

Towards Aligning Business Models with Business Processes: A Tool-based Approach

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Abstract: In an increasingly dynamic environment, organizations need to be able to constantly adapt their business model. When making decisions in terms of adapting a business model, the operative structures that help to implement these adaptations need to be considered as well. Changes in both layers, the business model as well as the business processes, have immediate impacts on each other, and thus, should be aligned in order to allow more informed decision making. In this article, we report on a research project that explores how business models and processes can be aligned by iteratively building and evaluating a prototypical software platform. Doing this, this study contributes to the design of software that facilitates the alignment of both layers as well as provides a foundation for deriving more advanced knowledge such as in the form of design principles.

Keywords: Business model, Business process, Alignment, Software platform, Graph-database

1 Introduction

An increasing digitalization opens plenty of new avenues such as for developing novel business models but also constitutes a number of challenges like the need for constantly transforming organizational structures [KSK18]. In order to achieve sustainable advantage and to survive in uncertain and complex environments, organizations need to be able to reconsider and adapt their core business logic (e.g., [Ve14] [Bo13] [Va12])—especially in fast-moving markets like those that are concerned with evolving (digital) technologies. As adapting business models is an ambitious task, corresponding decisions are often made too late [Bo13]. One approach that can facilitate this, is an enhanced alignment of the business model with the business processes that operationalize a certain business model. Changes in the business model layer have direct impacts on the underlying business processes [Va12] and vice versa. This also in line with core elements of business process management (BPM) which argue that ‘strategic alignment’ (i.e., processes need to be aligned with the overall strategy of a company) and ‘governance’ (i.e., design of decision-making to guide process-related actions) need to be addressed [RB10]. According to [Os04, p. 147], an “area of contribution could be the improvement of business process design due

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to a better understanding of the business model”. Doing so, the process designer is able to do more informed decisions in terms of how to implement an abstract vision [Os04].

To support the act of adapting a business model, visual thinking is indispensable [OP10]. Accordingly, visualization has been determined as the main tool for developing and analyzing business models [TA17]. Various benefits from visualization such as an enhanced communication of a model, better generating of new business ideas as well as facilitating collaboration, reducing complexity and uncovering hidden structures within a business model are already explored in previous research (e.g., [EH11] [Os04]). However, such visualizations are mostly abstract, wherefore the integration or linkage of additional conceptual models like process models should be investigated. Business processes enable transferring business model elements into more detailed information [Al08] [Os04] by, for instance, specifying the component ‘key activities’ via process models that describe these activities through in-depth process flows. To link both models, two main directions are conceivable, namely (*bottom-up*) business processes as a unit of analysis that provides meaningful information for (re-)designing and planning business models [Bo13], and (*top-down*) business models as an orientation for implementing business processes [Va12].

However, although some approaches are already explored, there is still potential regarding how both layers can be connected and, especially, how these can be supported by software, which is evident by, for example, [Va12, p. 8] who called for an “analysis and verification of the role of description languages and software tools.” This lack is problematic because it hinders the alignment of business models and processes as well as inhibits business model developers and process designers in making informed decisions. Hence, the question for this research study is formulated as follows: *How to design a software-supported alignment of business models with underlying business processes?*

To address this question, we first outline the research background of business models and business processes as well as the related work dealing with the alignment of both (Section 2). Following design science research (Section 3), we build and evaluate our main artefact, namely a software platform (Section 4) and demonstrate its applicability through a use case (Section 5). Finally, we discuss the results and conclude (Section 6). This article provides a concept and an explanatory instantiation of a software-supported alignment, which can be employed, for instance, by practitioners to make extensive analysis across their business models and processes to make more informed decisions.

2 Research background

2.1 Business models and their representations

Business models are often seen as an enabler for innovation and have emerged as a valuable unit of analysis and starting point for implementing new ideas [MTA17]. Accordingly, a good business model is essential for every successful organization—

regardless of whether it is a new business or an established player [Wi16] [Ma02]. The business model concept is widely understood as a (management) tool that facilitates different activities, for example: design, analysis, understanding, and evaluation of a company's core business logic [Ve14], visualization of a business logic, comprehension of the key elements in a specific domain [Os04], communication of such an understanding [Ga01], and assessment of the viability of new ideas [WV01].

