not been addressed in this project. There is a concept of a year dimensions on the attributes to explore.

A.4 Business Model Diver

Graph based approach to store multiple connected meta-models and their instances. Explore multiple different views off the same data.



Features

- Ontology of combined models in a graph representation
  - Business Model Canvas
  - Business Model Environment
  - Value Proposition Canvas
  - Empathy Map
- Allow for hierarchical grouping by self-referencing
- View generated from model
- Sub-models can be rendered in different sub-views

Technology

AngularJS
frontend & data binding

Neo4j
persistence

Neoclipse
graph editing

Publications

Only internal experiment

Ideas

The Business Model Canvas is a very high level representation of strategic components. There exists other models to address in more detail one of its components, such as Empathy Map or Value Proposition Canvas (VPC) for the customer segment. Moreover, Empathy Map and VPC share some of their elements (Pain, Gain). An ontological approach or a graph representation of the concept and their dependencies could help in defining each element only once, and then provide multiple perspectives over the same data.

Instead of creating one model which covers all situations, the different models are connected together. Each model should know how to render itself. In turn the system could then show the user all the available views for the current data he is viewing and allow to switch between them. This works at the root level, but is also applicable at the element level, which can include a sub-view: a zoom giving more detail into sub-elements of the explored parent element.

Additionally, having a graph representation, allows to self-reference the same type. This can lead to creating a hierarchy of elements of the same type and help to manage levels of abstraction. A high level consumer segment: generic consumer, could be split into sub categories like *commuters* and *families*, which then could be further looked at with a sub model like *Jobs to be done* (customer part of the VPC).

Evaluation

Early proof of concept of the idea. Initial result indicate that it is too complex for simple examples and the creative process, but shows potential for enterprise architecture and similar modelling oriented views.

OntoWiki has also been evaluated, but proved to be too generic in its visualization to be of use, as was Protégé.

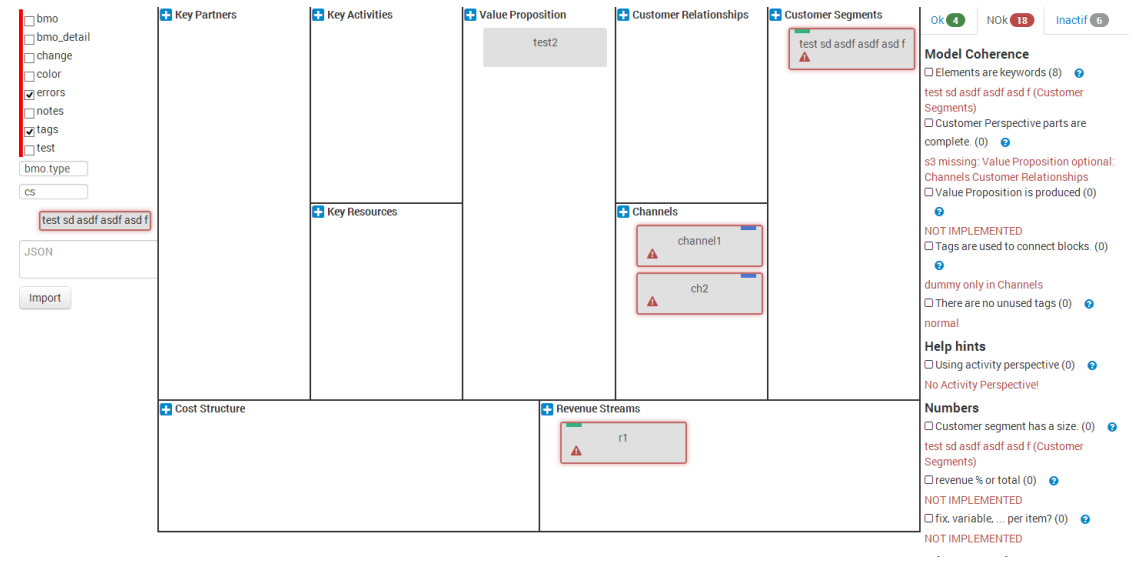
Future Potential

The experiment is a first step towards handling a multi-model environment of strategic business objects without defining one model for all aspects. Further research need to be done and compared to similar approaches. For instance, explore integration with enterprise architecture modeling.

The graph based approach to store not only the model, but also the instance data has the potential to facilitate the identification of pattern inside the graph.

A.5 Business Model Rules

Build coherent business model assisted by rule validation by evaluating elements and their attributes. Explore layer as filter and provider of attributes.



Features

Rule focus (right)

- Fixed list design for business model elements
- Rules to validate business model coherence
- Flags to highlight problems
- Hints to help solve the identified problems
- Score based on passed rules
- Import models from other tools

Layer focus (left)

- Layers are used to toggle visibility of features: errors, Color tags
- Layers add trait as attributes to elements: additional Business Model attributes, change indicator attribute
- Building block view is a selection on attributes (=> view can be customized to display other models)

Technology

AngularJS
frontend & data binding

Locale Storage
persistence

Publications

Ideas used in: Business Model Design: an Evaluation of Paper-Based and Computer-Aided Canvases. Fourth International Symposium on (*BMSD*) Business Modeling and Software Design. Scitepress, 2014

Ideas

Help create more coherent business model, by validating rules and giving hints. Rules can be transformed from guidelines and the complete list of guidelines and rules used are presented in appendix C. In addition to coherence checks, rules can also be used to trigger the display of hints if some blocks are empty, or some features underutilized.

Coherence rules involve the element and the building blocks in which they are in, but rules in general can also involve an elements' attributes. To extend attributes, new ones can be added by layers to elements. For example, a business model canvas detail layer cloud add the segment size attribute to all customer segment elements.

Layers can also be used to toggle visibility of features, the color tagging can for example be disable by unchecking the color layer.

Having layers provide additional attributes allows to consider displaying elements based on these attributes. The building blocks of the business model canvas become views which show elements which have a business model type attribute set to the same value as the filter on the building block. This makes the prototype flexible to quickly implement new visual models based on selection and filter of elements by their attributes.

Evaluation

Limited test have been performed by entering case business model and checking how they could be improved by the displayed rule hints.

Guidelines which inspired the rules have been tested on paper with a group of students and their projects.

