Requirements and Design Principles for Business Model Tools

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Requirements and Design Principles for Business Model Tools

Completed Research

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Abstract

Software tools hold great promise to support the modeling, analyzing, and innovation of business models. Yet, both research and practice lack a clear overview of the requirements and design principles for developing such tools. To tackle this issue, we gather requirements and design principles for business model software tools based on a structured literature review. We cluster the requirements within five core functions of tools and map subsequent design principles. By collecting and synthesizing various requirements and design principles, we provide a foundation for further research on business model software tools. In practice, these results contribute to the development of tools and can serve as an evaluation framework for intermediate development states and existing business model software tools. Future research can employ these results for artifact creation. This research guides the development of business model software tools to support firms in sustaining a competitive advantage.

Keywords

Business Model, Requirements, Tool, Analysis, Simulation

Introduction

Business Models (BMs) are important for company success, and they receive significant attention in theory and practice (Al-Debei and Avison 2010; Ebel et al. 2016; Szopinski et al. 2019; Weking et al. 2019). With competition growing steadily due to digitalization and globalization, and environments and customer requirements changing faster than ever, companies are forced to continuously adjust their BMs if they want to stay competitive (Augusteinstein 2019; Ebel et al. 2016; Saebi 2015). A BM describes the methods of value creation, value delivery, and value capture of a business venture (Teece 2010).

A BM needs to be developed, analyzed, and benchmarked against competitors. In practice, it is important to analyze and optimize the model for profitability and robustness, while allowing for strategic flexibility. The complexity of modeling and innovating a BM increases in today’s business environment, and alternative BM decisions need to be evaluated (Athanasopoulou et al. 2018b). With external shocks, fast-changing legislation, and intensifying competition, it is necessary to frequently adapt or innovate a BM (Augusteinstein et al. 2018; Schaffer et al. 2019; Weking et al. 2018).

To develop, evaluate, and manage BMs, computer-aided tools can be of help (Osterwalder and Pigneur 2013; Szopinski et al. 2019). The literature emphasizes the potential benefits software tools can offer and has called for further research on the subject (Ebel et al. 2016; Szopinski et al. 2019; Veit et al. 2014). Osterwalder and Pigneur highlight that tools “[...] should go beyond simple design tools and evolve into an own class of high-level decision support tools” (Osterwalder and Pigneur 2013). It is necessary to understand the requirements for the development of tools, and to know which design principles can be applied to fulfill these requirements. Researchers and practitioners lack guidance on building and selecting software tools (Szopinski et al. 2019). Extant BM research focuses on a variety of aspects and is fragmented.
(Massa et al. 2017). To the best of our knowledge, no comprehensive and integrative review of requirements and design principles for developing BM software tools exists.

To support the development of such tools, this paper gathers requirements and design principles for BM software tools based on a literature review. We use this methodology to structure the fragmented literature on BM software tools to provide an organized and integrative view supporting tool development.

The remainder of the paper is structured as follows: First, we illustrate the literature on extant software tools for BMs. Afterward, we outline the applied methodology of our research, building on a literature review following the guidelines of Webster and Watson (2002). Subsequently, the concrete requirements and design principles are introduced, clustered along five core functions identified within the coding process. In concluding the paper, we present the implications of this research.

**Extant Software Tools for Business Models**

The basis for tools in the context of BMs is a defined understanding of what constitutes a BM, i.e., which BM ontology or representation is applied. The most common model is the Business Model Canvas by Osterwalder and Pigneur (2010), which has become the quasi-standard for representing BMs (Massa et al. 2017). The Business Model Canvas is a BM ontology and, at the same time, the literature presents it as a tool for BM innovation. Other widely known tools are the e3-Value ontology (Akkermans and Gordijn 2003) or the St.Gallen Business Model Navigator (Gassmann et al. 2013).

Within this review, we focus on the requirements and design principles for BM software tools. Software tools are created using modern IT resources, such as software applications. Various software tools have been proposed to allow the representation and change of BMs (Szopinski et al. 2019). Many of the existing tools are restricted to designing and visualizing a BM (Terrenghi et al. 2017). Individual attempts have been made to identify IT’s role in other areas, such as BM transformation, evaluation, and management (Augenstein 2019; Rambow-Hoeschele et al. 2019; Terrenghi et al. 2017). Dellermann et al. (2019) develop a decision support system for BM validation. Peinel et al. (2010) describe a modeling method to support BM planning in the context of eGovernment. In a series of papers, Athanasopoulo et al. develop a tool for BM development in the context of the Internet of Things, implementing prefilled BMs utilizing so-called solution-based patterns (Athanasopoulo et al. 2018a; Athanasopoulo et al. 2018b; Athanasopoulou and de Reuver 2018).

