Digital Business Engineering: Findings from the Install4Schenker case

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Abstract. The development of digital business models is a key field of research in the age of digitization. As companies embark on the journey to develop digital business models, the need for a methodology which supports their journey is imminent. This paper contributes to sharpening the methodological foundation of Digital Business Engineering by conducting a single case study exemplified by Install4Schenker. Install4Schenker is a digital service coordinating, controlling and validating external craftsmen with the goal of avoiding two-men-handling while delivering products requiring installation such as heaters. Based on this case study, this paper aims to identify the potential for further research, optimizations, and clarifications for the Digital Business Engineering methodology.

Keywords: Digital Business Engineering, Digitization, Logistics, Business Engineering, Case Study.

1 Introduction

Concepts of business model research have gained increasing attention in information systems research [1], e.g., in prestigious journals [2]. The most of the business model conceptualizations address vital aspects such as value proposition, value creation, and revenue model [3]. Prominent examples are the Business Model Ontology (better known as Business Model Canvas) [4, 5] and the Business Model Navigator [6]. Emerging and existing technological innovations stemming from digitization pose disruptive change for business models [7]. The disruptive character of such innovation affects critical infrastructure, social structure, markets and more, which puts increasing pressure on traditional business models [8]. Even though there exists research on digital business models (e.g., see [9–12]), there is a lack of methodological assistance in their design [13].

Otto et al. propose Digital Business Engineering as a method for designing digital business models [13]. Digital business models take explicitly into account the conditions set by digitization in representing the inherent business logic [14]. As of now, Digital Business Engineering consists of method fragments, which have rarely

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been applied as a holistic method [13]. Through the application of the method in the environment of the use case Install4Schenker, the authors analyze its suitability and its purposefulness regarding the development of digital services. For this reason, the authors convey the development process of Install4Schenker utilizing the Digital Business Engineering method.

The paper is organized as follows. Chapter 2 introduces the engineering approach to the development of business models, namely Business Engineering. Lastly, this chapter introduces Digital Business Engineering, exploring its methodological fragments and its objective. Chapter 3 specifies the research design of this paper. Further, the authors introduce the problem at hand, two-men-handling, and the Install4Schenker use case. Following, Chapter 4 documents the application of Digital Business Engineering onto the problem leading up to the authors reasoning their propositions for enhancements and extensions for the method. Chapter 5 summarizes the research that was conducted and gives an outlook as to further potentials for research into Digital Business Engineering.

2 Background

2.1 Business Engineering

The primary goal of Business Engineering is to assist companies in conducting professional and fruitful transformation processes while developing new business models and products. This includes restructuring of organizational structures, processes, and habits regarding technical as well as human resources [15]. Business Engineering represents the construction gauge of business models [16]. The goal of Business Engineering is to generate business models as professional and logical fragmented as highly sophisticated products such as planes [17]. This is achieved, at its core, by using methods, which makes the work-process repeatable and plannable [18]. The connotation of the construction of business models in an engineering manner is not uniformly defined in the literature [19]. In literature, the general context of using methods and models is prominently associated with engineering. At its core, engineering practice is a design-oriented approach, which utilizes methods of Design Science Research [20], such as case studies or laboratory experiments, for developing knowledge [19].

A multitude of approaches to Business Engineering has developed over the last years [21–24]. Examples of this are Multiperspective Enterprise Modeling (MEMO) [25], Semantic Object Model (SOM) [26] or the Architecture for Integrated Information Systems (ARIS) [27]. While these approaches assist the user in modeling and structuring organizational processes, none of them takes explicitly into account conditions set by digitization.

2.2 Digital Business Engineering

Digital Business Engineering is a method being developed at the Fraunhofer Institute for Software and Systems Engineering [28] and the Center of Excellence for Logistics and IT (Leistungszentrum Logistik und IT), from which this paper originates [29]. The method aims towards assisting enterprises in the development of digital business solutions and follows the design principles of Method Engineering. Method Engineering conceptualizes components of methods into activities (What is to be done?), deliverables (What is the result of the activity?), techniques (How is the result produced?), roles (Which roles are involved?), and meta-models [30]. Figure 1 depicts the Digital Business Engineering methodology.