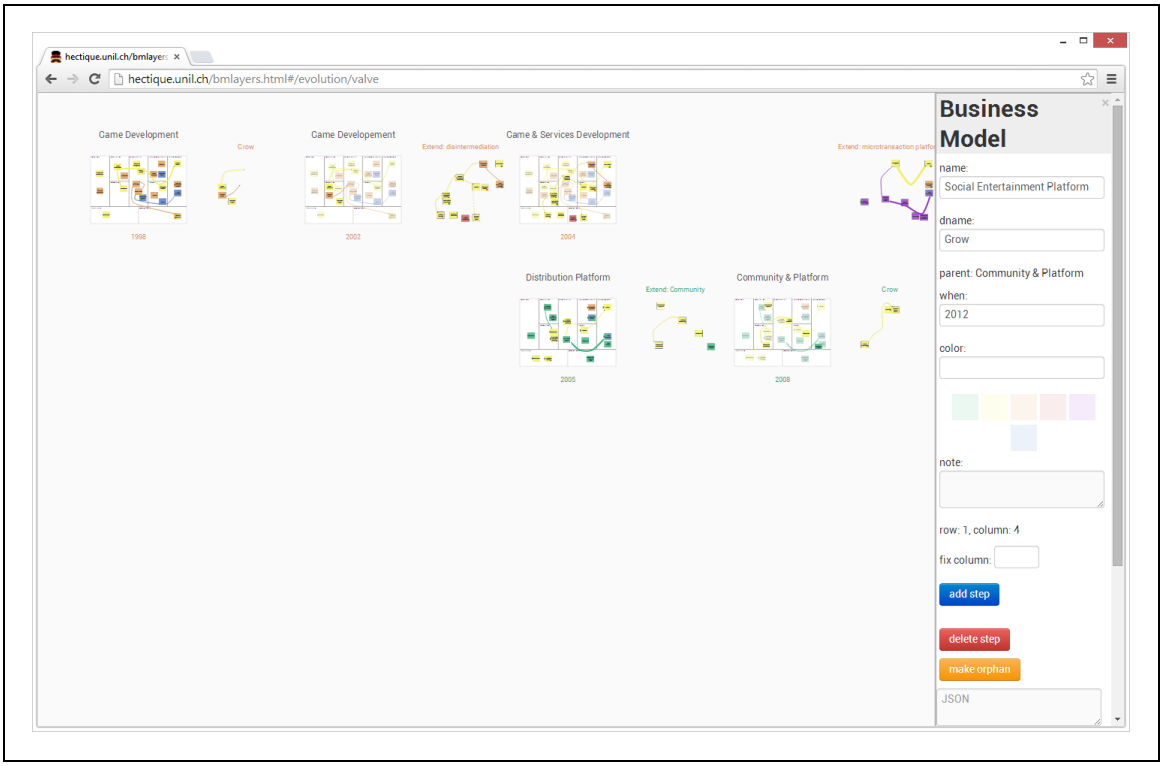
Future Potential

Validate individual rules performance. Rules should be tested in the context of how they help during the editing process, and not as an after the fact validation. This would utilizes the CAD tool at its full potential providing continuous validation.

Layers as integrator of additional attributes and models could be combined with the graph based approach explored in the previous prototype.

A.6 Business Model Layers

Visualize and help in manipulating the evolution and alternatives of a business model canvas. Guarantee coherence of the operations.



Features

- Visualize evolution of business models
- Compute the correct fade level for elements inherited from previous versions
- Workspace with pan and zoom to navigate versions
- Support for multiple models
- Multicolor tagging with gradient on element
- Visualize business model mechanics with arrows
- Change indicator (positive, negative)
- Column layout position can be specified manually to look like a timeline
- Visibility of intermediary steps can be toggled

Technology

AngularJS
frontend & data binding

D3.js
visualization

Firebase
persistence & data binding

Publications

Visualizing Business Model Evolution with the Business Model Canvas: Concept and Tool. Published in Proc. 16th IEEE Conference on Business Informatics (CBI'2014), IEEE Computer Society Press, 2014

Ideas

Describe business model evolution by visualizing which elements where added, removed or changed between two business models canvases. Inspired by tracing paper different layers are used to illustrate each step of the business model evolution. Digital tools can compute different level of fade for each element in each stage and adapt dynamically to any change during design. This selective filtering provides means to get a clear picture for each stage without having too much information accumulating over the evolution steps. Dependency between elements from one version to another can be managed and verified by the tool.

Business model mechanics are drawn between elements with arrows, and follow the element if it is moved around. Coherence is guaranteed, for example deleting an element will also disable any mechanics in which it was involved.

Not limited by space an infinite workspace can display as many canvas as are needed to display the tree of evolution of a business model and all its branches exploring different alternatives. Navigate between steps is done by keys or by panning and zooming.

Evaluation

Built and evaluated on the Valve Corporation use case (appendix B). It was then evaluated with nine groups of students who designed the evolution of their semester projects. The concept was quickly understood and feedback is very positive.

Future Potential

Evaluate how the concept can assist a project over its conception and evolution on a longer time frame instead of a posteriori evaluation.

A next versions of the software could explore a different visualization of the same transformation operations, for example on top of each other instead of next to each other.

Providing more hinting features and stronger dependency checks between elements is another area to explore.

A.7 Strategy Canvas

Apply design principles of computer-aided business model design to another business object (Blue Ocean's Strategy Canvas). Explore aggregation of values to provide future hinting.

Features

- Digital version of Blue Ocean's Strategy Canvas
- Real-time collaboration on the same canvas
- Live chat
- Desktop and iPad
- Create as many factor to compare as needed
- Create as many competitors/offerings as needed
- Reorder factors
- Change appearance of lines: color, symbol, style
- Add and remove items
- Removed items 'positions are kept if re-added
- Share strategy canvas (view or edit links)

Publications

No current publication, released prototype to the public as proof of concept.

Technology

AngularJS
frontend & data binding

D3.js
visualization

Websocket
real-time updates

Grails
backend

Spring Security
authentication & authorization

Postgresql
persistence

Ideas

Apply the same design principles used to create a Computer-Aided Design tool for business models canvas to another business object. Blue Ocean's Strategy canvas is a good candidate, because it is visual, simple to understand, yet expressive. The graph based approach is also generic enough that it could be transposed to another business domain.

Provide real-time live collaboration with chat, to experiment on virtual collaboration.

As the data of a value curve is limited to points on two axes, it might be simpler to find a way to aggregated them into a value which can be used for hinting on new canvases with similar curves. For instance, aggregating averages of the points although they are from a subjective perception of competitor should be simpler than comparing business model elements, and provide useful design insight for both.

Evaluation

Functionality of the prototype was tested with a small group of users. It has then been released as a public version on strategycanvas.com in 2013. As of 2014 over 3'000 models have been created. Preliminary analysis of the data shows that there needs to be extensive data cleaning before it can be used to provide averaged aggregated values for similar factors.

Future Potential

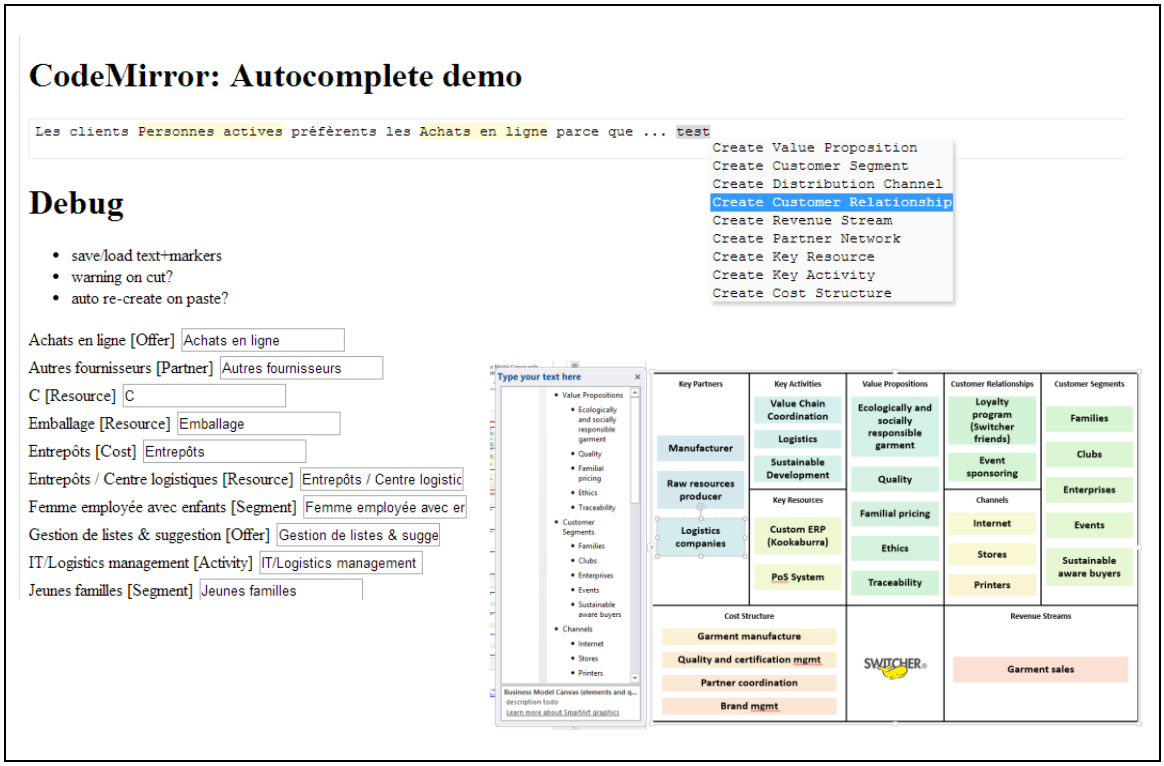
The next step is to elaborate hinting techniques to display and use the crowd sourced average value for similar factors.