Regarding the requirements for BM software tools, Szopinski et al. (2019) analyzed 24 programs in practice, providing characteristic functions and a comprehensive taxonomy of those tools. Dellermann et al. (2019) developed design principles for decision support systems for BM validation. Ebel et al. (2016) proposed 20 functions to innovate BMs. Fritscher and Pigneur (2014b) analyzed user adoption of key features of computer-aided BM design. Yet, existing software tools are often not used to their full potential and mostly support a rather static perspective on BMs, not allowing to evaluate different strategic scenarios or to incorporate inherent dynamics.

**Methodology**

We gathered requirements and design principles based on a structured literature review following the guidelines proposed by Webster and Watson (2002). To avoid bias resulting from exclusively searching articles in specific domains or leading journals, we used three different databases: Scopus, EbscoHost and Google Scholar.

All search streams included the term “business model” as this is the focus of our research. We focused on two additional terms (“tool” and “requirements”) along with synonyms of these terms, connected with an AND-operator. We did not restrict the search to the term “tool”, as the term itself is used in different ways within the literature. We additionally searched for “software”, “IT support”, “decision support”, “evaluate”, “simulate” (as there are evaluation and simulation approaches in the BM context, which also use tools, that are not tagged as such) and “simulation”. Along with “require”, we searched for “design principle” and “function”. We used a variety of search streams combining the terms above within the databases. The most important search queries were:
The literature search led to a total of 1147 hits within the databases. After extracting doublets, the initial number of papers found was 627. We first screened article abstracts and then read the full texts. In our review, we included articles that 1) deal with BMs and 2) describe either software-based tools (or similar, as mentioned above) or provide requirements or design principles. For the final selection, we included only double-blind reviewed articles to ensure the use of high-quality literature and articles that have BM tooling as the central research topic. After a forward/backward search, the final sample consisted of 17 papers.

**Figure 1: Literature search process**

For the coding process, two authors independently screened the articles and afterward read the full texts to derive requirements. Inconsistencies in decisions were resolved through discussion and mutual agreement. We follow definitions by Glinz (2007) for requirements. We clustered the requirements among core functions and mapped subsequent design principles. The core functions were derived from the literature search and coding process and display the main categories of functions that BM software tools typically possess. These functions are largely based on the taxonomy of functions for BM development tools in Szopinski et al. (2019) and are the following: *Modeling Support, BM Design, BM Analysis and Evaluation, Collaboration, and Technical Requirements.*

**Requirements and Design Principles**

Based on the coding process presented previously, we derived requirements and subsequent design principles in our five core functions. The requirements present specific demands upon tools stated in the literature. The design principles propose concrete solutions on how a specific requirement can be implemented. Some authors postulate requirements without elaborating on design principles and vice versa.

**Modeling Support**

*Modeling Support* contains the requirements and subsequent design principles for the guidance of users when they engage with the tool. These are, to a large extent, not related to the BM itself, such as providing a stimulating interface, motivating users, or offering clear descriptions. Next, BM-specific requirements to provide support during modeling and to ensure quality are provided. For example, these include the guidance through different BM development phases, automated guideline validations by automated flags, and ensuring the completeness of a BM with a syntax checker. The complete requirements of this function are presented in Table 1.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Design Principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide a stimulating interface (Athanasioupolou et al. 2018a; Ebel et al. 2016)</td>
<td>Multimedia content (Ebel et al. 2016)</td>
</tr>
<tr>
<td>Users have to be motivated (Ebel et al. 2016; Zec et al. 2014)</td>
<td>Gamification techniques (Zec et al. 2014)</td>
</tr>
<tr>
<td>The user should be assisted in being creative (Szopinski et al. 2019)</td>
<td>BM patterns (Szopinski et al. 2019)</td>
</tr>
<tr>
<td></td>
<td>Random or semi-automatically selected idea stimuli (Szopinski et al. 2019)</td>
</tr>
</tbody>
</table>
Requirements and Design Principles for Business Model Tools