Therefore, different business model modeling languages (BMMLs) are proposed that help structure business models [JKS17], for example: [Wi16] differentiate between strategy components (strategy, resources, and network), customer and market components (customer, market offer, and revenue), and value creation components (manufacturing, procurement, and financial). [OP10] describe a business model through nine *components* (value proposition, customer segments, channels, customer relationships, key resources, key activities, key partners, revenue streams, and cost structure), whose instantiations (or *elements*) serve to describe a concrete business model. However, regardless which approach or set of components is followed, one of a business model's central aspects is the processes that help to implement the core logic into a company as well as specific important activities that need to be performed for ensuring success.

2.2 Business process models

BPM research provides practice-oriented contributions by understanding, modeling, implementing, and optimizing business processes as well as providing corresponding methods such as modeling techniques and (software) tools (e.g., [Ha10] [HC93] [BR07] [SB10]). In essence, a process describes a logical, sequential order of operational events using and transforming resources to the main product or service outputs of a company [BS04]. According to van der Aalst, BPM-related tasks are often based on general phases for "(re-)design – implement/configure – run/adjust" [Aa13, p. 5]. Typically, these phases include steps for process identification, discovery, analysis, redesign, implementation, and monitoring [Du13].

For several decades now, business processes have been considered very important for the competitiveness of companies (e.g., [LDL03]). With the increasing complexity of companies from an organizational perspective and a technological perspective, the management of business processes has also gained in importance [Ja17], enabling a continuous adaptation and improvement of business activities [Tr10]. For this purpose, a number of modeling languages for the description and representation of business processes have been established [LK06] like, for instance, the *Event Driven Process Chain (EPC)* that is intended to present business processes with their activities, functions, and actors, or the *Business Process Modeling Notation (BPMN)* that has a broader set of elements and can be transformed into an executable model with the help of the *Business Process Execution Language (BPEL)*.

2.3 Combining business models and business processes

In general, the business model concept can be seen as an intermediary between the strategy of a business and the business processes [Al08] [Ve14] (Fig. 1, grey cells mark the focus of this study). Whereas strategy, on a high level, attempts to explain how an organization will prevail over competitors, business processes describe the way of implementing a business model into daily business routines—the operative level transforming a set of inputs into outputs—which is important, because changes in the business model layer raise organizational questions as well [Os04]. IS research mainly lays its focus on the relationship between business models and business processes and seeks to explore how both concepts interact with each other [Ve14]. This interaction can take different forms such as *top down* (e.g., “the business model acts as the base system from which the detailed operational business process model should be derived”, [Al08]) and *bottom up* (e.g., “monitor business processes in operations and to adjust the business model according to changes in business processes”, [Bo13]). However, in order to enable innovation and improvement across an entire business, these layers require continuous alignment.

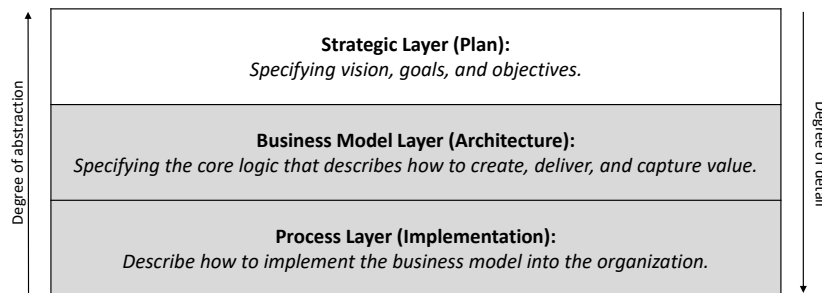


Fig. 1: Business model as a mediator between strategy and processes (adapted from [Os04])

3 Method

Design science research is appropriate to, for instance, explore IT support in the context of business model development (e.g., [Ve14]). For developing our main artefact, namely software supported alignment of business models with business processes, we first solve a specific problem (i.e., by building a concrete artefact) and seek to derive a more general solution afterward [Ii15]. Our research process is well-grounded by the method from Kuechler and Vaishnavi [KV08]. In total, we ran through several design cycles until the current state of our artefact (Fig. 2).

