Architecture and Implementation of a Decision Support System for Software Industry Business Models

Completed Research Paper

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ABSTRACT

The choice of the right business model is a crucial success factor, particularly in fast evolving industries like the software industry. Business model configuration from scratch but also the monitoring of the business model once it is configured represent important criteria for software companies to establish their business idea at the market. This paper presents an architecture design and its prototypical implementation of a business model assistance system that facilitates companies in the software industry to compose their business model as well as to carry out modifications on an already existing business model through business model monitoring. Therefore, users are provided feedback about the quality of their current business model by the use of KPIs as feedback parameters. The prototype has been developed based on previously carried out research work concerning the definition of business model elements in the software industry and the derivation of a software industry value chain.

Keywords

Business model, business model dynamics, decision support, software industry.

INTRODUCTION

A company’s long-term success is strongly influenced by an exhaustive conception and continuous improvement of its business model. A business model represents a “…conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm” (Osterwalder, Pigneur and Tucci, 2005). Thereby, it provides an abstract view on a company’s organizational structure and its value chain (Al-Debei and Avison, 2010; Demil and Lecocq, 2010; Richardson, 2008; Staehler, 2001).

Particularly in a fast evolving industry like the software industry, enterprises must be able to compose and describe their business model in a structured manner to prevail over competitors in the long run. Once the business model is defined, enterprises must have the chance to continuously monitor their business model and – if required – adapt it to external or internal influencing factors. Hence, besides the standardized configuration of business models, enterprises must also be offered the possibility to dynamically manage and control their business model.

Interest in business models has been increasingly in the focus of scientific research. However, in literature and practice there still exist several research gaps (Bellman, Clark, Malcolm and Ricciardi, 1957; Knyphausen-Aufsess and Dodo Meinhard, 2002; Osterwalder et al., 2005; Pateli and Giaglis, 2004; Timmers, 1998). Although various approaches regarding a standardized description of business models have been followed, to date no methodology for their standardized description and dynamic adaptation has been established (Scheer, Deelmann and Loos, 2003). So far, practice oriented approaches, such as IBM’s “Component Business Model” (Pohle, Korsten and Ramamurthy, 2005) or the “Business Motivation Model” (Business Rules Group, 2007) do not support a standardized configuration, monitoring or adaptation of business models in a full extent. One further critical aspect about current research is the generality of the business model concept. Although several research work about the constituent elements of business models exist, such as Linder and Cantrell’s “Change Models” (Linder and Cantrell, 2000) or Morris’ “Business Model Components” (Morris, Schindehutte and Allen, 2005), the derived concepts have no focus on a specific industry. As a result, current business model concepts neither support a
standardized consideration nor a detailed description of business models (Ghaziani and Ventresca, 2005). Hence, to date companies are not enabled to monitor the quality of their current business model nor carrying out modifications. Another critical aspect is the lack of software tools for automated support in terms of construction and comparison of business models. So far, existing tools such as the “Business Model Canvas”\(^1\) or “Phase 2 Generator”\(^2\) concentrate on generic aspects about business models not taking into consideration a standardized configuration or adaptation of business models to dynamic aspects (e.g. to current market developments).

This article presents an architecture proposal and its prototypical implementation of an assistance system that supports software-producing companies to configure their business model from scratch and, after having configured their business model, to continuously monitor its quality based on the definition of software industry-specific KPIs. Based on the monitoring results companies are supported to adapt specific aspects of their business model to external or internal influencing factors. The presentation of the functionalities of the assistance system is split into three scenarios. The first scenario describes how software companies receive support in modeling their business model from scratch whereas the second scenario explains how certain aspects of an already existing business model can be modified. The third scenario describes the monitoring feature of the business model assistance system.

The research work presented in this article follows a design-oriented approach (Hevner, March, Park and Ram, 2004). Preliminary research work of Schief and Buxmann (2012) as well as Pussep, Schief and Widjaja (2012) form the theoretical basis for the development of the assistance system. Shortcomings derived by their research work are used to specify the requirements for the assistance system. Schief and Buxmann developed 20 morphological building blocks for business models in the software industry, which in the context of the assistance system, are particularly used in terms of business model configuration from scratch (scenario 1). Pussep et al. (2012) derived the software industry value chain, which forms the basis for the consideration of dynamic aspects in terms of business model monitoring and business model adaptation (scenario 2 and 3). Thus, the assistance system supports decision makers of software producing companies to compose new business models, monitor its quality and to modify already existing business models.