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Feature Promotion (Best Practice) (Fritscher and Pigneur 2014b)</th>
<th>Entry Constraints (Use of Keywords) (Fritscher and Pigneur 2014b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tool should facilitate the handling of a BM (Fritscher and Pigneur 2014b; Szopinski et al. 2019)</td>
<td>Link to BMs and framework support (Szopinski et al. 2019)</td>
<td>Element clipboard (Szopinski et al. 2019)</td>
</tr>
<tr>
<td>Ensure correct, complete BMs and usage of provided features (Fritscher and Pigneur 2014b; Rambow-Hoeschele et al. 2019; Szopinski et al. 2019; Voigt et al. 2013)</td>
<td>Validation attributes (Fritscher and Pigneur 2014b)</td>
<td>Automated visual flags (Fritscher and Pigneur 2014a)</td>
</tr>
<tr>
<td>The BM representation should have a clear structure (Athanassopoulo et al. 2018a; Haaker et al. 2017)</td>
<td>Automated hints (Fritscher and Pigneur 2014a; Zec et al. 2014)</td>
<td>Coherence score (Fritscher and Pigneur 2014a)</td>
</tr>
<tr>
<td>Allow users to track the success of their actions (Ebel et al. 2016)</td>
<td>Graphical separation of areas in the BM (Voigt et al. 2013)</td>
<td>Assessment status (Szopinski et al. 2019)</td>
</tr>
<tr>
<td>Provide for constant grounding in the modeling process (Voigt et al. 2013)</td>
<td>Feedback mechanism (Ebel et al. 2016)</td>
<td>Syntax checker (Szopinski et al. 2019; Voigt et al. 2013)</td>
</tr>
<tr>
<td>Give the user the possibility to correct mistakes (Voigt et al. 2013)</td>
<td>Representation of the profitability of the BM (Voigt et al. 2013)</td>
<td>Error warnings (Rambow-Hoeschele et al. 2019)</td>
</tr>
<tr>
<td>Use of a common language and terminology to enable natural interaction (Fritscher and Pigneur 2014a, 2014b; Szopinski et al. 2019; Voigt et al. 2013)</td>
<td>Undo/Redo buttons (Voigt et al. 2013)</td>
<td>Symbolic language familiar to user (e.g. icons) (Voigt et al. 2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standardized controls (Voigt et al. 2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Glossary support (Szopinski et al. 2019)</td>
</tr>
</tbody>
</table>

Table 1. Requirements and Design Principles for Modeling Support

Business Model Design

Business Model Design consists of the requirements for designing a concrete BM. This function focuses explicitly on the process of designing a BM with a tool and the design principles relevant to that process. These are for example a section managing different models, the creation and editing of components, as well as the promotion of common terminology during design. One highly relevant requirement for the tool-based design of BMs is the provision of templates with predefined attributes, elements, BM types, interrelations, or even entire pre-made BMs. Providing templates increases the ease of use and is highly relevant in providing user support during design. Especially for users without a profound knowledge of BMs, the use of templates is crucial and enhances their ability to understand. Additionally, templates help ease the adoption of software-based tools, as they increase usability and reduce the time needed for the design process. Table 2 shows the aggregated list of requirements and design principles for Business Model Design.
Requirements and Design Principles for Business Model Tools

### Requirements

Users have to be able to customize the underlying BM to best fit a certain context (Giessmann et al. 2013; Szopinski et al. 2019)

- Adding of components (Schoormann et al. 2018a, 2018b; Szopinski et al. 2019)
- Merging and dividing of components (Schoormann et al. 2018a, 2018b; Szopinski et al. 2019)
- Renaming of components (Schoormann et al. 2018a, 2018b; Szopinski et al. 2019)
- Changing the arrangement of components (Schoormann et al. 2018a, 2018b; Szopinski et al. 2019)
- Linking of components (Schoormann et al. 2018b; Szopinski et al. 2019)
- Coloring of components (Schoormann et al. 2018a)
- Creation of BM types (Giessmann et al. 2013)