Another area to explore is to provide an interface to merge multiple models and accompany the discussion of merging a multi user perspective into one consensus strategy canvas. Contrary to the current live editing. This would be a two stage operation: first create individual canvases and then merge them collaboratively.

Concept of connected points to visually illustrate difference of metrics can be applied to other business metrics than factors of competition.

A.8 Business Model Text

Exploration of how to transform between text and canvas representation of business model data.



Features

Text to business model prototype (top left)

- Insert existing business model elements into the text from an autocomplete list
- Writing a text create new business model elements with a shorthand syntax
- In an existing text select and create business model elements
- Renamed elements are synced between text and business model

Office Smart Art prototype (bottom right)

- Custom Office Smart Art component
- Indented text list creates visible business model canvas elements
- Visual items are in sync with the list
- Placeholder for company logo picture

Technology

JavaScript
frontend

CodeMirror
textarea library

Office Smart Art
list to business model prototype

Publications

Only internal proof of concept. SmartArt available for download.

Ideas

Exploration of how to transform between text and canvas representation of business model data. What if the concept of IDE's autocomplete feature is applied to business model description writing? This lead to the first tested functionality of creating a text editor which allows to insert existing business model elements, while writing the story of the business model.

The opposite direction become also a useful direction to explore, while writing the story it can happen that missing elements are identified. Offering the possibility to create a new element while staying in the text seems ideal to not break the creative flow. This is enabled by typing a shorthand, for example *vp:"my new value proposition"* creates a new linked value proposition element.

While reading an existing text how to annotate it so that it can be used in a CAD tool. In this prototype, text can be highlighted and with a context menu create new linked business model elements.

Having linked elements between text and the business model element representation allows to keep them in sync as they get renamed.

This approach of two different views on the same business model data has also been explored with a custom *Office SmartArt* component, which allows the creation of business model canvas representation and its elements by writing an indented list format. This is supported inside Microsoft's Word and PowerPoint applications.

Evaluation

Limited evaluation by using the prototypes to illustrate small examples.

Future Potential

Create a setup to evaluate the performance of the proposed functionalities.

Having the elements linked with the story text, could allow to visually display the elements in the same sequence as they appear in the story without additional input from the user.

A.9 Business Model Types

Research tool to visualize and analyze data on business model types.

Features

- Displays all Business Model Canvas building block combination types (512).
- Filter and sort canvas usage data by types
- Visual support for data analysis

Technology

AngularJS
frontend & data binding

SVG
business model canvas thumbnail

Excel
data analysis

Publications

Proceedings of the 47 Annual Hawaii International Conference on System Sciences, Computer Society Press (Ed.), 2014

Ideas

To help in analyzing usage of color tagging to connect elements in different building block, data was first exported to excel, where it was coded into types. Each type is a combination of used building block on a business model canvas out of the 512 possible ones. To ease the analysis and navigation of the resulting dataset this small tool has been built. Having two sources of data, it helps in comparing the difference in types between them. Filtering and sorting is simplified and is instantly reflected by the tool. This simplifies the navigation of the data.

Evaluation

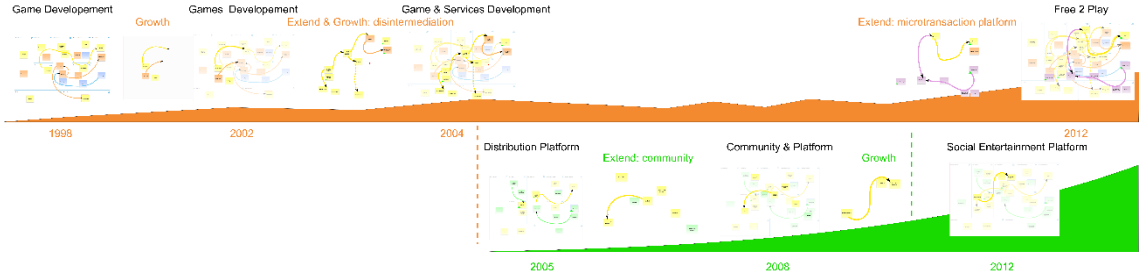
Support tool used for the research. No external evaluation.

Future Potential

The concept of types can be used to help in classifying cases for which customized suggestions can be offered. This could improve guidance of users to design better business models.

Appendix B
Business Model Evolution Case: Valve Corporation

from Game Development Studio to Social Entertainment Platform



http://www.fritscher.ch/phd/valve

This use case has been built to identify the evolution steps taken in a business model belonging to a real company. The focus is on gaining an insight into the sort of transformation that is involved. This case was used in the design of a visualization method for business model evolution (presented in Chapter 6). The illustrations shown in this appendix use the proposed visualization. To present the sort of transformation that occurs in a real-life situation, a more complex case had to be found. This led to the analysis of a company from the video game industry: Valve Corporation.

Valve Corporation is an American company, which started as a traditional video game development studio and transformed itself into a leading actor in digital video game distribution. The company is different from other big competitors in this industry because it is privately owned and has a flat, hierarchical structure. From a business model point of view their case is interesting, because more than one business model has evolved. A second business model emerged from the first one as more than just an extension. Once the second business model emerged, it evolved in parallel with the first business model.

We modeled the use case by grouping key events into discrete business model states/steps. These choices were the result of decisions made by the case designer, who did not follow clear rules, but used his experience.

A description of the events and mechanics is given for each discrete step identified. Additionally, any particularities of the business model are highlighted and, if available, business model patterns to which the current step can be assimilated are listed. Business model patterns are sets of business model elements and their interactions; these are arranged in a specific configuration, which is identifiable across different business models. They cover concepts such as

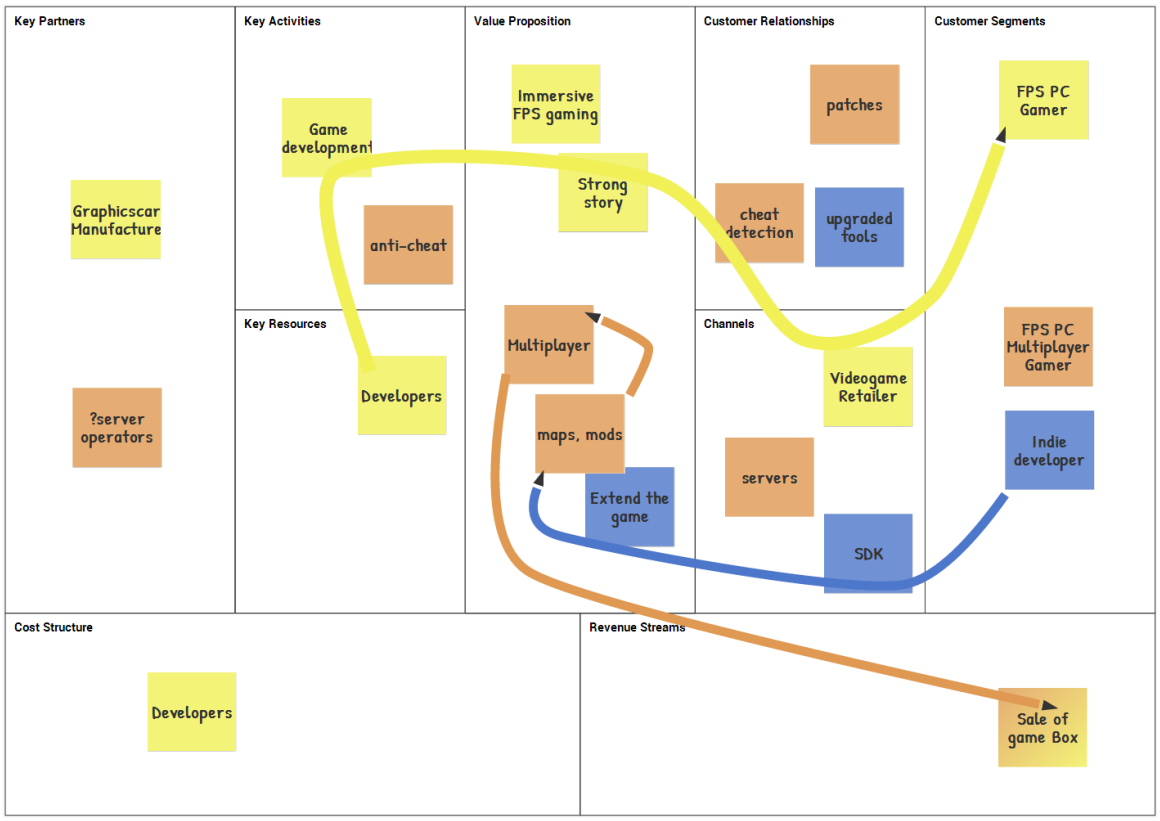
multi-sided platforms (Evans, 2003), Freemium (Wilson 2006), Long Tail (Anderson, 2008) and Open Innovation (Chesbrough, 2003).

