Comparison of Visual Business Modeling Techniques for Software Companies

Garm Lucassen, Sjaak Brinkkemper, Slinger Jansen, Eko Handoyo

Department of Information and Computing Sciences, Utrecht University,
Princetonplein 5, 3584 CC Utrecht The Netherlands
{g.lucassen,s.brinkkemper,slinger.jansen,eko.handoyo}@uu.nl

Abstract. Despite the widespread adoption of business modeling techniques in academic research and business, no research has been done into how efficient and effective business modeling techniques document and communicate business models. This paper compares three visual business modeling techniques with a visual approach and identifies the strong and weak points of each modeling technique, based on applying the techniques to three startups and interviews with industry experts. With this comparison, visual business modeling technique developers can improve their own techniques and software companies can determine which technique to apply in their specific case.

Key words: Visual Business Modeling Techniques, Software Business Models, Software Business Analysis

1 Introduction

According to Gordijn, Akkermans and van Vliet[1], a business model presents the business essentials of the business case to be developed and is seen as a first step in requirements engineering for any e-commerce information systems. Based on an elaborate literature study of business model definitions, Osterwalder et al. [3] defined the term business model as:

"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 de- scription 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."

In order to create business models, dozens of scientists have done research into universally applicable techniques. In the past ten years this has resulted in as many different techniques with varied approaches and results [1, 4, 5, 6, 7, 8, 9, 10, 11, 12]. But it was not until the introduction of Osterwalder's business modeling ontology [12] and corresponding book [13] that business models have become a frequently discussed topic and widely adapted tool in science and all forms of business. According to Google Scholar, Osterwalder's thesis outlining

the business modeling ontology has been cited 475 times to date. Furthermore, the Business Model Canvas is currently being deployed by larger consultancy firms. All technique creators argue that they have identified essential concepts which any given business model is made up of. It can be argued that no single business modeling technique successfully reached this goal. All techniques take widely diverging approaches, none of which have been fully accepted in business nor academics. Of all these techniques, some provide visual elements that can be used to create a business model, we refer to these as *visual business modeling techniques*. Three visual business modeling techniques: The Business Model Canvas [13], Software Ecosystem Model [4] and Board of Innovation [5] will be studied in this paper. We expect that these techniques are more effective and efficient when communicating the business models than non-visual business modeling techniques.

Yet, despite the widespread adaption of the Business Model Canvas, no research has been done into how effectively and efficiently different business modeling techniques document and communicate business models. In this paper we address this hiatus by asking the research question "What business modeling technique documents and communicates the business model of a software business most effectively and efficiently?". In section 2 the research method we used to formulate an answer to this question is introduced. Section 3 will identify the required concepts that modeling techniques should include. Following, section 4 introduces the business modeling techniques that will be examined in this paper more elaborately. Section 5 compares the aforementioned techniques' conceptual adherence to a list of requirements based on literature research and documenting and communicating effectiveness and efficiency based on application of the business modeling techniques to three software start-ups and interviews with industry experts. In this context effectiveness is regarded as to what extent the business modeling technique successfully captures and communicates the entirety of the business model, whereas efficiency is defined as how flexible and adaptable the business model capturing process is and how comprehensible and explicit all modeled information is communicated to the reader. To conclude, in section 6 the (dis)advantages extracted from the comparison of each model will be discussed and compared in order to formulate the recommended approach. The paper ends with a conclusion and future research possibilities in section 7.