- Providing functionalities for a detailed description of the underlying BM (Di Valentin et al. 2015; Fritscher and Pigneur 2014a, 2014b; Giessmann et al. 2013; Szopinski et al. 2019; Terrenghi et al. 2017)
- (Re)namings and description of created BMs (Giessmann et al. 2013)
- Adding of elements (Fritscher and Pigneur 2014a; Schoormann et al. 2018b; Szopinski et al. 2019; Voigt et al. 2013)
- Deleting of elements (Fritscher and Pigneur 2014a; Schoormann et al. 2018b; Szopinski et al. 2019; Voigt et al. 2013)
- (Re)renameing elements by using text fields (Fritscher and Pigneur 2014a; Schoormann et al. 2018b; Szopinski et al. 2019; Voigt et al. 2013)

- Allowing users to create their own semantic meaning (Fritscher and Pigneur 2014b)
- Duplicating of elements (Fritscher and Pigneur 2014a; Szopinski et al. 2019)
- Free (re)positioning of elements (Fritscher and Pigneur 2014a, 2014b; Schoormann et al. 2018b; Szopinski et al. 2019; Voigt et al. 2013; Zec et al. 2014)
- Guided (re)positioning of elements (Fritscher and Pigneur 2014b)

- Enables logical grouping of elements (Fritscher and Pigneur 2014b)
- Coloring of elements (Fritscher and Pigneur 2014a, 2014b; Zec et al. 2014)
- Links by drag and drop (Fritscher and Pigneur 2014b)

- Provide features for specifying BM versions/variants to compare different solution options (Ebel et al. 2016; Fritscher and Pigneur 2014a; Schoormann et al. 2018b; Voigt et al. 2013)
- Hiding/showing elements selectively (Fritscher and Pigneur 2014b) (Fritscher and Pigneur 2014a)
- Collaborative editor according to the wiki principle (Ebel et al. 2016)

- Users have to be able to refine the BM (Giessmann et al. 2013)
- Feedback loop (Di Valentin et al. 2015; Giessmann et al. 2013)

### Design Principles

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Design Principles</th>
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<td>Users have to be able to customize the underlying BM to best fit a certain context (Giessmann et al. 2013; Szopinski et al. 2019)</td>
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<td>Renaming of components (Schoormann et al. 2018a, 2018b; Szopinski et al. 2019)</td>
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<td>Changing the arrangement of components (Schoormann et al. 2018a, 2018b; Szopinski et al. 2019)</td>
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<tr>
<td></td>
<td>Linking of components (Schoormann et al. 2018b; Szopinski et al. 2019)</td>
</tr>
<tr>
<td></td>
<td>Coloring of components (Schoormann et al. 2018a)</td>
</tr>
<tr>
<td></td>
<td>Creation of BM types (Giessmann et al. 2013)</td>
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<tr>
<td>Provide functionalities for a detailed description of the underlying BM (Di Valentin et al. 2015; Fritscher and Pigneur 2014a, 2014b; Giessmann et al. 2013; Szopinski et al. 2019; Terrenghi et al. 2017)</td>
<td>(Re)namings and description of created BMs (Giessmann et al. 2013)</td>
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<td>Adding of elements (Fritscher and Pigneur 2014a; Schoormann et al. 2018b; Szopinski et al. 2019; Voigt et al. 2013)</td>
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<td>Deleting of elements (Fritscher and Pigneur 2014a; Schoormann et al. 2018b; Szopinski et al. 2019; Voigt et al. 2013)</td>
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<td>(Re)renameing elements by using text fields (Fritscher and Pigneur 2014a; Schoormann et al. 2018b; Szopinski et al. 2019; Voigt et al. 2013)</td>
</tr>
<tr>
<td>Allow users to create their own semantic meaning (Fritscher and Pigneur 2014b)</td>
<td>Duplicating of elements (Fritscher and Pigneur 2014a; Szopinski et al. 2019)</td>
</tr>
<tr>
<td></td>
<td>Free (re)positioning of elements (Fritscher and Pigneur 2014a, 2014b; Schoormann et al. 2018b; Szopinski et al. 2019; Voigt et al. 2013; Zec et al. 2014)</td>
</tr>
<tr>
<td></td>
<td>Guided (re)positioning of elements (Fritscher and Pigneur 2014b)</td>
</tr>
<tr>
<td>Enable logical grouping of elements (Fritscher and Pigneur 2014b)</td>
<td>Enable the application of BM templates (Athanasopoulos et al. 2018a; Di Valentin et al. 2015; Ebel et al. 2016; Fritscher and Pigneur 2014b; Giessmann et al. 2013; Schoormann et al. 2018b; Szopinski et al. 2019)</td>
</tr>
<tr>
<td></td>
<td>Enable the creation and customization of templates (Fritscher and Pigneur 2014b; Giessmann et al. 2013)</td>
</tr>
<tr>
<td>Enable logical grouping of elements (Fritscher and Pigneur 2014b)</td>
<td>Coloring of elements (Fritscher and Pigneur 2014a, 2014b; Zec et al. 2014)</td>
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<td></td>
<td>Links by drag and drop (Fritscher and Pigneur 2014b)</td>
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<td>Provide features for specifying BM versions/variants to compare different solution options (Ebel et al. 2016; Fritscher and Pigneur 2014a; Schoormann et al. 2018b; Voigt et al. 2013)</td>
<td>Hiding/showing elements selectively (Fritscher and Pigneur 2014b) (Fritscher and Pigneur 2014a)</td>
</tr>
<tr>
<td></td>
<td>Collaborative editor according to the wiki principle (Ebel et al. 2016)</td>
</tr>
<tr>
<td>Users have to be able to refine the BM (Giessmann et al. 2013)</td>
<td>Feedback loop (Di Valentin et al. 2015; Giessmann et al. 2013)</td>
</tr>
</tbody>
</table>