The second business model evolved in parallel with the first. For a simple narrative, we first presented the evolution of the first business model: game development. We then considered how the second business model: distribution platform, emerged and evolved.

The game development business model is described in four steps and the distribution platform has three steps. Figure 1 shows all the steps in one visual representation, which is best viewed on an interactive display with zoom capabilities. Each step is covered in detail in the following sections.

Figure 1 Valve Corporation's two business model and their evolution

B.1 BM1: Game development

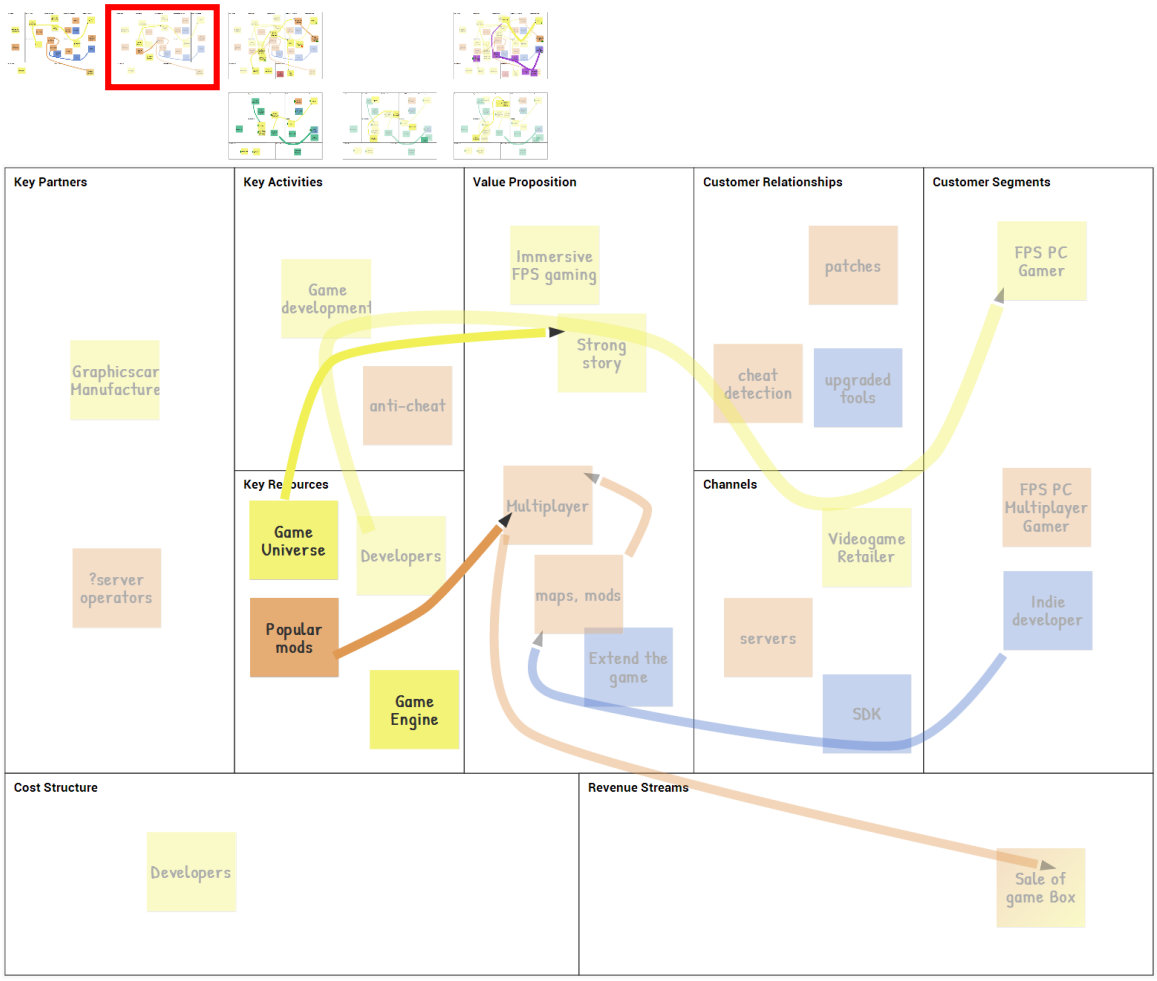


Founded in 1996 with the objective to produce high quality video games, Valve Corporation released their first title “Half-Life” in 1998. Their initial business model was a classic game development studio model, in which they targeted a typical set of gaming customers, in this case First Person Shooters (FPS). First, the game was produced internally by game developers. It was then sold through retail channels, making revenue after having incurred all the costs of development and marketing. Like the majority of FPS games, their title has both a single player and multiplayer adventure component, targeting two separate profiles of players and offering the opportunity to extend the longevity of the game. Although it requires additional effort to support multiplayer games such as maintaining servers, providing updates with bug fixes and anti-cheating features, it helps in the generation of new game copy sales after the release. In particular, if competitive online play of the game becomes popular.

Particularity: In addition to having both single and multiplayer game modes at release, there was a supplementary embrace of the gaming community by releasing a Software Development Kit (SDK) for free. This allows third-party indie developers to create new content for the game such as maps and game modifications.

Pattern: Offering third party developers access to the game engine with the SDK is partially like an Open Innovation Pattern, where technology is seeded.

B.2 BM1 Growth: Two Growth Models



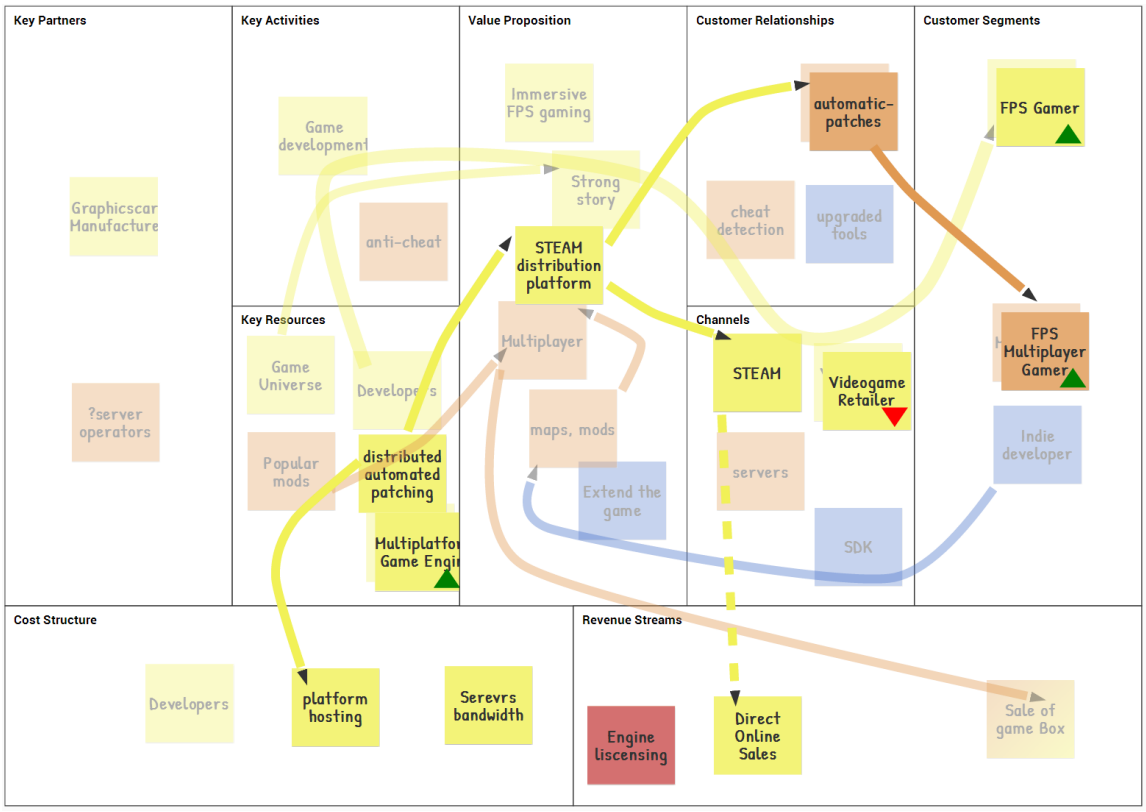
In order to grow Valve Corporation, two different strategies were used: first, as is common with successful games, they released expansion pack games in order to leverage the investments they made to their existing game engine. These extensions are new single player adventures in the same game universe; they also use the same technology, thus making it less costly to develop. Second, they hired developers of popular game modifications (mods) made with their free SDK tools. A better version was then released, which has full featured support of these custom multiplayer games. In both cases, they can sell to an existing core community and further grow it through their official support. The first strategy covers single-player population and the second targets multiplayer enthusiasts.