Initially, while the first chapter provides details of the related work and the research method, the second chapter introduces the theoretical foundations that are relevant for the development of the assistance system. The chapter “Conception of the Business Model Analysis System” explains the underlying architecture and the correlations between the existing layers of the architecture design. The section “Use Case Description and Prototypical Implementation” describes the use case scenarios that demonstrate the features of the business model assistance system. The paper closes with a conclusion and an outlook on future research.

THEORETICAL FOUNDATIONS OF THE BUSINESS MODEL ASSISTANCE SYSTEM

This chapter explains the theoretical basis of the prototype. First, the constituent elements of business models in the software industry are going to be introduced, followed by an explanation of the software industry value chain.

Business Model Elements for Software-Producing Companies

To be able to develop an assistance system for the configuration, monitoring and adaptation of business models, first a conceptual and structured description of basic business models elements has to be defined (Di Valentin, Emrich, Werth and Loos, 2012; Krys, Knyphausen-Aufsess and Dodo Bieger, 2011; Morris et al., 2005; Timmers, 1998). Thereby, a concentration on a specific industry sector with its typical characteristics enables to obtain as detailed information as possible. Business model elements do not represent entire business models, but they describe the integral components that make up a business model (Linder and Cantrell, 2000). By decomposing a business model into its constituent parts, enterprises are offered a structured approach for a standardized description, analysis and comparison of their business model (Burkhart, Di Valentin, Vanderhaeghen, Werth and Loos, 2012). So far, several analysis in literature and practice have been carried out regarding the constituent elements of a business model (Di Valentin et al., 2012; Linder and Cantrell, 2000; Morris et al., 2005). However so far, the focus has been on generic aspects not taking into account the characteristics of specific industries.

The business model elements presented in this paper refer to the software industry. Several literature studies and expert interviews with representatives from the software industry have been carried out by Schief and Buxmann (2012) to derive the

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1. http://www.businessmodelgeneration.com
Di Valentin et al.  DSS for Software Industry Business Models


constituent elements of business models in this industry. The result is a morphological box consisting of 20 building blocks (business model elements) that enable a standardized and comprehensive description of business models in the software industry. These building blocks have been classified to 5 business model categories, namely strategy, revenue, upstream, downstream and usage (Schief and Buxmann, 2012):

<table>
<thead>
<tr>
<th>Category</th>
<th>Business Model Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>strategy</td>
<td>unique selling proposition</td>
</tr>
<tr>
<td></td>
<td>product portfolio</td>
</tr>
<tr>
<td></td>
<td>value chain strategy</td>
</tr>
<tr>
<td></td>
<td>investment horizon</td>
</tr>
<tr>
<td>revenue</td>
<td>license model</td>
</tr>
<tr>
<td></td>
<td>pricing model</td>
</tr>
<tr>
<td></td>
<td>sales volumes</td>
</tr>
<tr>
<td></td>
<td>operating margins</td>
</tr>
<tr>
<td>upstream</td>
<td>technical platform</td>
</tr>
<tr>
<td></td>
<td>principles</td>
</tr>
<tr>
<td></td>
<td>localization</td>
</tr>
<tr>
<td></td>
<td>degree of standardization</td>
</tr>
<tr>
<td>downstream</td>
<td>sales channel types</td>
</tr>
<tr>
<td></td>
<td>target industries</td>
</tr>
<tr>
<td></td>
<td>target customer size</td>
</tr>
<tr>
<td></td>
<td>target customer type</td>
</tr>
<tr>
<td>usage</td>
<td>operating model</td>
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<tr>
<td></td>
<td>support model</td>
</tr>
<tr>
<td></td>
<td>maintenance model</td>
</tr>
<tr>
<td></td>
<td>replacement strategy</td>
</tr>
</tbody>
</table>

Table 1. Business Model Categories and Business Model Elements in the Software Industry (Schief and Buxmann, 2012)

Each business model element can be described by specific characteristics (e.g. “target customer size” can have as specification: “individual customer”, “small organization”, “medium organization” or “large organization”).