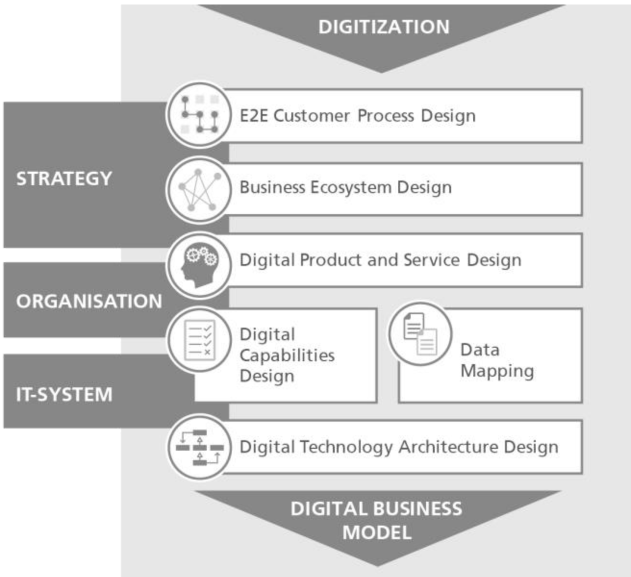

Figure 1. Digital Business Engineering Methodology [13, 31]

As of the current state of development, Digital Business Engineering consists of six activities, integrated into three design layers. The three design layers stem from Business Engineering and provide a Top-Down approach to subdividing the makings of an enterprise. The three design layers are Strategy, Organisation, and IT-System.

The ultimate starting point of Digital Business Engineering is End-to-End Customer Process Design. The activity aims to acquire knowledge about the future customer process, starting with the client being aware of a product and building a desire up until the fulfillment of the desire [32].

As a result of the gathered understanding of the End-to-End Customer Process, the activity Business Ecosystem Design provides tools such as network analysis for identifying possible competition, partners or actors in the value creation network. Depending on the case-specific requirements, techniques such as SWOT-Analysis can be applied to investigates one's market position [33].

The activity Digital Product and Service Design aims at developing digital services and products. Techniques such as Design Thinking or Business Model Canvas guide and assist the creativity and development process leading to innovative digital goods and services.

Digital Capabilities Design identifies and maps capabilities required for the development of digital products or services. The approach to identifying capabilities is of a holistic nature, in which it is not limited to taking into account digital capabilities, but capabilities of all organizational areas. Concenputalizations of capabilities are, e.g., dynamic capabilities and data management capabilities [14].

Further, the activity Data Mapping outlines the required data and data sources. Among other sources, this activity sub-divides and structures data in, e.g., internal and external data, while also providing room for appending additional data taxonomies. Finally, the last activity is Digital Technology Architecture Design, which conceptualizes data streams and individual components of the technology architecture.

3 Research Design

3.1 Case Study Research

The development process of Digital Business Engineering is based on the Design Science Research (DSR) methodology as proposed by Peffers et al. The design science research process consists of six activities, namely, *identify problem & motivation*, *define objectives of a solution*, *design & development*, *demonstration*, *evaluation*, and *communication* [34]. This publication builds upon the DSR results stemming from Otto et al. providing us with the current state of the Digital Business Engineering methodology [13]. The authors continue the DSR process with activity 4 Demonstration and activity 5 Evaluation for the method at hand. Demonstration entails finding a suitable environment to apply the artifact. For this, the authors chose to demonstrate the development of Install4Schenker as a single case study. Utilizing a single case provides an opportunity for intensive analysis of the given case [35]. With Install4Schenker, the authors can demonstrate the complete application of the method. Further, the activity Evaluation strives to analyze how well a solution is suited to solve a specific problem. Lastly, by the publication of this paper, the authors also conduct activity 6 Communication. The authors chose to utilize Install4Schenker because this project entails various requirements and conditions, as they are typical for the design of a digital business model. The solution requires the definition of a digital ecosystem, the development of a digital platform, is a data-driven approach and provides a digital service [36]. Thus, this project offers high value regarding the usability for further use-cases.