Particularity: Distributing their SDK for free enabled them to create a second growth strategy by collecting what they seeded. Growing existing mods that already have a community gives them a much better chance of commercial success, because the core value has already proven itself. Growing an existing player base also removes the problem of having to bootstrap the creation of a competitor pool that is large enough to allow players to always find someone online to play with them.

Pattern: Second phase of the Open Innovation pattern, harvesting successful projects by internalizing them.

Changes: Adding of resources: Game Universe, Popular mods, Game Engine.

B.3 BM1 Extend: Disintermediation & Growth: Multi-platform engine



Following a traditional game development model, Valve capitalized on its successful game Half-Life by making a sequel, using the established game universe. For the release in 2004 of their second big game Half-Life 2, they switched to a new game engine called SOURCE. Developing a new game engine allowed for the inclusion of new technologies, which offer better graphics and give more realistic physical features. In addition, it provided the opportunity to grow the potential user base by not only supporting PCs, but also Mac and modern gaming consoles.

Having observed that in order to support multiplayer gaming there is a need for automatic updating of the game (patching), as well as providing anti-cheat protection updates, they searched for a solution provider. After finding no interest from a third party to offer such a solution Valve Corporation ended up building their own distribution platform (STEAM). Such a functionality comes at the cost of having to maintain the platform, which includes: software, servers and bandwidth. In return it provides a better service to customers with up-to-date games always being available. It enables distribution of new features and provides a better online gaming experience through up to date anti-cheat software (Lee, 2008).

Particularity: A patching platform, which was developed out of necessity, became a golden opportunity to become a platform: internal innovation. By establishing a direct connection with the end customer (gamer), it became possible to set up direct online distribution and sales of

games. In turn, this led to disintermediate game publishers and retail stores. This is the origin of Valve Corporation's second business model, which is described further below.

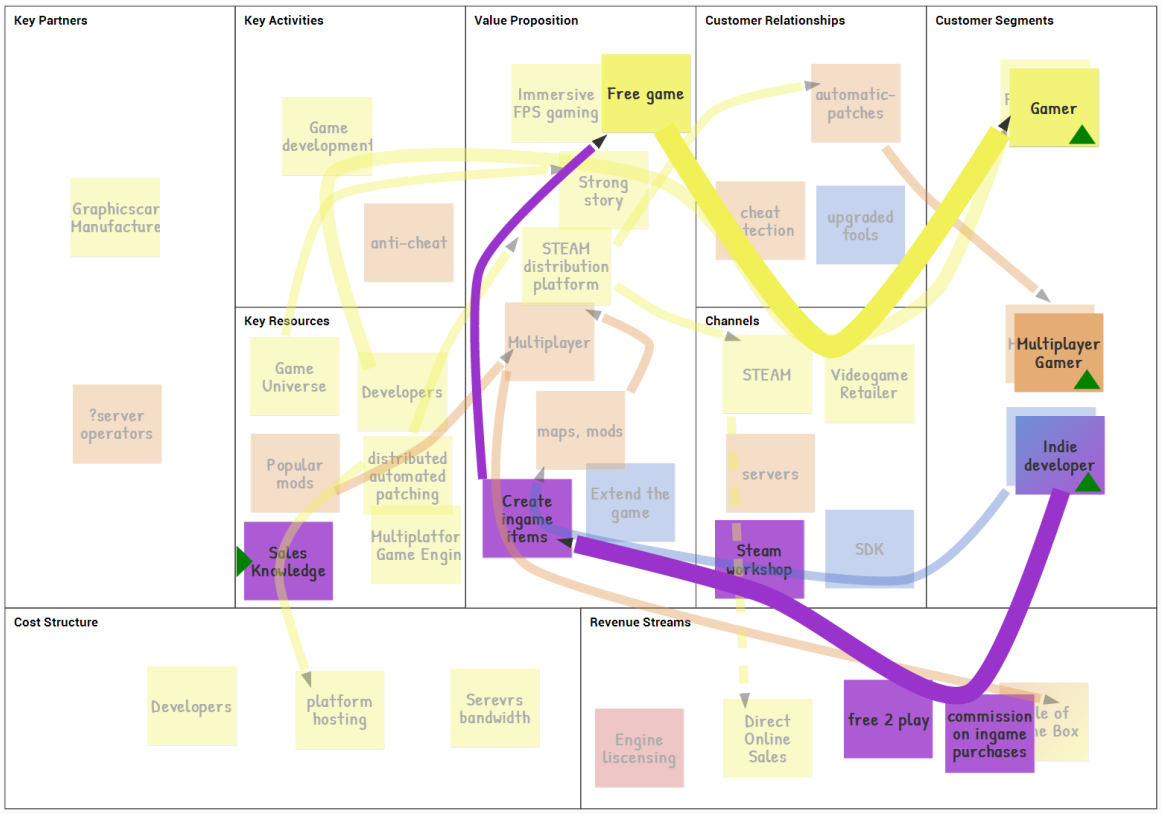
Pattern: Whilst there is no complete pattern at this stage, the basis of a platform infrastructure and technology has been built, which will enable a multi-sided business model.

Changes: Distributed automated patching was created as a resource. The game engine was changed into a multiplatform game engine. These resources led to a new value proposition for the STEAM distribution platform. In turn, this provided a new STEAM channel and led to a reduction in the importance of video game retailers. In terms of customer relations, patching became automatic. These changes increased the customer segments, which grew from FPS PC Gamers to FPS Gamers on all platforms. The resources generated new costs of hosting and bandwidth, but also provided new revenue through direct online sales.

B.4 BM1 Growth: Fan Engagement

Since Valve is supported by revenues from their second business model, they are less pressured to release their own games on a tight schedule. Instead, they prefer to make sure that any new games are absolutely ready before releasing them. Nonetheless, in order to maintain and grow their customer base, Valve goes beyond simple interactions and maintains a real fan base for their games. Steps involve publishing regular updates to the most popular multiplayer games for free, as well as creating additional content such as comics and short films to promote these new features. They even have a shop for fans, which sells T-shirts, and other items related to their customers' favorite games. There is also a "Cybercafé program", which broadens the reach of multiplayer games even further.

B.5 BM1 Extend: Free-to-Play



In 2011, Valve Corporation started experimenting on applying the free-to-play business model concept to one of their more successful multiplayer games, “Team Fortress 2”. This meant that they no longer sell the game, but offer it for free for anyone to download and play. The lost revenue from game sales are replaced by in-game micro transaction sales of add-on items. These items are customization for the in-game avatar, such as new decorative hats, glasses and, weapons.

