Conceptual approach to operationalize value creation in industrial service-dominant business models

Structured Abstract

There is an obstacle in the process of business model operationalization due to different perspectives between strategic- and business-view and the realizing designer's and engineer's view. While ideation and key patterns are designed from business-view, process designers and engineers are responsible for the implementation. This transition is complex and there are often iterations needed, although the services which are designed in different companies are often quite similar. Due to a lack of methodical assistance, cross-company scaling effects cannot be used and project efforts for realization of digital service-dominant business models remain high for each company. This article provides a concept for transforming generic service-dominant digital business models into conceptual process models including the involved resources. It covers various aspects of the business model and connects value proposition with required data, processes and resources. In this manner it can enable cross-company scaling effects for the conception of service-dominant digital business models.

Keywords

Digital Services, Value Creation, Business Model transformation

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Article Classification

Conceptual Paper

Contents

Introduction

The practical relevance of business model innovation has increased significantly in the last decade within industrial companies, due to its transformation from a producer to a service company (Schneider, 2018). Although the business model innovation process is well described as a whole (Wirtz and Daiser, 2018) and there are several tools for the early steps of business model innovation especially for conception business models in an abstract matter (Zolnowski, 2015); (Wirtz, 2010); (Weiner et al., 2012); (Köster, 2014) – first and foremost the Business Model Canvas (BMC), which has become a de-facto standard tool (Burmeister et al., 2016) to innovate and design new business models – there are difficulties in transforming these described models into practice (Suratno, 2020). Due to the typical representation of the business models as informal textual, verbal or graphical elements with connections as ontologies (Ojasalo and Ojasalo, 2018); (Turetken et al., 2018); (Osterwalder, 2004), there is a lack of a standardized methodology to operationalize these business models into conceptual process models which are the requirement for executable process models. (Suratno, 2020) This is especially true for industrial small and medium sized companies (SME): Besides the fact that there are first holistic top-down approaches (Suratno et al., 2018), the cost-intensive and heavily changing production of such companies is rarely considered and an investigation of the impact of hybrid service bundles on today's value creation systems seems necessary (Mittag et al., 2017). Conceptual process models are important to improve the understanding of the aspired business model from business and engineering point of view as well as to draw conclusions for activities and resources and to assign key values to the own company and to strategic partners to realize the service as a whole.

This paper arose from the project Plug_and_Control that focussed on digital services in industrial SME which are part of service-driven business models and aimed on the development and prototypical implementation of a concept for flexibly configurable, standardized data modules to enable modular technical services in producing companies. (Riedel et al., 2021) This article focuses on the question, how conceptual process models can be designed on predefined digital service-dominant business models of a company in industrial SME.

Methodological approach

In the research project Plug_and_Control, a method for operationalising the business model to process level for digital services was developed with the design science research methodology (Peffers et al., 2007); (Hevner, 2007); (Vom Brock et al., 2020), which addresses the missing connection described above.

The method was tested within five industrial applications (SME) and additionally in one laboratory setting focusing on

- automated recipe derivation, respectively automated generation of machine settings based on product quality data, product requirements and machine data in four different branches and technologies
- automated maintenance guidance based on machine failure data and customer service report
- self-service for changes in the configuration on complex industrial machines in dependence to order progress

There were several workshops for each test environment for the phases of value proposition design, business model design and value creation design, where at the end the conceptual process model was defined. (Jung and Kraft, 2017)

For the purpose of the ideation, the Gemini4.0 Business Model Canvas (Gausemeier et al., 2017) was used to describe the business service concepts.

Each workshop took place with different responsible representatives of the company with business-view and production-view. The moderator utilized MS Visio in a collaborative manner with the participants taking turns to design the business model and conceptual process views.

The workshops and their results have been used to evaluate the method and moreover helped to assess if the following requirements will be met:

- Ease of use, considering the lack of competencies due to limited quantity of employees in SME. (Saam et al., 2016)
- Low effort, considering the lack of resources of SME. (Lindner, 2019)
- Adaptability and extensibility, considering and supporting a wide diversity of different applications in different branches and technologies.

To encourage a consistent understanding of terms, this paper uses the definitions of the ISO 9000:2015 Quality management systems - Fundamentals and vocabulary as well as the DIN SPEC 33453:2019-09 Development of digital service systems.