In literature, there is much discussion on the validity and generalizability of outcomes of single case studies [37]. Still, various rationales for conducting single case studies exist, e.g., if the conducted case studies is the starting point for more case studies to come [38]. Further, the basis for generalization of the results from single case studies is not based on statistical results, but on analysis and reasoning [39]. Even though, the previous rationales apply to the present case study, analyzing a single case in-depth to further scientific development and generate comprehensive understanding is valid on its merit [40].

3.2 Install4Schenker

Products, such as electric stoves or heaters require professional installation. Two employees, one driver, and one professional craftsman deliver and install the product. This process is called two-men-handling.

Developing a service covering this process was one of the goals of the DB Schenker Enterprise Lab for Logistics and Digitization at the Fraunhofer Institute for Material Flow and Logistics, under cooperation with the Fraunhofer Institute for Software and Systems Engineering. Under the premise that large cities have a heterogeneous profile of customers, i.e., customers purchasing a vast variety of different products, it became known that the two-men-handling process is inefficient. Every delivery of, e.g., a bathtub or electric stove would require differently specialized craftsmen. Additionally, while the specialist would install the product, the driver would be waiting in the vehicle.

The Install4Schenker digital service provides a solution for this problem. Instead of utilizing in-house craftsmen, the platform coordinates delivery and installation between in-house drivers and external craftsmen. A mobile application handles the communication between the platform and the craftsmen.

The following chapters showcase the development process of the Install4Schenker digital service by utilizing Digital Business Engineering. The authors investigate, whether Digital Business Engineering provides a suitable method for assisting users in engineering a solution like Install4Schenker.

4 Developing Install4Schenker with Digital Business Engineering

4.1 End-to-End Customer Process Design

From the perspective of DB Schenker, retailers make up the body of the customer segment. The authors aim to investigate the complete end-to-end customer process and thus consider the whole process of buying a product up to its delivery and installation. Henceforth, we differentiate between the customer (retailer) and the end-customer (consumer).

The end-to-end customer's journey starts with an end-customer realizing his desire or need to buy a product, which requires installation. The end-customer uses different channels such as the internet or print to gain information about the product. He further purchases the delivery and installation service with a retailer and thus awaits the delivery of the product. The end-customer's desire lies solely in acquiring a product and the installation service as well as to receive the service comfortably, i.e., at his desired point of time.

Initially, the end-customer informs himself about a product, which satisfies his desire, e.g., to buy new furniture via the different channels. Once the end-customer reaches a decision, he purchases the product online or at a store. The retailer receives the order and triggers the installation and delivery process with DB Schenker. From the customer's point of view, the next interaction takes place once the product is delivered and installed. The end-customer does not have any insight regarding how DB Schenker provides the service. Figure 2 visualizes the customer process as a service blueprint.

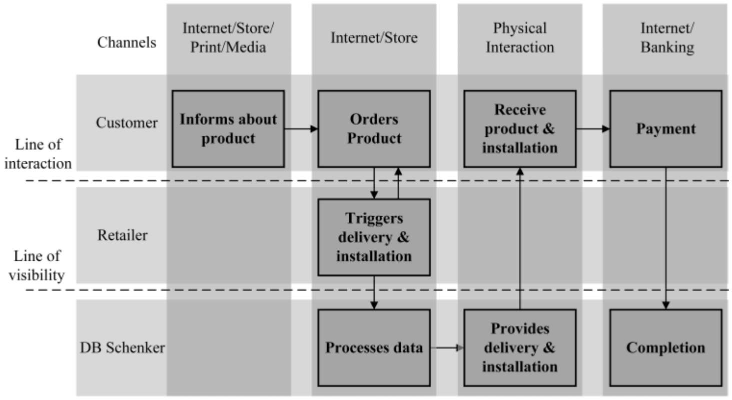

Figure 2. Excerpt of the customer journey depicted as a service blueprint.