Following [KV08], we began with the *formulation of a concrete problem*, here the lack of software support that allows integration business models with more detailed models such as business processes (see also [Sz16]), for instance, to make use of detailed information during the analysis of business models or the dependencies between specific processes and

business decisions. To *suggest a solution* for this problem, we reviewed existing literature to obtain typical approaches for alignment of both layers. Drawing on the results, in the *development phase*, we started to implement the identified approaches in two available prototypes: A business model development tool (see [SBK18] for a more detailed description of the tool) and a service development platform that allows modeling business processes (see [Ka19] [Ha19]). For *evaluation purposes*, we accompanied and observed a project (across three months, i.e., one semester) that was performed by three students who were enrolled in a bachelor-level Information Systems program. Based on their feedback and our observation during the application, we were able to report some initial lessons learned for the current software platform.

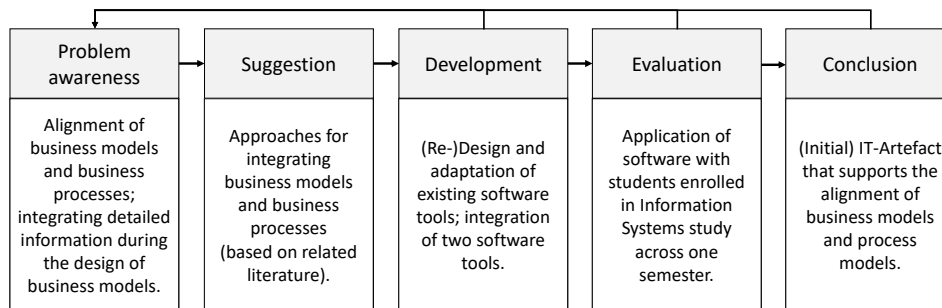


Fig. 2: Research process (adapted from [KV08])

4 A software platform for aligning business models and processes

4.1 Suggesting a solution concept

As there is only limited research on how to align, connect, or integrate business models with business processes, we started to develop an abstract architecture for structuring possible solutions that contribute to this field. Therefore, in line with other process landscape-approaches that structure different level of abstraction (e.g., [Oe03]), we seek to explore how an alignment, starting from the business model layer (i.e., top-down), can be designed. For this, a business model representation acts as an initial point to derive different approaches that support the connection of both layers (i.e., business model and process). To do so, based on a well-established modeling language for business models, the *Business Model Canvas*, an alignment on three different levels is conceivable (Fig. 3):

First, on **Level 0**, an entire business model is detailed by business processes. In doing this, the complete set on components and elements are used for deriving a business process model. For example, a Carsharing business model is specified by a process model that visualizes how value is created and how value delivered to a certain customer segment such as private households interesting in sharing mobility. In this case, the process might

also be on a rather abstract level, wherefore the value and helpfulness of one concrete process model requires further investigation.

Second, on **Level 1**, a single business model component including their elements can be detailed via a process model. For example, the component ‘key activities’ contains general tasks that need to be carried out in order to contribute to the value creation and value delivery of a company. These abstract activities can be specified through more detailed process models that help to represent information such as which concrete tasks need to be performed, which resources are required to execute a task, and which persons or roles are in charge of a task. As an example, the component key partners from a Carsharing business model can be specified by describing how external partners are involved that provide insurances for the shared vehicles (i.e., what task is performed by whom).

Third, on **Level 2**, a single business model element (i.e., a concrete element of a business model component) can be used to specify process models. For instance, the key activity ‘cleaning cars’ for a Carsharing business model can be specified by describing what types of cleanings are offered (e.g., in-cabin cleaning vs. rim cleaning vs. front shield cleaning etc.), what tools are required for a certain cleaning (e.g., brushes, sponge, soap), and which skills are demanded to execute it (e.g., staff that is trained with chemicals).