Software Industry Value Chain

Business models are often seen as an adjustor between a company’s strategy and its business processes. Although business models and business processes are characterised by a close relationship, these terms however are often used interchangeably in practice (Harmon, 2009). Business models contain an abstract view on a company’s core logic of creating value (Osterwalder et al., 2005) whereas the business process model describes the implementation of a concrete scenario into executable process steps. This aspect can be explained e.g. by the production of an output by the use of several input factors (Gordijn, Akkermans, Van Vleet, 2000; Hammer and Champy, 1994). Thus, a company’s business model and strategic goals form the basis for the design of the underlying business processes (Scheer, Jost, Heß and Kronz, 2005). In doing so, a clear understanding about the scenario to be modelled can be gained as changes within a company’s business model influence its underlying business processes.

In addition to the derived business model elements, a software industry-specific value chain has been derived, based on several literature and practical studies (Pussep et al., 2012). This software industry value chain forms the basis for the consideration of the process view within the assistance system as well as the monitoring of a business model’s quality. Therefore, a mapping between the derived business model elements and the software industry value chain has been derived, by classifying specific business processes of the software industry value chain to each business model element of the morphological box (Burkhart et al., 2012). The software industry value chain consists of 10 activities:

![Software Industry Value Chain](image)

Figure 1. Software Industry Value Chain (Pussep et al. 2012)
To each activity in this value chain diagram specific business processes are assigned to. Hence, modifications on specific business processes caused by modifications on business model elements come along with implications for the corresponding value chain activity. If e.g. a software company decides to change its operating model from “On Premise” to “On Demand”, these modifications will go along with changes on the underlying value chain activities, such as the activity “Marketing”.

CONCEPTION OF THE BUSINESS MODEL ANALYSIS SYSTEM

In general, an assistance system represents a computer-based system that supports humans in decision making (Blutner, Cramer, Krause, Mönks, Nagel, Reinholz and Witthaut, 2009). In the context of this paper, an assistance system for business models represents a tool that supports several target groups in the software industry (company founders and companies that have been active in the marketplace for some time) to compose their business model as well as to monitor and carry out modifications on an existing business model.

Due to the close relationship between business models and business processes, the prototype is interfaced to business process level. By this means, the prototype supports several scenarios: On the one hand it facilitates company founders to configure their business model from scratch. Beyond that, it also indicates the effects of changes within one business model element on its underlying business processes (e.g. an outsourcing of business processes, which is caused by changes on the business model is accompanied with modifications on resource allocations and responsibilities in the underlying business processes). The following figure depicts the design approach of the prototype which follows a three tier architecture:

![Conceptual Design of the Business Model Assistance System](image)

Data Source Level:

The layer of data sources encompasses the data sources that are interfaced to the prototype. The reference database forms the basis for carrying out market analysis. It contains a large collection of reference business models for software producing companies. These data were elicited from the 100 largest software companies worldwide (based on the US classification scheme of SIC codes), by considering dimensions like annual accounts, transaction volumes, number of employees etc. (Schief, Pussep and Buxmann, 2012). By this means, similar business models of companies that are already active in the market can be taken into consideration as reference for the own business model. This data can be also used to compare and evaluate the own business model with those of competitors. An additional interface to the web allows taking into account...
current information when composing or modifying the underlying business model. Hence, current market data such as competitive analyses, forecasts or industry sales can be dynamically considered as reference for the own business model.

Application and Analytics:

The second layer comprises all major functionalities for analytic features and basic modifications for business models. Based on the layer of data sources dependency analysis within the business model elements can be carried out among the business model elements to make statements about how modifications within one business model element influence the other elements. Hence, recommendations within each step of business model modification can be carried out (BM Recommender Component). An interface to the process modelling tool ARIS supports the process of business model transformation into executable business processes. Thereby, users are shown within each step of business model modification, how these changes affect the underlying business processes.

User Interface:

The user interface represents the most aggregated level in which information about the evaluated data is provided to the user (e.g. company founders or executive managers). The interface to the web and to the reference data base allows to carry out market analyses and to present current market developments and / or the development of software companies along a timeline based on semantic knowledge networks. This helps company founders to get an overview about the specific market segment in which they plan to establish their business (Market Analysis View). However, the visualization of the market analysis view is not in the focus of this paper.