2 Research Method

In this research several visual business modeling techniques (BMTs) are discussed and compared. In order to be able to generate a scientifically accountable list of requirements a literature study was conducted. Google Scholar and ACM Digital Library searches were performed with combinations of *business model, business modeling, technique, e-business,* as keywords. Business model definitions based on 16 authors and 10 relevant modeling techniques were accumulated this way. Furthermore, the studied BMTs were applied to three high-tech startups in order to investigate the effectiveness and efficiency of the documenting

process. This part of the research was conducted using Yin's case study method [2]. First the startups were modeled based on information extracted from the products. Afterwards a meeting with a founder of the startups took place where the modeling process was repeated. Upon completion the models were compared and discussed with the entrepreneur. Ultimately the digital models were redesigned and confirmed by the entrepreneurs via email. Last but not least, structured interviews with industry experts consisting of six (ex-)entrepreneurs, two network partners and one venture capitalist were conducted in order to examine the effectiveness and efficiency of communicating the business models. The experts were asked what concepts they saw as essential, to evaluate several business models presented in each BMT, discuss (dis)advantages and articulate their preferred technique. After conducting the interviews and startup modeling lists of (dis)advantages were extracted within 24 hours of the interviews.

3 Identification of Core Concepts

Osterwalder's definition of business models [3] as presented in the introduction corresponds with our perception of business models and contains the foundation of what concepts we expect the BMTs to include:

1. Customer Value Proposition
2. Partnerships
3. Architecture of the firm
4. Revenue streams
5. Logic of earning money

To confirm whether this list of concepts is still viable, we reiterated upon Shafer et al.'s [14] research into essential business model concepts for business modeling techniques. In the paper, 12 business model definitions in academic articles, originating between 1998-2002, are dissected in order to find one list of essential business model concepts. We reiterated upon this study in Table 1 by adding 4 more definitions by different authors between 2000-2008 [7, 8, 9, 15]. Among these definitions, 9 concepts were observed significantly more frequently than others. Descriptions of these concepts can be found in Table 2.

1. Customer
2. Value Proposition
3. Revenue
4. Costs
5. Activities
6. Partners
7. Distribution Channels
8. Resources
9. Competencies

Table 1: All observed concepts

Concepts	Timmers (1998)	Hamel (2000)	Linder and Cantrell (2000)	Afuah and Tucci (2001)	Amit and Zott (2001)	Weil and Vitale (2001)	Dubosson-Torbay et al. (2002)	Margrett a (2002)	Rayport and Jaworski (2002)	Van Der Vorst et al. (2002)	Hoque (2002)	Chesbrough (2003)	Hedman and Kalling (2003)	Morris et al. (2003)	Osterwalder et al. (2004)	Johnson et al. (2008)	Total
Customer		X		X			X	X	X		X	X		X	X	X	10
Partners & Channels	X	X	X			X	X			X	X	X	X		X		10
Revenue/pricing	X	X	X	X			X				X	X		X	X	X	10
Value Proposition			X	X			X	X	X	X		X		X	X	X	10
Activities		X	X	X			X			X			X		X	X	8
Competencies		X		X	X		X						X	X	X		7
Cost			X				X	X				X		X	X	X	7
Resources/assets		X			X		X		X		X		X			X	7
Strategy		X	X								X	X					4
Customer relationship		X					X								X		3
Differentiation		X									X			X			3
Information flows	X				X	X											3
Output (offering)					X				X				X				3
Product/service flows	X				X	X											3
Branding							X				X						2
Competitors									X				X				2
Create value					X									X			2
Customer information		X					X										2
Financial aspects							X		X								2
Management													X	X			2
Mission		X									X						2
Profit							X	X									2
Business opportunities					X												1
Cash flows						X											1
Culture											X						1
Customer benefits									X								1
Customer interface		X															1
Economic logic								X									1
Environment											X						1
Firm identity											X						1
Firm reputation											X						1
Fulfillment and support		X															1
Functionalities										X							1
Implementation				X													1
Infrastructure-applications										X							1
Infrastructure-management							X										1
Product innovation							X										1
Specific characteristics										X							1
Sustainability				X													1
Transaction content					X												1
Transaction governance					X												1
Transaction structure					X												1

When applied to software companies, two of these concepts are considered unnecessary. First, analysis of business models made with the Business Model Canvas revealed that the most important resources are the result of activities of the company. Explicitly specifying resources displays redundant information to the reader. Secondly, information concerning competencies compared to the competitors does not fit the scope of a business model. A business model specifically provides information about the business being studied. Not its competitors. Considering that Osterwalder's definition includes all 7 remaining concepts, we conclude that his definition is viable for the scope of our research.