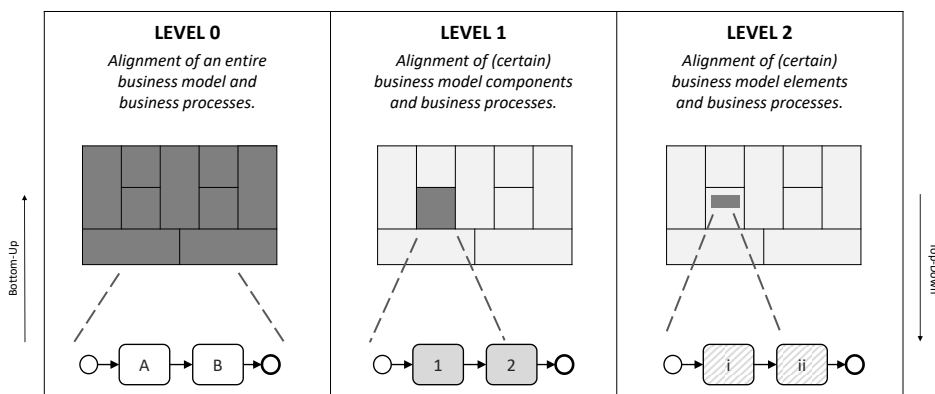


Fig. 3: Level of alignment (between the business model and business process models)

In order to respect the bottom up-perspective as well, we aim to provide a direct connection between both layers, which means an adjustment in the business model should affect the underlying process model elements and, vice versa, a change in a process model should lead to an update of the business model representation.

4.2 Developing an expository instantiation

Following the suggested solution concept, for the alignment of business models with process models, our software platform utilizes two independent web-based applications,

each covering one of the functionalities, and integrates them into one digital platform (Fig. 4). The exchange, and thus, the integration of both applications (and their underlying modeling languages) is realized with the help of an API interface, which enables merging both models in a single data-scheme.

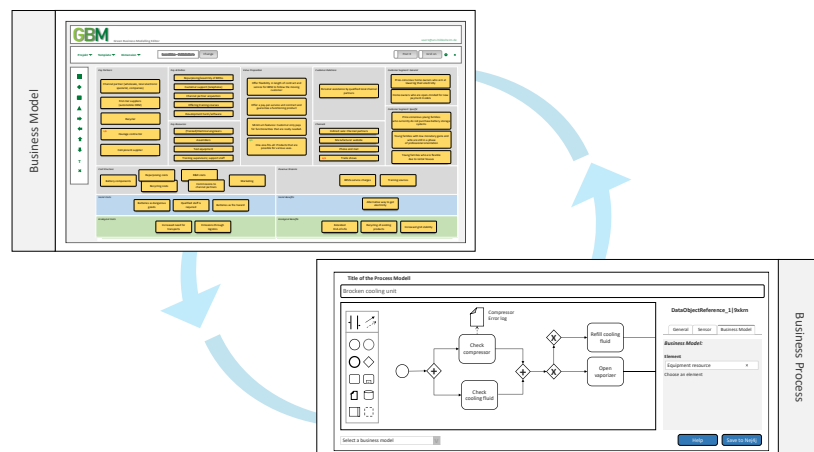


Fig. 4: Integrated business model (top) and process (bottom) modeling environments

To represent **business models**, a software-supported development environment is implemented by applying the modeling language Business Model Canvas [SBK18]. The application, a so-called business model development tool, provides several features for modeling a business model including representing the core business model elements by means of post-its. Typically, these tools allow to digitally represent and change business models, and as such, have the potential to support their users in performing certain actions more efficiently than with the ‘pen & paper’ versions of the modeling languages. To do so, they allow, for instance, assessing business models, filtering certain elements, versioning of business models, or collaborating within a team⁴. The information from the represented business model is initially stored in a relational database as well as is made accessible to the second application for process modeling via an API.