4.2 Business Ecosystem Design

The realization of Install4Schenker requires different actors in the value creation ecosystem. The authors determine the following players in the ecosystem: Customer, Retailer, Service Provider (DB Schenker), Craftsmen, and Driver. Between those actors, different activities and information flow takes place.

Further, the authors apply techniques of network analysis to identify possible patterns, as well as critical nodes in the graph. Measures, such as Betweenness Centrality, are indicators of the importance of a node in regards to the overall network [41]. Figure 3 shows the resulting business ecosystem. The scaling of the nodes indicates the betweenness, i.e., the significance. Based on the network analysis, both the Consumer and DB Schenker are the most critical parties in the network.

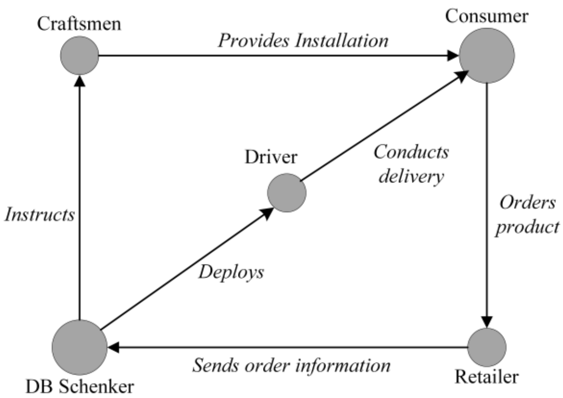

Figure 3. Graph representation of the business ecosystem. Each node represents an actor.

4.3 Digital Product and Service Design

Based on the initial problem of DB Schenker to provide delivery and installation services while utilizing only one driver, the authors developed the following solution. Instead of using in-house craftsmen, the authors implement a digital platform coordinating drivers with external craftsmen. The digital platform offers various potentials such as utilizing network effects, scalability and laying a basis for future additional revenue models. For example, at a later point, the platform could be extended to service additional industry sectors.

Figure 4 shows the operation of Install4Schenker in context of the provision of the delivery and installation service. The retailer triggers the installation and delivery service with the logistics service provider DB Schenker. The platform integrates order information as provided by the retailer. The platform triggers delivery by instructing a driver and feeds job information into the mobile application acting as an interface for the craftsmen. Both driver and craftsmen arrive simultaneously at the targeted destination. From this point, the driver delivers the product to the end-customer's doorstep and his responsibilities end. The platform provides a multitude of functions, e.g., the coordination and distribution of jobs, processing customer evaluation of the job, validating the craftsmen's certifications, and provide geographical information for each task.