However, interviews with industry experts identified only 4 essential concepts that are relevant in their position. They mainly use business models to communicate the business its potential to investors in a visually pleasing way. In order to reach this goal a wide variety of concepts that should be included were identified, varying between backgrounds, experience with BMTs and role specific needs. After extensive analysis of recordings of all interviews, 4 concepts were found to be essential: (1) Value proposition, (2) Identification of customers, (3) Logic of earning money, consisting of costs and revenues in concrete figures and (4) Activities. These concepts encapsulate the diversifying aspects of a business, which are the defining factors for investors according to the experts. These required concepts conform to the concepts identified by the literature study excluding channels and partners. Although experts acknowledged that channels and partners are important, they were deemed inessential due to their often replaceable nature and limited added value when communicating a unique value proposition.

In order to effectively compare all BMTs in section 5, one uniform list of required concepts needs to be formulated. The five concepts identified through interviews with experts and supported by the literature study form the foundation. All BMTs include partners and two out of three BMTs include channels in their approach extensively. Not including channels and partners in the comparison would mitigate the use of both the Software Ecosystem Model and Board of Innovation extensively. Therefore, both channels and partners are added. The final list of required concepts, shown in Table 2, effectively mirrors the 7 concepts identified in the literature study.

Table 2: Final list of required concepts for visual business modeling techniques

Concepts	Description
Customer	Which customer segments are targeted? [16]
Value proposition	What bundle of products and services creates value for a specific customer segment? [12]
Revenue	How much money can be made by price x volume? [8]
Partners	Who are the partners that provide the key resources to the company? [13]
Activities	What makes the profitable delivery of the value proposition repeatable and scalable? [8]
Resources	What are the most important assets required to make the business model work? [13]
Costs	How are costs allocated? [8]

4 Introduction of Business Modeling Techniques

In this section three BMTs will be introduced by discussing their approach. Specifically visual business modeling techniques were used for this research because the resulting models incorporate visually distinguishable elements that facilitate easy and fast communication of the business model. More specifically these three techniques were selected because of three different factors. The Business Model Canvas was chosen because of its widespread acceptance among business and academics. The Software Ecosystem Model is used in several courses and developed at Utrecht University, where this study took place. Lastly, the Board of Innovation was adopted because it is the latest visual BMT and generating publicity quickly.

Business Model Canvas [13] is derived from Osterwalder et al.'s research [12] into a business model ontology. His research identified four areas with nine building blocks that a business model should address to create a complete visual representation which displays the links between all business segments. Modeling starts on the right side of the canvas by clearly formulating the customer and value proposition. The remaining seven building blocks, consisting of Key Partners, Key Activities, Key Resources, Customer Relationships, Channels, Revenue Streams and Cost Structure, are derived from the needs and requirements of the customer segments and value proposition. Figure 1 in the next section provides an example of a completed Business Model Canvas.

Software Ecosystem Model [4] is based on Weil and Vitale's supply networks [16] and specifically aimed at modeling product software businesses. The approach combines two models. (1) A Product Deployment Context (PDC) provides a simple, quick overview of the architecture and dependencies of a software product in its running environment by describing the context in which the product operates. The stacking order of the elements defines the hierarchy between different products and components. (2) The accompanying Software Supply Network (SSN) displays all parties that facilitate the company to provide a value adding product. The diagram shows asset, knowledge and software transactions between the different parties in the company's network. Examples of both the SSN and PDC are shown in Figure 2 in the next section. Modeling starts by defining all entities and flows. Company of interest, customers, potential intermediaries are connected by product, service, finance and content transactions between the entities. Afterwards all suppliers are listed and transactions with the company of interest added. Based on the list of suppliers the PDC is modeled of how the technology of the product is made up.