Key insights

The conceptual approach to operationalize the value creation in industrial service-dominant digital business models is based on methods for describing the business model, which consider partial models. E.g. the Gemini4.0 BMC (Gausemeier et al., 2017) consists of the partial models of supply, customer, value creation, financial, incentive and risk models, whereby this paper focusses on the value creation model which should enable the value proposition (here: supply model). The aim of the methodology is to operationalize and design the value creation in detail and on the other side to standardize the aspects of the value proposition. This paper describes the operationalization part of the method. Customer, financial, incentive and risk models are explicitly not considered in this concept and could be part of future research.

In order to design the process flows, the following steps must be performed, whereby conceptual process models are created in phase 2:

1. Ideation and Business Model Design
    a. Ideation of the industrial digital service including the determination of the value proposition and definition of relevant functionalities.
    b. Determine the elements of the value creation models like resources, activities and involved actors
2. Conceptual Value Creation Design (Conceptual process model)
    a. Modularisation of functionality sets to specify a service module. Service modules are understood as a set of functionalities which fulfil a specific and definable task and define the exact procedure and the data required to fulfil that task. (Riedel et al., 2021)
    b. Build a sequence of the service modules.
    c. Determine relevant data as part of key resources for each service module.
    d. Determine the source of data.

e. Determine other relevant resources for each module. Other resources include infrastructure, software and tools.
f. Determine relevant actors like involved partners and link them to the service modules, the resources and the data.
g. Link the service module to relevant existing processes.
h. Build a sequence for all activities for each service module.
i. Assign each process to involved actors.

3. Executable Value Creation Design (Executable process model)
   a. Design of the service from an information technology perspective
   b. Transfer of the design into the information technology view and application-specific implementation.

Phase 1 represents the conceptualisation from a business perspective, phase 2 transforms this business models into conceptual process models and phase 3 transforms the conceptual models into executable process models, e.g. for prototyping. Iterations are part of the method. Entrepreneurial practice has shown that phase 3 often reveals new possibilities or obstacles, that must be considered in phase 1 and 2 of the next iteration.

The following paragraphs describe how to perform phase 2 to create conceptual process models for a use case. The objective of the example use case is to determine machine settings for 3D printers based on the manufacturing order's requirements. For this purpose, the relationships between manufacturing data and achieved product quality must be mapped into a mathematical model. In order to realise the value proposition, the service consists of three service modules which have to be performed in the described order:

(1) collect data
(2) create a mathematical model of relevant interrelationships and optimize it
(3) determine machine settings

Derived from the service and the use case, the required data for the use case of 3D printing can be specified in the next step. On an abstract level of detail, required data to realize the service are the customer's requirements on the product to be produced, the machine settings of the 3D printer, the process data of the 3D printer and the operator (worker) as well as the quality data of the products and the costs of producing, which is relevant to the customer. (Wilsky et al., 2018)

When the data for the application is defined, the sources of these respective data have to be determined, which could be for instance the 3D printer itself or databases and software like an Enterprise Resource Planning (ERP) system. Additionally, other relevant resources needed for the service have to be defined. For the described use case planning software with interfaces for the requirements, modelling software, the 3D printer itself, measuring equipment and an ERP are necessary. In the next step the actors have to be defined to realize the service. There are the customers, a planning department, 3D-printers and the operating workers as well as a quality assurance and a controlling department involved. These actors should now be linked to the service modules, the required data and further resources. It is worth mentioning that one object could be source of data, an actor and also another resource. Like the system 3D printer, which is an actor because it produces parts, is a source of data because the sensors and interfaces collect and transmit data and is a resource for the company. Figure 1 shows the summary of the primary steps of phase 2: Key activities/service modules and key data are highlighted in yellow, whereas supporting data which is mainly used to generate and optimize the model is marked in grey.