The **process modeling tool** is based on the freely available web application *bpmn.io*⁵ and thus provides a user-friendly interface for modeling processes according to BPMN 2.0. For this study’s purpose, an additional attribute has been implemented into the application, which contains the connection to the post-it’s (i.e., business model elements) from the previously described business model development tool. This allows the user to assign business model elements to relevant parts of the process model. The BPMN element ‘Data Object’ is considered for this and can be, when selected, linked to the business model

⁴ For an overview of typical features that are implemented by business model development tools, please refer to Szopinski et al. 2019 [Sz19].

⁵ *bpmn.io* is a BPMN 2.0 rendering toolkit and web modeler. For more information and downloads, please refer to: <https://bpmn.io> (accessed: 08.10.2019).

through a dynamic dropdown field, which is able to provide the entire set of elements from the business model (Fig. 5 on the right side). To limit the visible elements in the dropdown field, the related business model has to be chosen before modeling the process, since a process is used only within the scope of a single business model. If a process section is assigned to several business models or parts, additional data objects can be created.

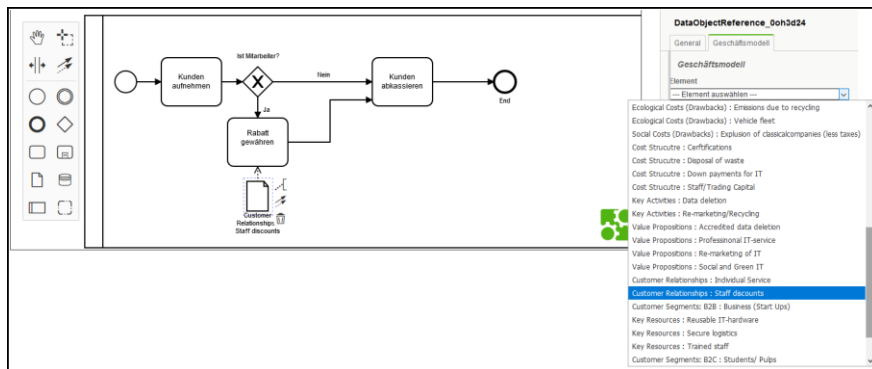


Fig. 5: Process modeling environment with linkage to the business model

Moreover, we tested a configurator that presents all elements from the business model as well as provides a possible target model element (i.e., elements in BPMN 2.0). Therefore, we stored an initial list of a possible connection between the business model components of the Business Model Canvas and standard objects of BPMN such as pools, data objects, and tasks. For example, a key partner might be transferred into a process pool or a key resource might be transferred into a data object (Fig. 6). If the user would like to specify another target element, she or he is free to select a more suitable type from the dropdown menu. In doing this, the user can select and add certain elements to the process modeling environment.

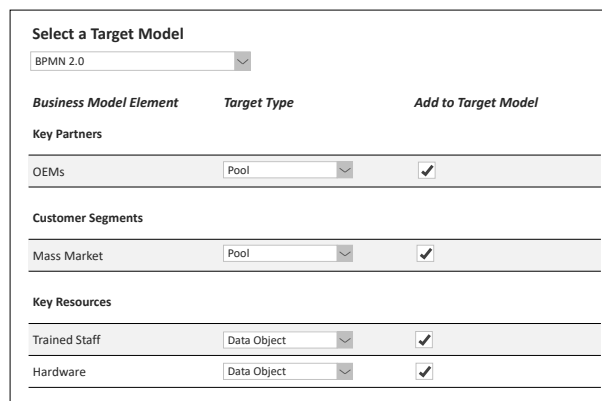


Fig. 6: Configurator to transfer business model elements into process model elements