Board of Innovation [5] is a technique that aims to provide users an easy way to create a visual representation of transactions within any company. The scope of this technique is limited to visually representing concrete activities and asset transaction that take place in the context of the business. Intangible information such as customer relationships, positioning and strategy are left out.

By using 16 distinctive icons a comprehensive image of the business model takes shape. 6 Actor icons represent the business, companies and suppliers in the value network, consumers, non-profits and government. The 10 remaining icons represent product, service, experience, exposure, reputation, money, less money, data, right and credit transactions. Icons can easily be moved around to facilitate business model innovation. The Board of Innovation is used as a whiteboard kit with magnets that represent the actors and transactions. Modeling starts by identifying all actors in the ecosystem, followed by defining the initial transaction with the customer. Afterwards all transactions with suppliers, partners and stakeholders related to the initial transaction are added. An example is presented in Figure 3 in the next section.

5 Comparison of Business Modeling Techniques

This section will compare the BMTs introduced in the previous section. First we will research whether the BMTs theoretically include all required concepts introduced in section 3. Afterwards, an assessment will be done concerning to what extent the required concepts are effectively and efficiently communicated and documented based on experiences with the documenting process of three software startups and interviews with industry experts. The next section will present the recommended BMT based on (dis)advantages of each technique, which are in turn based on the findings of this section.

5.1 Comparison on Concepts

As seen in Figure 1 the Business Model Canvas explicitly provides segments for each required concept. The technique also includes key resources, which we considered to be inessential in section 3 because it displays redundant information. In this example you can see that all the resources can be derived from the key activities segment. Thanks to the flexibility of this technique redundant segments, such as key resources, can be ignored when necessary.

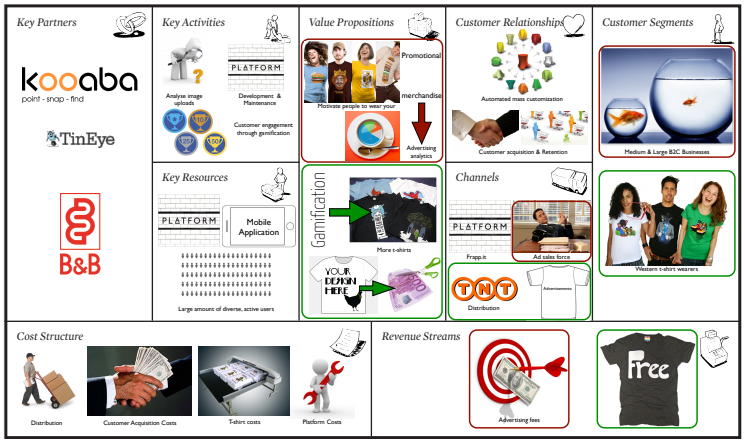

Fig. 1: Business Model Canvas - Software Startup 1

Figure 2 shows an example of a Software Ecosystem Model for a fictitious software company. The SSN uses light (yellow) and dark (orange) labels for customers and suppliers respectively. Transaction flows with labels map the value proposition, cost and revenue. Internal processes and activities are not explicitly identified, instead the model exclusively focuses on the product by modeling what architectural elements the product comprises of in the PDC. Channels are occasionally included when the customer is reached through an intermediary, but more often than not the model assumes customers are being reached without specifying how.

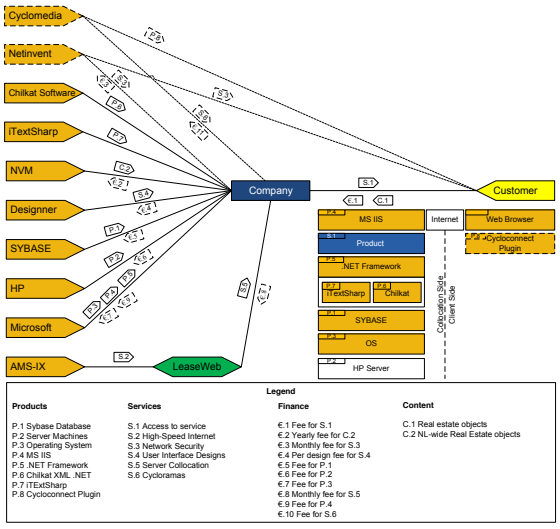

Fig. 2: SSN & PDC - Example Software Company [17]