### Table 2. Requirements and Design Principles for Business Model Design

**Business Model Analysis and Evaluation**

There are a variety of possibilities for the analysis and evaluation of BMs. The main requirements proposed are the analysis of the external environment, financial analysis, evaluating a BM’s robustness, the identification and planning of changes within a BM, and the visualization and analysis of interdependencies between BM elements. For example, for financial evaluations, different design principles, such as “what-if” analysis, benchmarking, and price simulations can be applied to fulfill these requirements. In general, for the analysis of BMs, the requirements mostly propose metrics-based approaches and call for simulations. Based on this, concrete and quantitative scenarios can be derived and simulated according to the varying goals of the analysis.

In his doctoral thesis, Augenstein (2019) provides a series of papers addressing tooling within the context of BMs, from which requirements for the integration and annotation of data for analysis are derived. The author develops a tool for mining data for the modeling and analysis of BMs based on a mining algorithm. The requirements and subsequent design principles for Business Model Analysis and Evaluation are summarized in Table 3.
**Requirements** | **Design Principles**
---|---
Users need to be able to conduct an analysis of the company's competitive environment and add data to the data set to create a shared understanding (Giessmann et al. 2013; Terrenghi et al. 2017) | Industry benchmarks and market analyses (Ebel et al. 2016)
External links (Ebel et al. 2016)
Attachments of external documents (Ebel et al. 2016)
Shared write board (Ebel et al. 2016)
Data extraction and import (Giessmann et al. 2013) | Structured data tables of raw data (Augenstein 2019)
Mining algorithm (Augenstein 2019)

Provide calculation and consolidation functions to aggregate only BM relevant source data, as well as merging logics to recombine the data (Augenstein 2019) | Push notifications (Fritscher and Pigneur 2014a, 2014b)
Databases in the background (Rambow-Hoeschele et al. 2019)
Semantic network (Augenstein 2019)
Visual links (Augenstein 2019)
Internal links (Rambow-Hoeschele et al. 2019)

Provide functionalities to keep track of external developments (Ebel et al. 2016) | The existing BM should always be visible (Athanasopoulo et al. 2018a)
BM roadmapping (Szopinski et al. 2019)

Need for a prompt signal that can spot a disruption or threat, or opportunity, in advance (Terrenghi et al. 2017) | Non-financial assessment (e.g. ratings or likes) (Szopinski et al. 2019)
Trade-off analysis (Schoormann et al. 2018a)
Creation & evaluation of alternative BMs (Athanasopoulo et al. 2018b)

Enable to digitally visualize interdependencies between BM elements to make value creation process and interdependencies explicit (Augenstein 2019; Szopinski et al. 2019) | Predefined attributes on cost structure and revenue (Fritscher and Pigneur 2014a)

Provide functionalities that allow for basic BM evaluations (Schoormann et al. 2018b; Szopinski et al. 2019) | BM simulation (Terrenghi et al. 2017; Voigt et al. 2013)