From a technical perspective, the integration is facilitated by merging initially separated models into a single graph database. We decided to use graph-oriented storage technologies in the scope of our approach, since their implicit resemblance to our data-schemes (e.g. structural models), their examination in process related scopes [Aw07] and their fast query times, which become relevant when handling extensive processes and business models. Compared to other storage technologies, graph databases focus on the relationships between elements. The underlying structure is a graph consisting of individual nodes and edges, with each of these elements containing key-value pairs in which information is stored. The nodes can be connected arbitrarily by the edges to link the information and form mesh structures [BK14]. If a business model is imported, it is converted into such a tree structure, where the root node of the tree represents the business model and is related to its child nodes, one per field of the BMC (value proposition, etc.). Each field-node holds relations to the above mentioned post-its (Fig. 7). Business processes are stored in the same way: The elements of the BPMN are represented by nodes with key-value pairs for their type, name, etc. and connected to each other via relationships. This shows the implicit proximity of process models and graph databases and speaks in favor of a shared use. The business model and process are linked via the post-it's mentioned above. For this prototype, *Neo4j*⁶ was used as the underlying storage technology. As mentioned above, the graph database is addressed through an API that allows a direct connection between the modeling environment and data storage (Fig. 7).

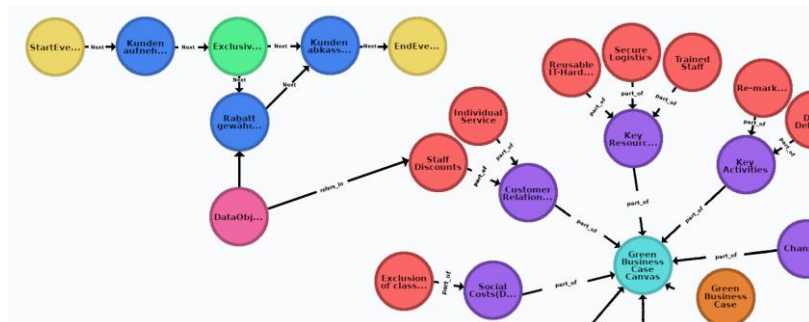


Fig. 7: Schematic representation of the graph structure (linked process model, top-left, and business model, bottom-right)

5 Evaluation

For evaluating the software platform, we, as first step, carried out an ex ante artificial evaluation (e.g., [Ve16]) in an educational context. Artefacts that characterize the structure of a system are typically evaluated through the implementation of prototypes, which demonstrate the applicability via illustrative scenarios [Pe12]. Within a practice-oriented

⁶ „Neo4j is a highly scalable native graph database, purpose-built to leverage not only data but also data relationships.“ For more information please refer to <https://neo4j.com>.

university course across three months, a group of three bachelor-level students from Information Systems applied the software platform to develop a business model for electrical vehicle charging stations and its underlying business processes. Moreover, three researchers from (1) business model development, (2) process design and (3) electrical vehicles act as experts for evaluating the group's ideas and providing feedback. In the following, we describe some lessons learned and justify these with statements from the project participants.

The results show that the software, in general, is a valuable asset for the integrated modeling of business processes and business models (“especially with the ‘key activities’ it would be appropriate to define these more precisely with processes.”). The feedback is focused on the (visual) implementation of the environment. By choosing the BMC as a representation for business models and BPMN as a modeling language for processes, all users were able to employ the software easily. While the top-down approach was straightforward to apply (“we applied the top-down strategy for our models [in opposite to the bottom-up approach]”), building the business model based on the processes was perceived as difficult due to the lack of transitions from process elements to business model fields. Furthermore, direct linkage of, e.g., key activities to process steps was suggested in order to link the two layers more closely. Furthermore, through the demonstration, we could collect additional requirements for the software platform, for example: features for zooming across the process models, replacing buttons for saving a project, providing recommendations in terms of typical elements that detail other elements, as well as additional features for collaboration. Through an illustrative scenario, the students were able to iteratively specify which elements of the business model could be detailed by which elements of the BPMN. Therefore, they reported a log file in which they specified and justified which element can be detailed such as certain ‘key activities’ have been transferred into a process, certain ‘key partners’ have been transferred into pools and lanes, and certain ‘key resources’ have been transferred into data objects. The results from this inductive approach can be employed in further steps to specify concrete relations between specific business model and process model elements.