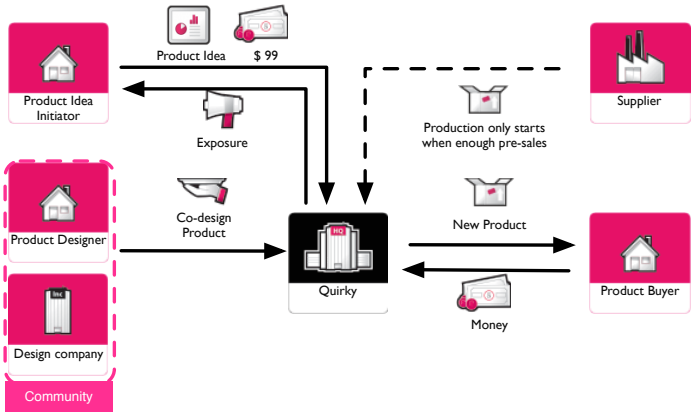

Fig. 3: Board of Innovation - Quirky [5]

The Board of Innovation uses distinct icons clarified by text to identify between different types of customers and partners. Flows with transactions represented by smaller icons model the value proposition, processes, activities and revenue flows. Costs are left out, although including them is possible. The model assumes customers are reached without concretely specifying how, as can be seen in Figure 3.

5.2 Effectiveness and Efficiency Comparison

As mentioned in the introduction, in the context of this research effectiveness is regarded as to what extent the business modeling technique successfully communicates and captures the entirety of the business model. Efficiency, on the other hand, is defined as how comprehensible and explicit all modeled information is communicated to the reader and how flexible and adaptable the business model capturing process is. To be able to effectively assess these four aspects, each is broken down into a number of elements that will be compared. Both definitions and all elements were extracted from the interviews with industry experts.

Communicating effectiveness

1. **Acceptance**: of the technique in business and academics.
2. **Internal Cohesion**: the elements of the model are related to one another.
3. **Number Concreteness**: concrete numbers are shown in the model.

Capturing effectiveness

1. **Explicit Modeling Method**: instructions explicitly defining the approach are provided.
2. **Method Efficacy**: instructions are easily translated into practice.
3. **Absence of Redundancy**, the resulting models contain no redundant information.

Communicating efficiency

1. **Accessibility and Understandability**: accessible and understandable at first encounter of a model resulting from the modeling technique.
2. **Value Proposition**, External Process, Internal Process, Transaction and Partner Explicitness: explicit representation of aforementioned elements in the model.

Capturing efficiency

1. **Evolvability**: modeling approach can be changed without redesigning the entire approach.
2. **Flexibility**: inclusion of concepts can be adapted to the modeler's needs.

With the evaluation of the preceding section in mind, we expect the Board of Innovation and Software Ecosystem Model will be least effective and efficient in documenting and communicating business models of software companies, whereas the Business Model Canvas will have a negligible amount of complications.

Business Model Canvas Modeling the startups appeared to be easy thanks to the collaborative, iterative and segmented style of the business Model Canvas. In practice modelers struggled with the individual segments and considered them unclear concepts. The provided discussion questions for each segment that are supposed to provide thinking guidelines turned out to be a double edged sword. More often than not the questions lead to considering the segment completed after answering the questions or provoking discussion on semantics of the segments instead of the segments themselves. Moreover, although including arrows is encouraged in order to clarify relationships between segments this often results in cluttered models with reduced communication value. Lastly, it is difficult to determine when a model is satisfyingly correct and/or complete thanks to the flexibility of the technique. Regardless of these inconveniences all entrepreneurs preferred the Business Model Canvas for documenting the business model because it contained the most explicit information on both tangible and intangible aspects of the business and communicated the information in a highly accessible manner.