USE CASE DESCRIPTIONS AND PROTOTYPICAL IMPLEMENTATION

In this chapter, the three use case scenarios for the implementation of the prototype as well as first evaluation results in form of expert interviews with representatives in the software industry are going to be presented.

Use Case 1: Configuration of a Business Model from Scratch

The first scenario focuses on company founders in the software industry that intend to start their own business to transform their business idea into practice. Before company founders can transfer a concrete business plan into practice, they first have to get an overview about the key elements of their business model. Hence, company founders are informed about which components are most important to transform their business idea into practice. Within this scenario the prototype supports company founders to configure their business model from scratch by clicking through the 20 business model elements and selecting several specifications within each element. Within each business model element users are shown several specifications to select:

![Business Model Element with its Specifications](image)
The figure above shows the business model category “Upstream”, which consists of the business model elements “Technical Platform”, “Principles”, “Localization” and “Degree of Standardization” (Schief and Buxmann 2012).

After having configured the business model, users receive an e-mail with a comprehensive overview of their configured business model (see Figure 6) containing the constituent elements of their business model in a structured manner. Based on the connected business model reference data base several market analyses are being carried out to recommend users potential investors that are convenient in supporting their business idea (the explanation of the “data analysis” component in the previous chapter describes the sample which forms the basis for carrying out these market analyses). Furthermore, users are shown a list of competing enterprises that pursue a similar business idea and consequently could be potential rivals once the business is running. This aggregated information can be used as a basis for consultation interviews with potential investors that are needed to start the business. Besides company founders, further target groups of this scenario are analysts, scientists or business developers.

Use Case 2: Business Model Adaptation

The second scenario focuses on enterprises that have been active in the market for some time and intend to change several aspects about their already existing business model. In this scenario, the prototype provides recommendations about business model adaptations for specific business model elements. An interface to the process modeling tool ARIS shows how changes within single business model elements influence a company’s business processes. If users change one element of their business model, effects on the other elements of the business model are displayed in form of recommendations. Figure 4 shows an example for a recommendation. In this example, users get informed that a change within the business model element “localization” from “national distribution” to “pan-European distribution” influences the business model element “sales volumes”:

![Figure 4. Recommendations for Business Model Modifications](image)

Within each step of business model modification, the underlying value chains and business processes are indicated through an interface to ARIS (see Figure 4: “arislinks”). Thereby, within each step of business model adaptation, the software industry value chain is deposit. By clicking on an activity of the value chain, an EPC-diagram is displayed in ARIS which indicates all related organizational units, functions, information flows and resource objects of the value chain activity’s underlying business processes:

![Figure 5. Interface to Business Processes](image)
Figure 5 demonstrates with the example of the process step “conducting marketing activities” how users gain insight about related aspects concerning this business process step. Thereby, users are provided information about the effects of business model modifications on the underlying business processes by indicating all related views of the business process. Thus, if specific aspects about a business model change, users are informed which artifacts within the related process step are affected and should be considered in terms of business model adaptation.

**Use Case 3: Business Model Monitoring**

To be able to continuously control the quality of the configured business model, the business model assistance system offers the functionality of defining specific KPIs to business model elements. Therefore the prototype is connected to the ARIS Business Server by a KPI-annotation tool. The following Figure shows a small cut-out of an already configured business model. The selected business model elements of the current business model are highlighted:

![Excerpt of a Configured Business Model](image)

**Figure 6. Excerpt of a Configured Business Model**

By clicking on a business model element (left row of the morphological building blocks) the software industry value chain with its 10 activities is shown in form of an overlay highlighting the process which belongs to the chosen activity:
Selecting an element from the software industry value chain forwards the user to one or several corresponding business processes. For instance, if the user selects the business model element “support model”, the corresponding activity in the value chain diagram is highlighted. By clicking on this activity, the corresponding business processes belonging to the value chain activity “support” will be opened.