We aggregate the feedback into the following three essential lessons learned: First of all, the modeling language used (independent of the subject) has to be oriented on common languages and frameworks to leverage the full potential of our approach. An integration seems valuable and feasible, but a common understanding has to be met in order to benefit accordingly. Second, the users seek for support while performing the modeling, thus we propose a recommendation tool which helps the user (a) choosing the next or according elements and (b) indicate elements that need further detailing or already have similar functionality to reduce redundancies or adapt them appropriately. Third, the modeling environment should be flexible so that an individual working environment can be created.

6 Discussion and future research

For aligning business models and process models, this study introduces an abstract solution concept as well as a software platform consolidating modeling features for both perspectives (i.e., business model and process) based on graph databases. We evaluated the platform within a university course, which demonstrated the applicability of the artefact and revealed insights on missing or improvable features. Overall, the results indicate advantages of an integrated software platform for the users in terms of a coherent modeling environment and the resulting improved usability as well as an integrated data-model and storage in a shared database, enabling faster in-depth analysis.

Having the information of both models in a uniform data-scheme allows configuring and adapting existing processes into new business models and thereby generating plenty of 'meta-information' regarding the relation of processes and business models. Accordingly, this study has several implications for research and practice: First, (semi-)automatic derivation of processes or recommendations for common/standardized business processes. As there are already comprehensive catalogs of, for example, reference process models or standards and frameworks, it might be possible to assign these to specific business model elements. The software platform can be able to automatically recommend a set of processes based on a business model representation (e.g., typical processes for administrating a booking platform or for billing). Consequently, through an alignment, users can directly trace the impacts of adjusting a business model in terms of their underlying processes. These functions allow the user to leverage existing process models and to facilitate the transfer of process innovations in other domains (cross-industry innovation). Second, the unified data-structures enable the execution of business processes on information systems such as assistance systems, which enable, for example, the immediate roll-out of adjusted business processes when they are linked to the business model (e.g. as proposed by [Ka19]). Third, new opportunities and approaches for ensuring the compliance of a company are provided. For instance, because process models indicate detailed information regarding outputs of a certain task (e.g., higher negative impact on the environment by creating an increased amount of emissions), more informed decisions can be made on a business model layer. Accordingly, processes provide a valuable unit of analysis for both. Fourth, when altering the process of a key activity, this change can be reflected in the business model automatically. For example, the runtime of a business process can be measured or estimated (in terms of costs) and directly influence the overall value of the business model or new pools or lanes can lead to updated key partners in the business model.

Even though we derived some valuable insights, this study is however not free of limitations, which opens paths for future research. First, when integrating more elements and their representations of a business model into our software platform (e.g., pre-defined goods and CAD-models of products as key resources), even more relations between detailed information and the business model layer may be observed and managed centrally. Implementing and evaluating this potential extension will be part of our future research, in which we seek to make use of product-related models in particular that,

ultimately, help to represent business models of, for instance, entire product-service systems. Second, another limitation is that we primarily focus on the top down approach, and thus, mostly specify process elements based on a certain business model. In further investigations, the bottom up approach might be explored in order to analyze how the information provided within, for example, large process landscapes that often exist in companies, can act as a foundation for deriving further models. Third, in the current version of the platform, we focus on business process models as a type of detailed models that contribute to the representation and analysis of business models. In next steps, we aim to explore and integrate more types of information sources like, for example, by aligning further Canvas-based tools such as the *Value Proposition Canvas* [OP14] that might be fruitful for detailing the component value proposition (i.e., Level 1 alignment, see Section 4.1) or by aligning further modeling languages such as the *Entity Relationship Model* [Ch76] to represent data in its relationship for resources such as software applications. Finally, as our evaluation took place in an artificial setting, next steps should deal with observing the artifact in a naturalistic environment (e.g., by employing methods such as a case study or expert interviews). This extended evaluation should explore the usefulness of the software platform in addition to the already demonstrated applicability.

Overall, we hope that our work (i.e., a concrete software platform and an architecture for aligning business models and processes) provides orientation for practitioners and academics in terms of what approaches can be employed for integrating more detailed models such as business process models with business model representations. In doing this, we lay the foundations for further research that is concerned with, for instance, making more informed business model decisions, conducting more extensive analysis across an organization, or (semi-)automatic derivation of models.

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