Opinions regarding communicating effectiveness and efficiency were varied among industry experts. Most stated the Business Model Canvas is a great tool because it provokes modelers to actively think about all required aspects of a business model and has a strong emphasis on clearly communicating the value proposition. At the same time they thought the technique still had room for improvement when it comes to explicitly presenting crucial aspects of business models. Instead of using vague, general terms such as customer retention and acquisition, segments should clarify how the business aims to achieve these goals. Furthermore, although the Business Model Canvas identifies the cost factors, revenue streams, key partners and key activities, no information is given on concrete figures of costs factors and revenue streams, what the role of these partners is, nor what concrete processes the key activities entail. According to the

experts this information is crucial to communicate the differentiating factors of the business. Lastly, the experts stated that the ambiguous discussion questions lead to a confusing documenting process. One entrepreneur experienced with using the technique in project groups reiterated that many people resort to strictly filling in the discussion questions. Seven out of eight experts preferred the Business Model Canvas for their communication needs, although three out of seven stressed that it was important to include a process focused model such as the Board of Innovation.

Software Ecosystem Model Modeling the startups on a whiteboard was easy compared to the digital modeling process. The Software Ecosystem Model comes with templates for use with modeling software such as Microsoft Visio or Omnigraffle, which do not facilitate automatically formatting the individual elements. Instead these software products require modelers to carefully align every single element by hand, resulting in a large amount of tedious tasks. Moreover, whenever changes are necessary to maintain an up to date model, all numbers on the labels and in the legend need to be changed manually. This discourages keeping the model current and results in a particularly painful modeling experience. Furthermore, although modelers are instructed to include *all* software suppliers, the questions was raised to what extent *all* reaches. Software products which are built with Ruby, should theoretically include 31 gems by 21 different developers when deploying the core Ruby on Rails framework. Including all the tiniest suppliers will inevitably lead to a confusing SSN, cluttered by dozens of suppliers. Regardless of these inconveniences, the main objection for the entrepreneurs not to prefer this model was its incapability of including intangible elements of a business such as good-will, status or customer relationships. Last but not least is the high level of entry for non-technical modelers. Without extensive technical knowledge the model turned out to be inapplicable.

All experts considered the Software Ecosystem Model to be ineffective and inefficient at communicating a business model. Although the extensive inclusion of supplier details received praise, the model was deemed too technical, inaccessible and unattractive to be used as a communication tool towards potential investors. All experts said that they were not provoked to study the transactions due to the use of text instead of images. Moreover the priority of suppliers was impossible to discern because their transactions are not linked to the customer, caused by the congregating lines at both sides of the model. Another implication of this disadvantage is that internal software and business logic can not be included, which the entrepreneurs regard as an essential concept as identified in section 3. Similar to the Business Model Canvas no concrete figures or profitability estimates are provided. One entrepreneur with extensive experience with this technique did mention that the Software Ecosystem Model is the only technique that is capable of effectively communicating money flow nuances such as the difference between kick-back fees and license fees.

Board of Innovation Modeling the startups was easy because of concrete guidelines as to what information is expected to be included. Moreover the whiteboard kit that facilitates collaboration was considered to be particularly useful when discussing details of the company with colleagues. On the other hand, entrepreneurs regarded the model to be too simplistic for extensive internal briefing on the business due to its lack of freedom concerning intangible elements. Equivalent to the Software Ecosystem Model, this was the main objection for the entrepreneurs not to prefer this model.

Expert opinions on the Board of Innovation were divided in two camps. Half of the experts appreciated the clear, synoptic approach and lauded the technique's inclusion of strictly essential aspects. The other half claimed the presented models were *too* simplistic while still requiring to be extensively studied to completely understand the business model and discover what aspects are essential. A frustration all experts agreed on was that the relation between transactions of different actors was unclear. Again, missing information on core internal activities was a source of criticism.