Business processes are displayed within the “Business Process KPI Annotator”, which allows the annotation of KPIs to specific entities of the displayed business process. These KPIs have been derived by several literature studies and expert interviews with 13 practitioners from the software industry (Bonakdar, Weiblen, Di Valentin, Zeissner, Pussep, Schief, 2013) to ensure the selection of key measures of high practical relevance (for more information about these interviews see the next section and the publication of Bonakdar et al. 2013). If the user clicks at a function within the business process model (in this example “service request registration”) a box in form of a popup is opened in which the user can select predefined KPIs to attach to this function. Thereby, business processes are modeled in form of Event Driven Process Chains (EPCs). Figure 8 shows the Business Process KPI Annotator with annotated KPIs to specific functions of the EPC-diagram:
After the successful KPI-annotation the representation of the business model in the prototype is updated. Thereby the annotated KPIs of the edited business process are added to the corresponding business process element. Critical values of KPIs are highlighted by a red marker whereas a green marker implies that the value of the KPI is in a non-critical state. Hence, the presentation of the business model gives users a clear overview of the KPIs belonging to the business model and allows further strategic analysis from business model perspective.

**First Evaluation Results**

For the presented prototype first evaluations in form of expert interviews have been carried out in practice with representatives in the software industry. Thereby, the configuration of a business model (use case 1) as well as the adaption of a business model (use case 2) has been carried out by practitioners. The representatives were either CEOs or employees with strategic and managerial tasks. In total, 13 representatives have been consulted, thereof 7 large and 6 small and medium sized enterprises. For more information concerning this study see also Bonakdar et al. (2013). To gain results which can be applied to the entire software industry, the composition of the selected software companies was as broad as possible. Therefore, the expert interviews have been carried out with software companies that are established in several market segments such as e-learning software producers, enterprise software producers or providers of media asset management systems. First, interviewees had to compose their business model based on scenario 1. In a next step, interviewees had to carry out modifications on a fictive, already existing business model according to the scenario “Business Model Adaptation”. Furthermore, we could gain valuable insights about relevant KPIs that should be considered in terms of monitoring a business model. For this purpose, after the evaluation of the use case scenarios, interviewees had to classify to each activity of the software industry value chain key measures (e.g. “number of service requests”, “number of bugs” or “number of implementation inquiries”) that are relevant in their opinion to monitor the quality of a business model in the software industry (Bonakdar et al, 2013; Di Valentin et al 2012). The next phase of the evaluation will be focused on evaluating the feature of “Business Model Monitoring” (use case 3 represents the enhancement of the first version of the prototype which only covered use case 1 and 2).

The first evaluation results have demonstrated that most interviewees estimate the research work as highly relevant (85 %), whereas 15 % claimed that the implemented concept is too academic as it tries to convey the derived research results into a holistic construct. 68 % stated that aspects about the relationships between business models and business processes, as supported within the second scenario are already taken into consideration in practice. However, there is still a lack of a conceptual method for considering these interrelations and monitoring the quality of the underlying business model. In the most interviewees’ point of view, the evaluated prototype is most useful for start-up companies establishing their business model from scratch. Hence, the majority of the interviewees estimate the scenario “Configuration of a Business Model from Scratch” as highly relevant.

**CONCLUSIONS AND OUTLOOK**

This paper has presented a tool for an assisted configuration, monitoring and adaptation of business models in the software industry. In previously carried out research work, a software industry value chain and software industry-specific business model elements have been derived which form the conceptual basis for the presented business model assistance system. The assistance system supports several target groups. Start-up companies are assisted to compose their own business model from scratch. Companies with an already existing business model are supported to monitor the quality of their business model and – if required – to carry out modifications on an already existing business model.

The scenario “Configuration of a Business Model from Scratch” so far does not provide recommendations within each step of business model configuration. Thus, current research work focuses on an integration of (proactive) recommendations within each step in the process of business model composition. Therefore, existing interrelations between the business model elements have to be analysed and taken into consideration. So far, the focus of the prototype has been on the software industry. In future research work, further industry branches (e.g. automotive industry) should also be taken into consideration to derive a structured framework for a standardized description of business models. Hence, business model components and value chain activities of further industries have to be carried out and transferred into a conceptual framework. The current version of the prototype is connected to business process level through the process modelling tool ARIS. In future research, further process modelling tools will be integrated to enable broader application potentials of the assistance system.
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REFERENCES