After successfully transitioning to the free-to-play model, more and more community events are being organized to cultivate the value of in-game items. Some actions give access to special items, which can then be exchanged with other players or sold on a market. In addition, as they did with all their games, Valve turned towards indie developers, offering them the possibility of producing new content for the game. This time, they included a revenue sharing model for items created by third parties.

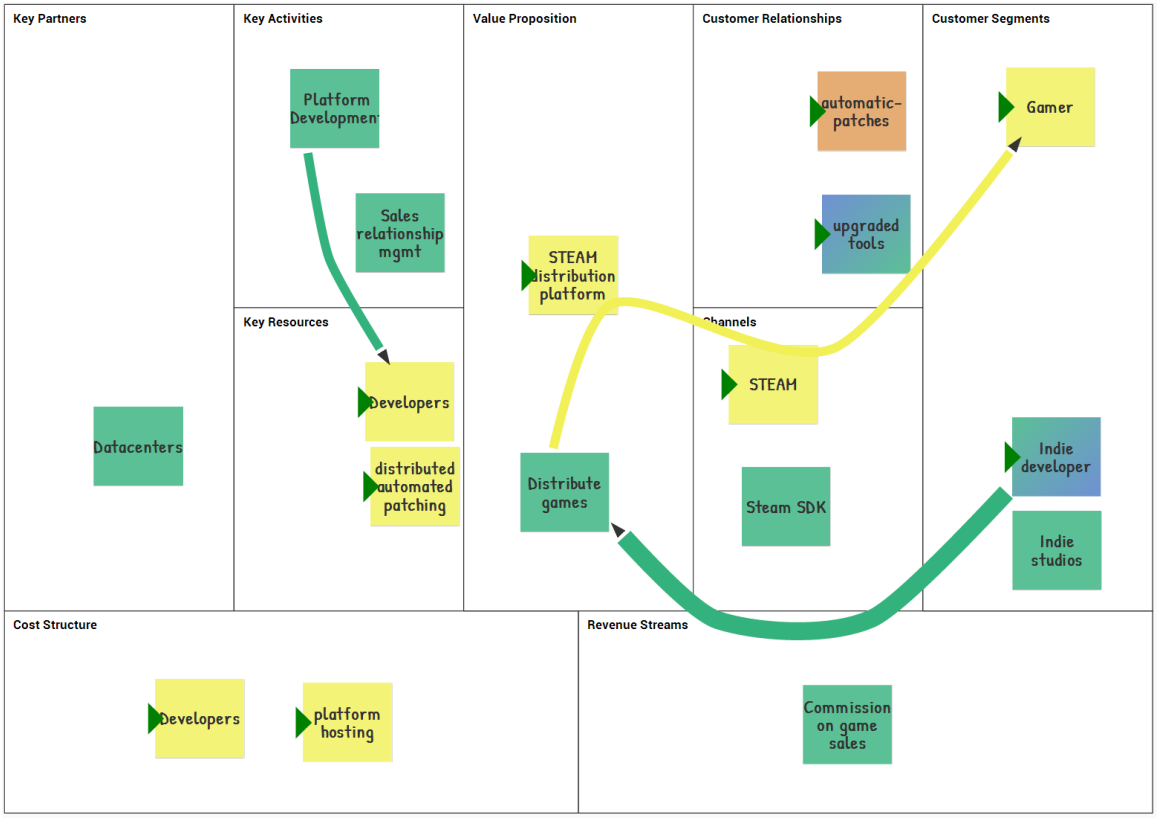
Particularity: The experiment to forgo revenue by offering the game for free involved some risks, especially when the conversion rate for free-to-play games can be as low as 2 to 3 percent of people who actually buy something. However, Valve started to see conversion rates of about 20 to 30 percent for decorative objects (Bishop, 2011). Some of their success can be attributed to the way they engage their community beyond the game through comics, their shop, and cross

promotion for new items (by buying a game on the platform, customers receive special unique items in Team Fortress 2). Valve also has a strong knowledge of pricing and marketing, and sales knowledge capabilities acquired in their second business model for a digital distribution platform (see below).

Pattern: The free-to-play pattern is similar to the freemium pattern; however, instead of having a free version and a premium account that gives additional features, the paying feature mostly only offers graphic customization, which does not affect the balance of the game. It is not a pay-to-win game.

Changes: Sales knowledge was imported from the second business model. Thus, it was possible to add Free-to-Play and a double-sided business model by connecting the free game players with in-game items produced by indie developers. Increases were seen in the whole customer segment. New commission on in-game transactions was added as a revenue source.

B.6 BM2: Distribution Platform



Valve Corporation's second business model is their distribution platform (STEAM), which evolved to become a market leader for downloadable PC games. In 2011, they controlled 70% of a 4 billion dollar market.

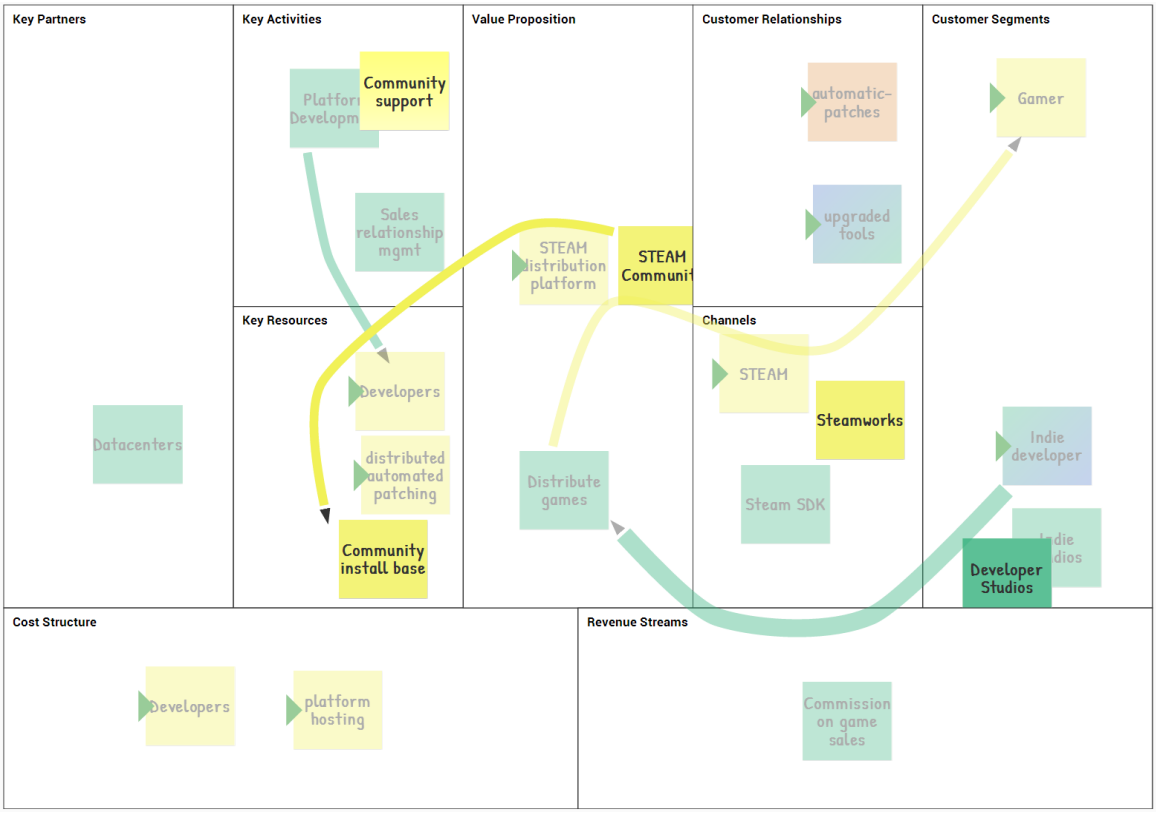
After improving and successfully using their content distribution platform for all their new games, Valve set up their first publishing partnership in 2006, making it not only a game developing studio, but also a digital download provider with a new business model. They provided a growing gaming community with access to third-party independent game developers. In exchange for a share of transactions, the STEAM platform handles the sale transactions and distribution of the third party's game. Resources and knowledge for creating this platform were transferred (imported) from their game development business model to support this new offering.