6 Discussion of Advantages and Disadvantages

Table 3 was created by assessing the (dis)advantages identified in the preceding section for each element introduced in section 5.2. Considering the results of the theoretical comparison of BMTs and preference of entrepreneurs and industry experts we expected the Business Model Canvas to have a negligible amount of disadvantages in comparison with the Software Ecosystem Model and Board of Innovation. Although the Business Model Canvas is the strongest BMT when it comes to communicating effectiveness and capturing efficiency, the Board of Innovation is superior in efficiently communicating and effectively capturing a business model. Moreover the Board of Innovation has a larger absolute number of positive aspects (7 versus 10). Therefore, we were inclined to think that the Board of Innovation is the most effective and efficient BMT.

However, industry experts specifically stressed that the most important aspect of a BMT is to be able to include all differentiating factors of a business and effectively communicate those factors to potential investors. This are the exact aspects the Business Model Canvas accomplishes best, while the Board of Innovation has a weaker approach. Furthermore, all negative aspects of the capturing effectiveness are caused by the ambiguous guidelines presented in the handbook. These aspects can easily be improved by explicating what is expected of the modeler, providing concrete modeling guidelines and updating the examples to include more explicit information. Although this simultaneously solves the partner inexplicitness and number inconcreteness, explicit process information remains absent. This is where the Board of Innovation comes in. The flexibility allows modelers to painlessly incorporate internal processes by modeling the internal logic in a large business icon, perfectly complementing the Business Model Canvas. In practice the Business Model Canvas can then be used as a first, general

Table 3: Comparison of all business modeling techniques

			Business Modeling Techniques		
			BMC	**SEM**	**BoI**
Effectiveness	Communicating	Acceptance	+ +	- -	0
		Internal Cohesion	+	-	-
		Number Concreteness	-	- -	-
	Capturing	Explicit Modeling Method	-	+ +	+ +
		Method Efficacy	- -	- -	+ +
		Absence of Redundancy	-	+ +	+ +
Efficiency	Communicating	Accessibility and Understandability	+	-	+ +
		Value Proposition Explicitness	+ +	+	+ +
		External Process Explicitness	-	+ +	+ +
		Internal Process Explicitness	- -	- -	- -
		Transaction Explicitness	+	+	+
		Partner Explicitness	-	+ +	+ +
	Capturing	Evolvability	+ +	- -	+ +
		Flexibility	+ +	- -	-
Legend	+ + Perfect	0 Neutral	- Suboptimal		
	+ Acceptable		- - Unusable		

overview, while the Board of Innovation provides a more elaborate insight concerning role of the partners, the internal and external processes of the business. What BMT is best applicable in a specific use case depends on the working context, but with the knowledge presented in this section we recommend modelers to adopt both the Business Model Canvas and the Board of Innovation when modeling a software business.

7 Conclusions and Future Work

This paper discussed the effectiveness and efficiency of three visual business modeling techniques and presented concrete advantages and disadvantages of each technique. After conducting a literature study and interviews with experts a list of seven essential concepts was identified which each technique should include in their framework. Based on theoretical inclusion of the essential concepts we expected the Business Model Canvas to be most effective and efficient at communicating and documenting business models, whereas the Software Ecosystem Model and the Board of Innovation were expected to garner a considerable amount of criticism.