Provide a basic predetermined profit calculation (Fritscher and Pigneur 2014b) | Quantitative information such as prices, costs and quantities (Szopinski et al. 2019)
Financial analysis module (Voigt et al. 2013)
Competition analysis (Giessmann et al. 2013)
Direct benchmark (Giessmann et al. 2013)
Attribute variation analysis (Giessmann et al. 2013)
Price simulation (Giessmann et al. 2013)
"What-if" analysis (Zec et al. 2014)

Generate different financial estimation scenarios for the BM (Di Valentin et al. 2015; Szopinski et al. 2019; Terrenghi et al. 2017) | Heatmap (Haaker et al. 2017)

Provide functions for simulating and financially evaluating a BM (Szopinski et al. 2019; Voigt et al. 2013) | Development and training of a machine learning algorithm (Dellermann et al. 2019)
Classification and Regression Tree (CART) (Dellermann et al. 2019)

Visualize the robustness of BM components in a certain scenario or future development by providing BM stress testing (Haaker et al. 2017; Szopinski et al. 2019) | Selection of favored variant (Giessmann et al. 2013)

Provide a crowd-based classifier to predict the outcomes of BM design choices based on human assessment (Dellermann et al. 2019) | Development and training of a machine learning algorithm (Dellermann et al. 2019)
Classification and Regression Tree (CART) (Dellermann et al. 2019)

After running analyses and simulations, final refinement and adaptation of attributes should be possible (Giessmann et al. 2013) | Selection of favored variant (Giessmann et al. 2013)

**Table 3: Requirements and Design Principles for Business Model Analysis and Evaluation**

**Collaboration**

Software tools can use different functionalities to enable collaboration among users. Collaboration mainly aims to streamline workflows among teams and improve communication, speeding up progress, and increasing the satisfaction of users. In the BM context, collaboration requirements vary, including offering ways for users to interact with each other, real-time collaboration (for example, by real-time collaborative
modeling), and allowing and automating reciprocal feedback processes. However, it is important to note that, even though collaboration functions offer various benefits, they are by no means essential for software-based BMs and tend to increase the technical complexity of development. Table 4 provides different requirements and design principles for Collaboration.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Design Principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitate collaboration across time, location and organizational boundaries</td>
<td>Software as web application (Zec et al. 2014)</td>
</tr>
<tr>
<td>(Ebel et al. 2016; Schoormann et al. 2018b; Zec et al. 2014)</td>
<td>Software as virtual platform (Ebel et al. 2016)</td>
</tr>
<tr>
<td>Provide user and role management functions to support the coordination of the</td>
<td>User management (Szopinski et al. 2019)</td>
</tr>
<tr>
<td>collaborative work on a BM (Szopinski et al. 2019)</td>
<td>Role management (Szopinski et al. 2019)</td>
</tr>
<tr>
<td>Community: Enable interaction between users (Dellermann et al. 2019; Ebel</td>
<td>Message functionality for synchronous communication (Ebel et al. 2016; Schoormann</td>
</tr>
<tr>
<td>et al. 2016; Schoormann et al. 2018a, 2018b; Szopinski et al. 2019; Voigt</td>
<td>et al. 2018a, 2018b; Szopinski et al. 2019; Zec et al. 2014)</td>
</tr>
<tr>
<td>et al. 2013; Zec et al. 2014)</td>
<td>User lists with search and tagging functionality (Dellermann et al. 2019; Ebel</td>
</tr>
<tr>
<td>Provide features for (real-time) collaborative development and refinement of</td>
<td>et al. 2016; Szopinski et al. 2019; Voigt et al. 2013)</td>
</tr>
<tr>
<td>the BM (Dellermann et al. 2019; Ebel et al. 2016; Schoormann et al. 2018a,</td>
<td>Locked features (Voigt et al. 2013)</td>
</tr>
<tr>
<td>2018b; Szopinski et al. 2019; Voigt et al. 2013; Zec et al. 2014)</td>
<td>Multi-format comments (Dellermann et al. 2019; Ebel et al. 2016; Szopinski et</td>
</tr>
<tr>
<td>Enforce a separation of single and team phases to increase the quantities of</td>
<td>et al. 2019; Voigt et al. 2013)</td>
</tr>
<tr>
<td>idea (Zec et al. 2014)</td>
<td>Sharing of BM projects (Schoormann et al. 2018a, 2018b; Voigt et al. 2013; Zec</td>
</tr>
<tr>
<td>Support the reduction of social anxiety or evaluation apprehension (Zec et</td>
<td>et al. 2014)</td>
</tr>
<tr>
<td>al. 2014)</td>
<td>Copying of BMs (Schoormann et al. 2018b; Voigt et al. 2013)</td>
</tr>
<tr>
<td>Allow for quick selection of the best models within the group (Dellermann</td>
<td>Multi-format export of BM projects (Schoormann et al. 2018a, 2018b; Voigt et</td>
</tr>
<tr>
<td>Provide users with different types of working on a BM (Szopinski et al. 2019)</td>
<td>Asynchronous modeling (Ebel et al. 2016)</td>
</tr>
<tr>
<td>Allow users to track changes made in the BM (Schoormann et al. 2018b; Zec</td>
<td>Concurrent modeling (Ebel et al. 2016)</td>
</tr>
<tr>
<td>et al. 2014)</td>
<td>Collaborative synchronous modeling (Szopinski et al. 2019; Zec et al. 2014)</td>
</tr>
<tr>
<td>Table 4. Requirements and Design Principles for Collaboration</td>
<td>Reasoning features (Schoormann et al. 2018a, 2018b)</td>
</tr>
</tbody>
</table>