Particularity: Valve was amenable to creating a new business model which opened up their distribution platform to others, even though this may mean that they sell competing games.

Pattern: Unbundling (Hagel and Singer, 1999): Valve managed to avoid a bundled business model when they opened up their technology to third parties. They managed to directly distinguish between and unbundle the two models, handling them separately. This allowed the platform to take off in its own direction without being held back by their game development business model.

Changes: Developers and the initial STEAM distribution platform were "imported" from the initial game development business model.

B.7 BM2 Extend: Community



In order to attract and engage more gamers, and keep the current gamers from leaving the platform, Valve has added more and more features. Most of these features also provide advantages to the developer that chooses to use their platform as they can directly integrate them into their games.

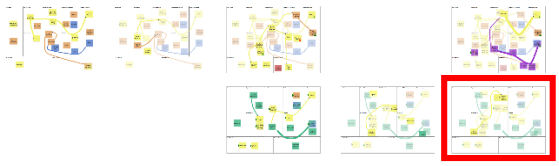
What started with a basic friends list that shows who is online for each game, has extended to an all-encompassing game integration overlay. This allows the gamer to access an array of community features such as chat, achievements, leaderboards and profiles, all directly from within their favorite game. The achievements and other features are directly provided as a Software Development Kit (SDK) to the developer through a framework called Steamworks. In addition, it also provides features such as matchmaking and cloud-based save game synchronization. The billing and transaction cut is handled by the platform.

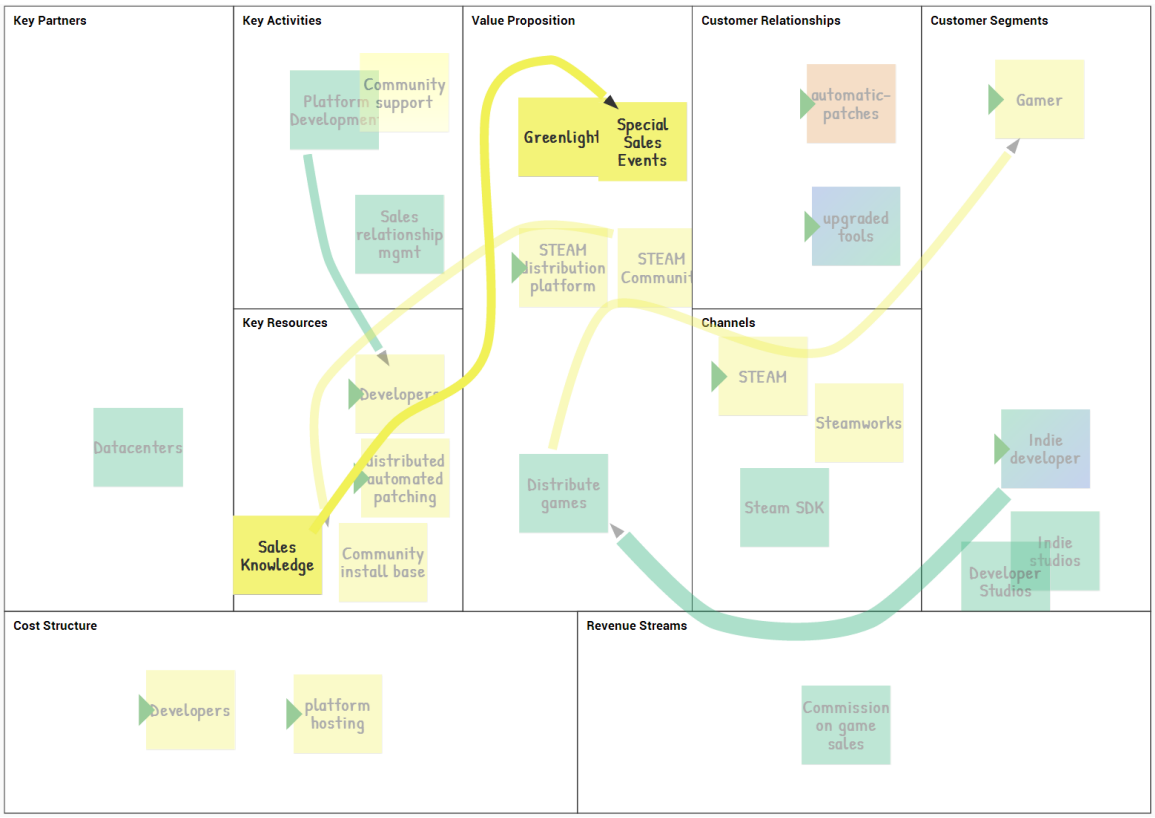
Particularity: As Valve did for their SDK games, counting on the community to provide interesting new content, they also counted on independent developers and small game studios to grow the overall gaming community. They encouraged small mod makers to release a professional paying full game version on the platform instead of insourcing them as they had done before.

Pattern: The platform is a double-sided business model pattern connecting gamers with game developers.

Changes: The new community features supported by Steamworks, help to create a community install base on which Valve can draw in later evolutions. New bigger game studios have joined the platform to distribute their games.

B.8 BM2 Growth: Social Entertainment Platform





As social networks emerge and become more popular, their social mechanics are also being added to the STEAM platform. These features include friends' activity streams, which share their achievements in game screenshots, gifting of games and the collection of virtual items.

To further grow the community, and extend the range of available games, two new services were added:

"Steam Workshop" helps third-party games to manage in-game add-ons created by the community, as well as sell in-game items through micro-transactions.

"Steam Greenlight" allows any developer to submit their game or modification into a catalog. Users then can vote for the ones they want to see distributed by the STEAM platform. This lowers the requirements to become a partner on the platform and automates the onboarding of new games.

In the meantime, by maintaining their platform, Valve has become very knowledgeable about how to sell games through online distribution by experimenting with different sales formulas.

"Now we did something where we decided to look at price elasticity. Without making announcements, we varied the price of one of our products. We have STEAM so we can watch user behavior in real time. That gives us a useful tool for making experiments which you can't really do

through a lot of other distribution mechanisms. What we saw was that pricing was perfectly elastic. In other words, our gross revenue would remain constant. We thought, hooray, we understand this really well. There's no way to use price to increase or decrease the size of your business.

But then we did this different experiment where we did a sale. The sale is a highly promoted event that has ancillary media like comic books and movies associated with it. We do a 75 percent price reduction, our Counter-Strike experience tells us that our gross revenue would remain constant. Instead what we saw was our gross revenue increased by a factor of 40. Not 40 percent, but a factor of 40. Which is completely not predicted by our previous experience" (Bishop, 2011).

This desire to experiment and sales expertise was also applied to micro-transactions and the extension of the game developer business model to include Free-to-Play (see above). However, after refining the interactions, they integrated the system back into their platform for other developers to use.

Particularity: With Steam Greenlight they open up their platform a bit more and chose to expose themselves to more risk. As an intermediary and a very community focused platform they have a reputation to maintain and letting people vote is a compromise between very selective quality control (like the Apple App store) and a complete open platform (like Google Play store).

Pattern: Beyond a double-sided business model, towards a double business model synergy, each side being a business model for itself, but gaining from the co-evolution.

Changes: The sales knowledge that was acquired helped to create new value propositions, such as Greenlight, and special sales events.

B.9 Future Evolutions

Valve has shown their intention to extend their platform to all screen sizes. They already have a mobile client that integrates their store and community features. They have also announced projects that involve big screens (TVs). In addition to further extend their software platform availability, they are looking into custom hardware devices. They aim to be less dependent on their competitors, which now see them as a key player. Previously, these competitors had dismissed the idea of online software distribution.

Valve has not abandoned their initial business model of making first-class games, but because of their platform revenue stream, they were not forced to rush out their titles. Now, they are able to choose when to release their games, making sure that they are definitely ready. This allows them to maintain a good reputation in terms of the quality of their games. This is especially the case since they are known to offer continuous long-term support after release (also probably paid for by the platform).