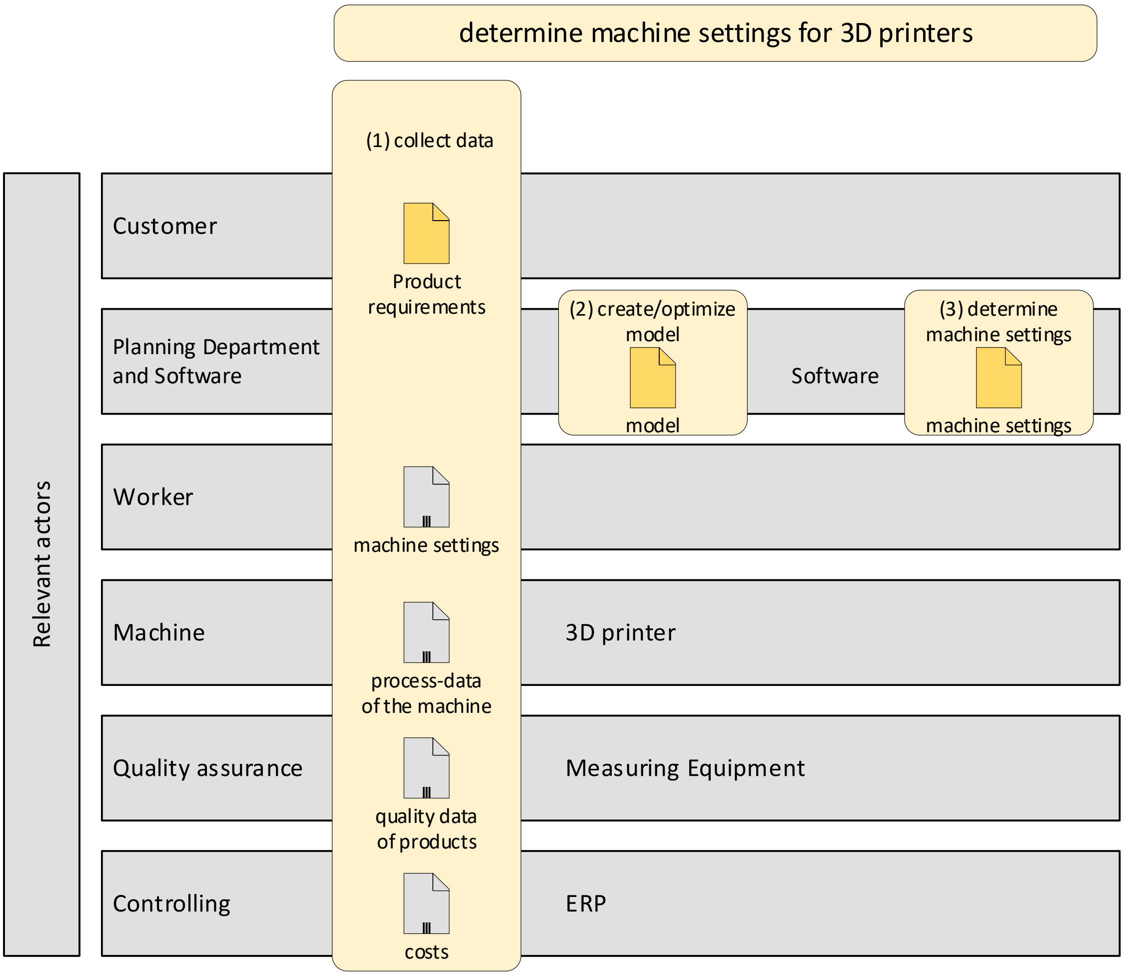

Figure 1 Pre-conceptualisation of the service "Determine machine settings for 3D printers" in phase 2f

The resulting preliminary concept of the service can now be expanded into a complete concept of the process sequence. Therefore, the service must be integrated into existing processes of the industrial companies. This is important since required data is often part of the already collected information during production and so existing processes or their data could be used. To integrate the pre-conceptualisation of the service shown in figure 1, a consultation with the respective departments is necessary.

There is also a distinction needed between the data of previous orders for model creation and enrichment (marked in grey), and the data of the current manufacturing order for the use of the model (marked in yellow). The technical implementation by means of information should be discussed with the business process designer who is responsible for executable process models (Suratno, 2020) and part of phase 3 of the method. Consideration of involved information technology and processing of information in preparation for executable processes are not part of this paper.

Figure 2 shows a designed conceptual process model based on the Business Process Model and Notation (BPMN) (Object Management Group, 2011) for the use case of determining machine settings for 3D printers on a high level of abstraction which is valid for several industries. The pre-defined service module ‘collect data’ is not shown as separate process but as lines from their source. The level of detail, which can be achieved with this method, could be refined as desired and the included dimensions in the data sets can vary strongly.