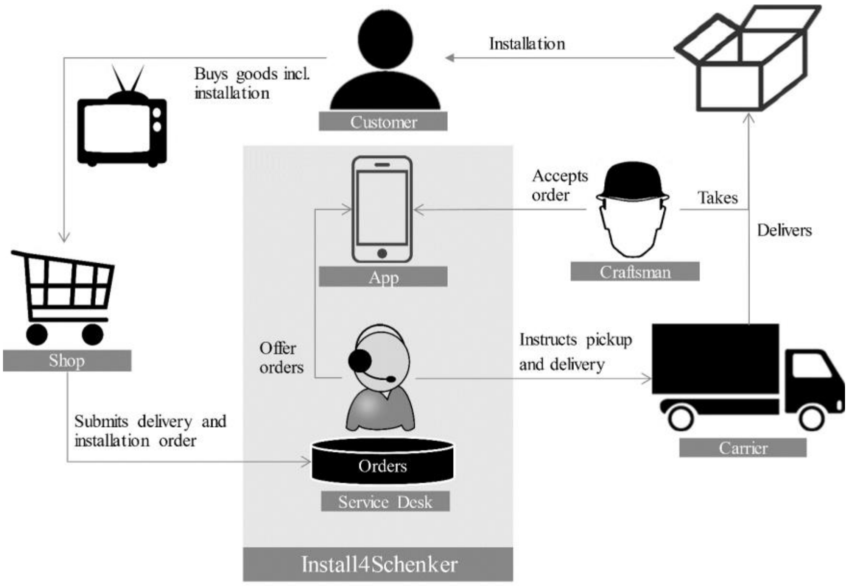

Figure 4. The future customer process for Install4Schenker

The authors further utilized the Business Model Canvas to fulfill requirements of a business model such as value proposition, revenue streams or cost structure. This step takes into account, e.g., resulting costs like development, maintenance, and operating expenses.

4.4 Digital Capabilities Design

Based on the previous steps the authors derive digital capabilities required for the realization of Install4Schenker. The authors chose to follow the capability reference model for dynamic and data management capabilities as proposed by Bärenfänger et al. and apply the framework to the use case [14]. Based on the reference model the authors outlined capabilities required for designing a digital service and needed for the realization of Install4Schenker. Figure 5 shows data management capabilities. Both the capabilities and the relevant data were worked out in a workshop setting by three researchers from the Fraunhofer ISST and the Technical University of Dortmund.

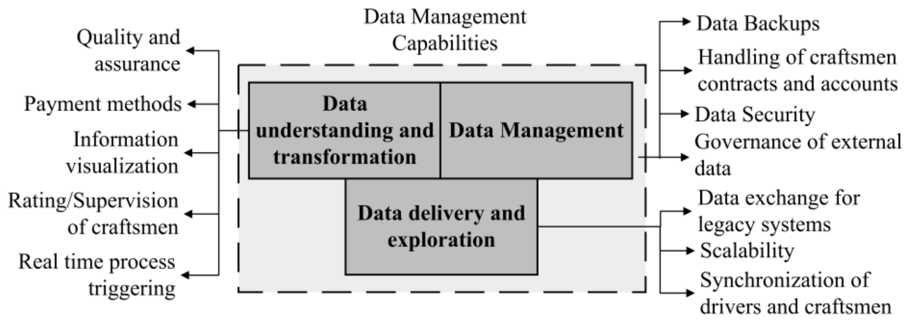

Figure 5. Capabilities as proposed by Bärenfänger et al. [14] for Install4Schenker

4.5 Data Mapping

Further, the authors analyzed the required data and data sources. The data structure divides twofold, into internal data on the one hand and external data on the other. Internal data contains information about the drivers, their location and job status. Further, data about the statistics, i.e., quality measurement of completed jobs, or feedback and TMS (Tour Management System) information accumulate internally. Information about orders provided by the retailer or the customer is integrated from external sources. Also, craftsmen need to provide certificates as well as payment information and personal data. Figure 6 indicates an excerpt of occurring data.

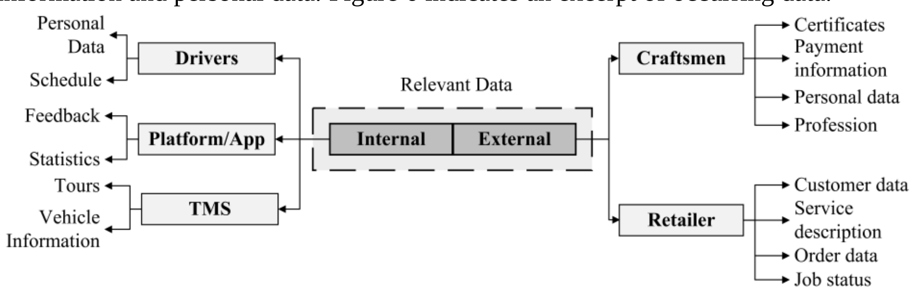

Figure 6. Excerpt of required data and data sources for Install4Schenker

4.6 Digital Technology Architecture Design

Figure 7 shows a conceptual representation of the technology architecture underlying the Install4Schenker digital platform. The data management system PostgreSQL provides order information and feeds it to the server using an Application Programming Interface (API). Via the internet, the platform exchanges data between the server, the service desk, and mobile devices. A browser application and a mobile application provide user interfaces, for drivers and craftsmen respectively. Figure 7 depicts the conceptual technology architecture. The level of detail of the digital technology architecture depends on the requirements set by each case.