**Technical Requirements**

Besides user support and mostly non-functional requirements, there are a variety of functional requirements proposed, summarized within the core category of Technical Requirements. These requirements describe which standards can or should be supported, what kind of export and import functions should be available, if and how integration with other tools should happen, what kind of attachments and reports are necessary and propose different technical architectures. Table 5 provides the identified technical requirements and design principles.
### Table 5. Technical Requirements and Design Principles

#### Discussion and Conclusion

Software tools hold great promise to support the modeling, analyzing, and innovation of BMs. Yet, both research and practice lack a clear overview of the requirements and design principles for developing such tools. This paper gathers requirements and design principles for BM software tools with a literature review. A variety of requirements have been identified and clustered in five core functions. First, regarding modeling aspects, the tool needs a motivating interface that can be adapted to the user according to their background and skills. The tool should guide through different modeling phases with an engaging structure and perform automated checks on modeling standards. Furthermore, it should promote ideas and stimulate creativity by suggesting BM patterns. Second, for BM design, the tool needs to be able to create, alter, and manage different BM designs. It should also provide users with templates for BM types, attributes, components, and even offer complete BMs. Third, for analyzing and evaluating BMs, the tool should provide...
different approaches for financial analysis tests. It should be able to visualize possible BM changes and incorporate environmental changes into modeling. Fourth, a BM design tool should offer collaborative features. For example, users should be able to communicate synchronously and asynchronously within their community. It should be possible to model and design a BM simultaneously with several users. Fifth, there are technical requirements and design principles that BM tools should meet. These cover basic demands, such as interoperability with other tools, export and import functions, reporting, and specific technical architectures for incorporating operational data. Concrete design principles are mapped onto these requirements that support implementing these requirements in a software tool.

Our results are based on a review of the existing literature and have certain limitations. To mitigate subjective coding, we used collaborative input from two researchers. As the requirements were aggregated from different literature sources, we cannot ensure that the provided list of requirements and design principles is exhaustive, nor that the assignment of requirements onto the core functions is fully consistent. The resulting overview of requirements is generic. To use these results for tool development, contextualization has to occur, for example, according to industry specifics.

This study has several implications for research and practice. For researchers, we collect, combine, and synthesize various requirements and design principles for BM software tools. In this way, we provide an overview of the current literature and a foundation for research on BM tooling. For practitioners, the collection of requirements and design principles establishes a starting point for the agile development of new BM software tools. Furthermore, it can serve as an evaluation framework for intermediate development states and existing BM tools.

We identify three key areas for future research. First, researchers can build on our review, using it to identify the first two steps of a design science approach for developing a BM tool, that is (1) identifying the problem and motivation and (2) defining objectives for a solution (Peffers et al. 2007). Second, empirical research can validate our findings. Third, future research can evaluate the usefulness of BM software tools. We show that the BM and its innovation are crucial for sustainable firm success. We provide guidance regarding requirements and design principles for developing innovative BM tools that can support firms in sustaining a competitive advantage.

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References