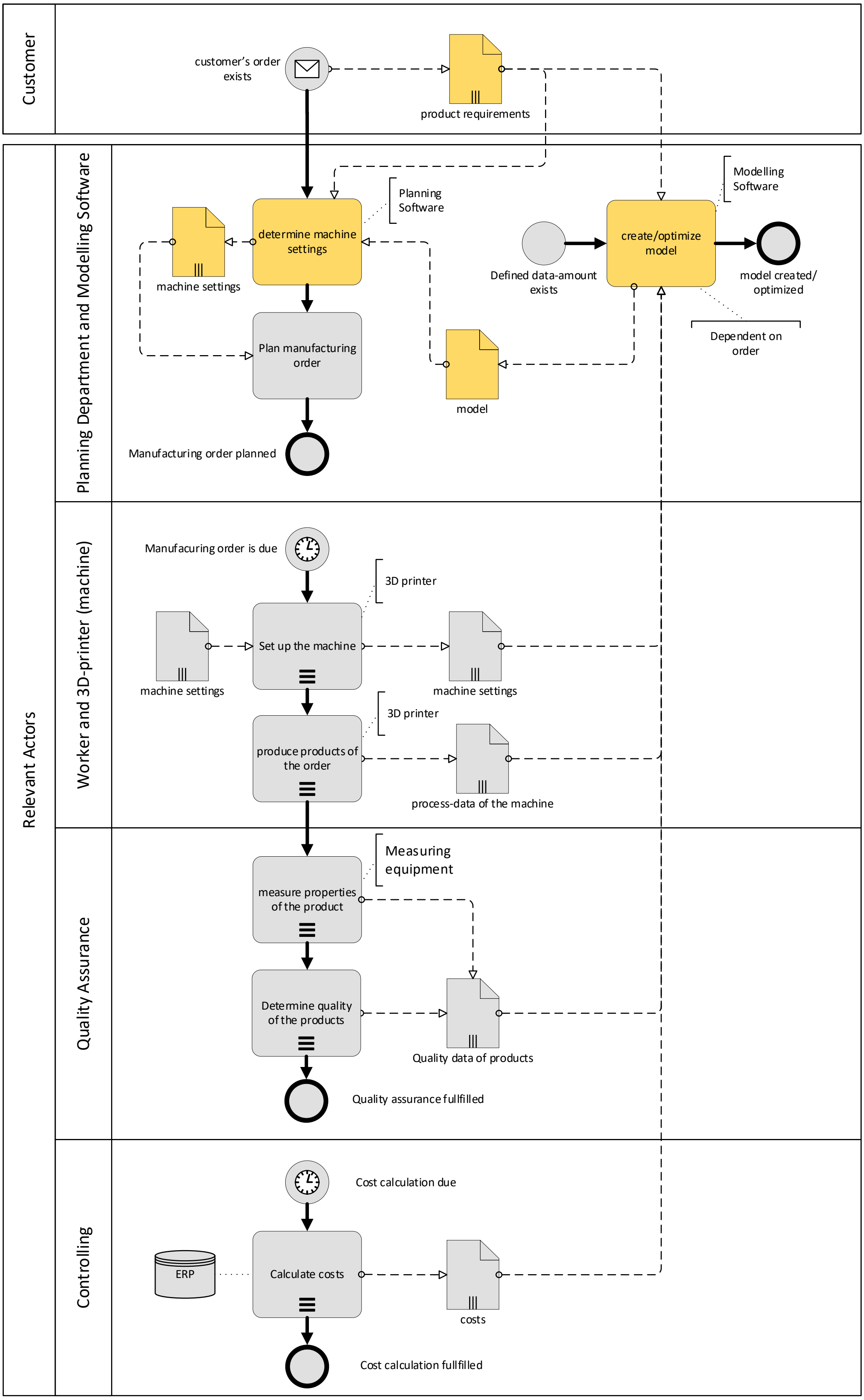

Figure 2: Conceptual process models of the service "Determining machine settings for 3D printers" in phase 2i (Riedel et al., 2021)

Discussion and conclusions

The described method in this paper enables the design of conceptual processes according to defined rules or to adapt stored reference processes to fit them to the desired business model. Furthermore, the work has shown that services such as automated recipe derivation, i.e. the determination of machine parameters for the production of an item according to defined quality, time and costs, occur according to recurring patterns in different companies and industries. These patterns are the basis for deriving processes from the value proposition. In the future more, standardized use cases and scenarios could be described and modelled to build a shared library. This would be especially helpful for SME, with their limited resources.

The workshops showed that the developed method was easy to use, since the conceptual process models can be built based on the widely used BMC or further developments and the methodology has proportional low effort with a total of 5 to 8 workshop-hours excluding the business model ideation for each of the test environments. The workshops also showed that similar services in industrial context could be described in the same manner: Their conceptual structure is the same, but they are distinguished in detail, like specific data sets, methods of analysing and editing these data as well as the detailed processes. In conclusion, the method was adaptable onto different services and extensible to several degrees of automation capability which is very useful for SME. The developed concept can also be used in large companies, theoretically, but there is no evidence for this yet. Moreover, it was only tested within conditions of research projects. This leads to future research questions:

- Could more dimensions of the business model be transformed using this framework?
- For which other services – e.g. non-industrial ones – is the framework valid as well?

Furthermore, research is needed to automatically transform service modules not only into conceptual process models but also into executable ones. Therefore, a standardized modular system should be helpful.

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