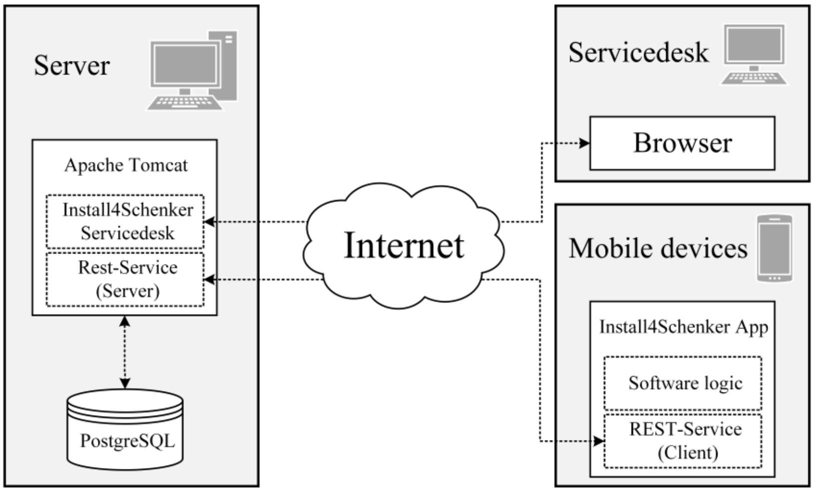

Figure 7. Conceptualization of the digital technology architecture of Install4Schenker

5 Discussion and outlook

In this paper, the authors aimed towards showcasing the development process of the Install4Schenker digital service and identifying possibilities for further research regarding the Digital Business Engineering method. At this point, the authors can conclude that Digital Business Engineering provides a practical blueprint for the development of a conceptual digital business solution.

The activities End-to-End Customer Process Design and Business Ecosystem Design provide a clear picture of the future customer process and the corresponding business ecosystem. As identified, there is no need for further research. Digital Product & Service Design operates with generalized techniques for product and service development. At this point, the development or implementation of solution-specific (e.g., for platforms) techniques is advised. In the activity Digital Capability Design, the authors implemented the capability reference model as proposed by Bärenfänger et al. [14]. Still, there is additional potential for considering dynamic capabilities. The activities Data Mapping and Digital Technology Architecture Design result in a conceptual representation of data and the technology architecture. At this point, the authors propose contextualization of both activities to get a clear picture of their correlation. Further, based on the scenario of application, Data Mapping, as well as Digital Technology Architecture Design, need situational techniques assisting the development of more detailed deliverables. Table 1 summarizes the conducted case study and points for future research.

Table 1. Summary of the techniques used to develop Install4Schenker

Activity	Deliverable	Technique	Future Work
E2E-Customer Process Design	Future Customer Process	Service Blueprint	-
Business Ecosystem Design	Actors in the value creation network	Network Analysis	-
Digital Product & Service Design	Concept of digital products or services	Business Model Canvas	Implementation of case-specific techniques (e.g., Platform Business Model Canvas)
Digital Capabilities Design	Overview of required capabilities	Capability Reference Model	Further implementation of the capability reference model
Data Mapping	Overview of data and data sources	Data Mapping	Contextualization of data with capabilities and technology architecture
Digital Technology Architecture Design	The concept of the digital technology architecture	Digital Architecture Design	Contextualization of data and technology architecture

Additionally, general points of interest for further research were identified. Firstly, the generated deliverables for each activity require methodological contextualization. Method Engineering provides the concept of a meta-model acting as a blueprint for the method, which serves this purpose [30]. Secondly, further application of Digital Business Engineering in case studies and workshops in both academia and practice is imporant for further development of the method. Thirdly, a toolset providing tools for different scenarios and guidance towards their usage is needed.

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