The documenting process and interviews with experts concerning communication of the business modeling techniques revealed that the Business Model

Canvas 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 the technique still has room for improvement concerning its unclear modeling process and inexplicit representation of certain crucial aspects, such as the provided discussion questions and how to determine when a model is satisfyingly correct. The heaviest criticism was reserved for the Software Ecosystem Model, which was considered unpractical to work with, too technical for non-technical readers and to produce unattractive and inaccessible business models. The Board of Innovation, on the other hand, received acclaim for its pleasant documenting process. Half of the experts praised the clear, synoptic modeling approach which results in accessible and efficient models. However, the other half of the experts considered the resulting models to be too simplistic for most of their needs. In the discussion we analyzed the strong and weak points of each technique and concluded that the Business Model Canvas is the most effective communicating and efficient documenting technique because of its acceptance and internal cohesion, and evolvability and flexibility respectively. These aspects are considered to be the most important aspect of a business modeling technique by the industry experts. The Board of Innovation is considered as the most effective documenting and efficient communicating technique due to its extremely simple approach when both capturing and modeling. The Business Model Canvas and Board of Innovation complement each other on communication of the entire business model. This resulted in the recommendation of adopting both business modeling techniques when modeling a software business.

Future work includes validating the (dis)advantages through quantitative research consisting of more case studies and interviews with experts. Furthermore improvements based on the identified (dis)advantages need to be incorporated into the business modeling techniques. For example, the Software Ecosystem Model requires a complete overhaul of the modeling approach and a graphical redesign in order to become relevant and accessible for non-technical readers.

References

1. Gordijn, J., Akkermans, H.: Designing and Evaluating E-business Models. In: IEEE Intelligent Systems. 16, 11-17 (2001)
2. Yin, R. K.: Case Study Research - Design and Methods. SAGE Publications, Newbury Park (2003)
3. Osterwalder, A., Pigneur, Y., Tucci, C. L.: Clarifying Business Models: Origins, Present and Future of the Concept. In: Communications of the Association for Information Science. 16, 1-25 (2005)
4. Brinkkemper, S., Soest, I., Jansen, S.: Modeling of Product Software Businesses: Investigation into Industry Product and Channel Typologies. In: 16th International Conference on Information Systems Development, pp. 307-325. Springer, Boston (2009)
5. Mey, N. de, Ridder, P. de: Board of Innovation, http://www.boardofinnovation.com

6. Chesbrough, H., Rosenbloom, R.S.: The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin off companies. In: Industrial and Corporate Change. 1, 529-555 (2002)
7. Morris, M., Schindehutte, M., Allen, J.: The Entrepreneur's Business Model: Toward a Unified Perspective. In: Journal of Business Research. 58, 726-735 (2005)
8. Johnson, M. W., Christensen, C. M., Kagermann, H.: Reinventing Your Business Model. Harvard Business Review. 12, 50-59 (2008)
9. Linder, J., Cantrell, S.: Changing Business Models: Surveying the Landscape. Accenture Institute for Strategic Change, Cambridge (2000)
10. Lagha, S. B., Osterwalder, A., Pigneur, Y.: Modeling e-business with eBM. In: 5th International Conference on Management of Networked Enterprises (CIMRE), pp. 1-14. Mahdia (2001)
11. Pateli, A. G., Giaglis, G. M.: A Framework For Understanding and Analysing e-Business Models. In: Eur. J. Inf. Syst. 13, 302-314 (2004)
12. Osterwalder, A.: The Business Model Ontology - a proposition in a design science approach. Unpublished doctoral dissertation, HEC Lausanne (2004a)
13. Osterwalder, A.: Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Wiley, Hoboken (2010)
14. Shafer, S. M., Smith, H. J., Linder, J.C.: The Power of Business Models. In: Business Horizons. 48, 199-207 (2005)
15. Osterwalder, A., Pigneur, Y.: Investigating the Use of the Business Model Concept through Interviews. In: 4th International Conference on Electronic Business, pp. 568-573. Academic Publishers/World Publishing Corporating, Beijing (2004b)
16. Weill, P., Vitale, M.: Place to Space: Migrating to Ebusiness Models. Harvard Business Press, Boston (2001)
17. Boucharas, V., Jansen, S., Brinkkemper, S.: Formalizing software ecosystem modeling. In: 1st international workshop on Open component ecosystems, pp. 41-50. ACM, New York (2009)
18. Penker, M., Eriksson, H.: Business Modeling With UML: Business Patterns at Work. Wiley, Hoboken (2000)