Particularity: There is a real synergy between the two business models; the new technologies developed for one model are reused in the other. Social platform features are integrated into the game engine and new game engine features are passed to the modding community. Their knowledge of social platform management and game development is required to develop new features such as automated matchmaking. General sales knowledge of games can also be transferred into in-game micro-transaction support.

Pattern: Beyond a double-sided business model, towards a double business model synergy. Each side is a business model for itself, but gains from the co-evolution.

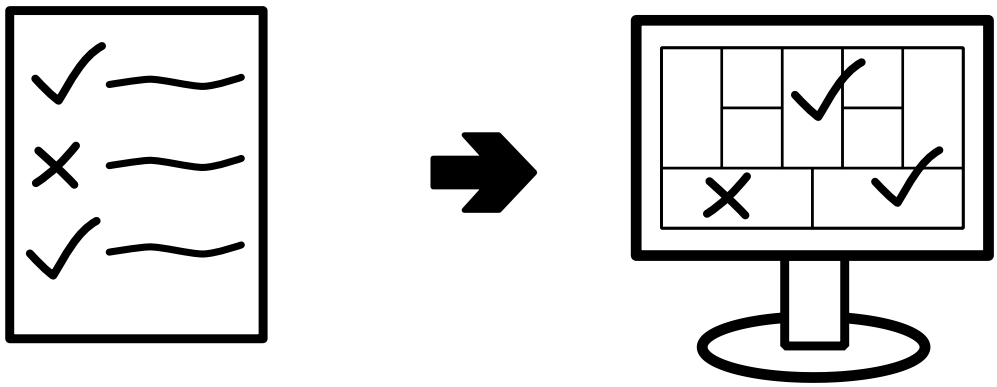
References

Anderson, C. (2008). The long tail: Why the future of business is selling less of more. Hyperion.
Bishop, T. (2011). How Valve experiments with the economics of video games, GeekWire, retrived on 2011-12-12 http://www.geekwire.com/2011/experiments-video-game-economics-valves-gabe-newell/
Chesbrough, H. W. (2003). Open innovation: The new imperative for creating and profiting from technology. Harvard Business Press.
Evans, D. (2003). Managing the Maze of Multisided Markets, strategy+business
Hagel, J., & Singer, M. (1999). Unbundling the corporation. Harvard business review, 77, 133-144.
Lee, J. (2008). The Last of the Independents?, gameindustry.biz, retrieved on 2010-07-09 http://www.gamesindustry.biz/articles/the-last-of-the-independents-
Wilson, F. (2006). The freemium business model. A VC Blog, March, 23.

Other Sources

- http://www.dsi.unive.it/~marek/files/seminari/Andrea%20Pretotto/Steam%20Relazione.pdf
- http://businessinvestorpro.com/why-is-valve-so-successful-a-look-at-the-valve-business-model/
- http://www.pcgamer.com/2012/03/16/garrys-mod-has-sold-1-4-million-copies-garry-releases-sales-history-to-prove-it
- http://www.forbes.com/forbes/2011/0228/technology-gabe-newell-videogames-valve-online-mayhem.html
- http://www.valvesoftware.com/company/
- http://www.steampowered.com/steamworks/SteamworksBrochure2011.pdf
- http://en.wikipedia.org/wiki/Valve_Corporation
- http://en.wikipedia.org/wiki/Steam_(software)#History

Appendix C
Business Model Rules



This Appendix presents the list of all the guidelines and their corresponding rules, which have been implemented in the Business Model Rules prototype (A5).

Guidelines are useful in formalizing best practices of a design activity. However, for them to be used in a Computer-Aided Design tool, they need to be further transform into testable rules. Rules can then be validated automatically on an ongoing basis by the system. In Chapter 5 a set of guidelines have been proposed to build more coherent business models, and illustrated an example of such a transformation. The guidelines and their corresponding transformation into rules and resolution hints are presented in sections further bellow.

There are limitation applying to the kind of guidelines which can be directly transformed into rules. Although it works well for coherence checking, more subjective guidelines which relate to perspective of each stakeholder are difficult to automatically check with a tool. This applies to the following three guidelines of the article:

- The meaning of the element is understandable by all stakeholders.
- The element is a key component in explaining the business model; indeed, without it the business model cannot be explained.
- The detail level of the elements are adequate (there are not too many detailed elements, nor to few which are too generic).

Another limitation are guidelines which when transformed into a rule require additional data form them to be validated. In the case of the financial perspective guidelines for example:

- Financial perspective is valid:
  - Revenue stream is generated from a value proposition-customer segment set. (A revenue stream can also be “free”).
  - Major fixed costs are listed.
  - Major variables costs are listed.

To create rules for this guideline, additional financial attributes for cost and revenue elements such as financial numbers and types would be required.

On the other hand, there are also rules which can be implemented in a CAD tool and are more useful than on paper. This is the case of rules which display suggestion based on the context of the current editing state. They can be used to trigger and display helpful information at the appropriate time. For example, if one of the perspective is not filled out after a number of elements have been added to the business model, and some defined time has already passed in the editing session; a guide explaining this perspective could be shown. Or after a number of elements have been added without any use of colors, a tutorial on using colors can be suggested to the user.

Beyond offering coherence and suggestion rules, there are also rules which can help by identifying patterns. For example, if one color set of elements is a subset of another, it can be made aware to the user. He then has the possibility to check his colors, and might get insights on better business model synergies.

The three following section present the guidelines from Chapter 5 and their corresponding rules as they have been used in the Business Model Rules prototype (A5).

C.1 Guidelines applying to any individual element and their corresponding rules

These guidelines help in maintaining a visually understandable BMC.

Guideline	
▪ There is only one idea per sticky note. ▪ Ideas are written with keywords, or presented with a simple illustration.	
Rule	No more than a predefined threshold of words in each element's name and at least one.
Resolution Hint	Rewrite name as keywords.

C.2 Guidelines applying to individual building blocks

These guidelines help to identify the right amount of detail for the BMC.

Guideline	
▪ All nine building blocks of the model are used, or have at least been considered.	
Rule	There exists at least one element for each business model building block.
Resolution Hint	Check if there is really no element which apply for the empty block.

Guideline	
▪ Elements that are too detailed have been grouped into a simpler element. ▪ Elements that are too generic have been split into more detailed elements.	
Rule	There are no more than a specified number (given by a threshold) of elements in the same building block with the same color.
Resolution Hint	Either merge elements that are too detailed (building block guideline) or change colors of element belonging to a different value proposition to distinguish the segments (connection guideline).

C.3 Guidelines applying to connections between elements in different building blocks

These guidelines help with the coherence of the BMC.

Guideline	
▪ Colors are used on elements to highlight their connections. ▪ There are no orphan elements: all elements are connected to another element (in a different block to themselves).	
Rule	A color has to have at least elements in two different building blocks.
Resolution Hint	Add the color to another element in another building block.

Guideline	
▪ Each color is labeled and has a specific meaning.	
Rule	Two sets of colored elements should not be identical.
Resolution Hint	Same set should have same meaning and label, remove or add color from one or more elements.

Guideline	
▪ Client perspective is valid: - Each customer segment is addressed by one or more value proposition. - A channel supports a value proposition-customer segment set. - If present, a customer relationship targets a customer segment.	
Rule	Each color set has to have at least an element of a value proposition, a customer segment and a revenue stream. Optionally it should include an element of a channel and a customer relationship.
Resolution Hint	Complete the color set by adding the missing mandatory elements.

Guideline	
▪ In case of multiple customer segments, colors distinguish each business side.	
Rule	A customer segment has to have a corresponding value proposition element with the same color as itself.
Resolution Hint	Create missing elements or add right colors to the elements

Guideline	
▪ Activity perspective is valid: - Each value proposition is produced/delivered by a key activity, a key partner or offers a key resource. - Key resources or key partners support an activity.	
Rule	Each color set has to have at least an element of a partner, an activity or a resource.
Resolution Hint	In the color set complete the missing elements.