Service Value Creation Using Data Science

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ABSTRACT

Purpose: This paper outlines an approach to design customer-centred services by systematically integrating the methodologies of service science and data science.

Design/Methodology/Approach: The methodological approach described in this paper combines the approaches of service science and data science. The tools and methodologies for designing services are assessed and described in relation with the concepts of the service dominant logic. The steps of the service design process are characterised by their specific problem statements. The relation of these problem statements with the potential outcomes of data science tools is investigated. To do so, we elaborate a structure of data science methodologies w.r.t. their potential for the creation of service value. The outcomes gained from data science are then systematically applied in the different phases of the service design process.

Findings: Developing services with a focus on customer needs does not systematically leverage the full potential of data and analytics. On the other hand, developing services starting from the data perspective does not systematically meet the customer needs.
A procedure is provided to select the appropriate analytics tools depending on the stage and problem statement of the service design process. We show how customer service benefits can be created by analytics.

Research limitations/implications: Although the systematic approach for the development of data-driven service value creation has been tested with a set of practical use cases, the applicability in a wider range needs to be verified.

Practical implications: Thanks to the approach shown in this paper the potential of data-based services can be realised. The paper provides a practical guidance that can be applied in service design projects.

Originality/Value: The innovation of this paper is a combination of the two scientific fields service science and data science for improving service innovation. The resulting combined approach represents a new contribution to the scientific community of service science.

Paper type: Research paper.

KEYWORDS: service science, service design, data science, data product design, data-driven service.

1. INTRODUCTION

This paper describes a new methodology for creating service value using data science. The goal is to design and engineer service that is consequently customer-centred, i.e., derived from the customer's requirements, and that leverages the potential of data science.

The approach discussed in this paper starts with the concept of the service-dominant (S-D) logic, which defines service as the application of competences (knowledge and skills) for the benefit of another entity or the entity itself (Lusch and Vargo 2008).

The S-D logic considers service as the fundamental purpose of economic exchange (foundational premise 1, FP 1). The value creation is moved from the provider to the collaboration process between the provider and the customer. The quality of the service is determined by the customer perception rather than by the engineering on the side of the provider (Vargo and Lusch 2014).

According to the S-D logic, value is always co-created by the customer (FP 6). Value is deployed over a period of time which exceeds the discrete moment of sales and distribution. E.g., the service value creation may start with the customer evaluating the service, continue with learning to use it, paying, renewing it etc. (FPs 6 and 7). The service concepts are based on the assumption that service is exchanged among human actors who create resources by integrating and combining other resources (FP 9).

Therefore, those co-creating actors, building a network of actors, make up service ecoystems (Lusch and Vargo, 2008). All actors are both providers and receivers of service benefits. The human actor benefiting from the service may be a consumer, or an employee getting support for doing his job, or a citizen getting support for his daily life. This applies also to industrial services (e.g., in Industry 4.0), in which human actors are creating value typically supported by the service provided by other human actors or by technical machines.

With respect to the customer benefit, each realisation of a service creates a different experience and assessment by the customer, depending on his individual situation and context (FP 10). When designing a new service, it is therefore essential to first define the target customer and to explore his needs for service in his specific context. The next step is then to design a value proposition that provides service benefits that are relevant for this target customer in his context.

Meierhofer and Meier (2017) provide an approach for the systematic development of service value given the outcomes of analytics. The paper describes how analytics-based results can systematically be deployed into service value. The approach of the paper here is based on Meierhofer and Meier (2017), but tackles the challenge from the opposite side: we assume that we have a given customer situation in which we apply the service design methodology. From service science and service design, there is a comprehensive set of methodologies for designing relevant value for customers (Lusch and Vargo 2008, Osterwalder et al. 2014, Polaine and Løvlie 2013, Brenner and Uebernickel 2016). The specific literature about service design (Osterwalder et al. 2014, Polaine and Løvlie 2013, Brenner and Uebernickel 2016) describes how to design value propositions that are relevant for the customer. Service is designed in an iterative process consisting of several distinct phases. In all steps of this process, there are specific design challenges to be solved. With the data available today and the tools to analyse it, better solutions for these challenges can be found. Still, there is no systematic procedure available to do this.

The specific problem statement "How to support service innovation with data science?" is discussed in the literature. For instance, Provost and Fawcett (2013) break the service challenges into sub-challenges that lend themselves to a solution by data science. Scherer et al. (2016) combine analytics and service design with a focus on characterizing how customers use products and how they act. Other sources typically use data science for analysing customer behaviour or customer segmentation (e.g., Wang et al. (2016) or Kwong, Huimin, and Luo (2016)). In (Siegel 2016) there is an extensive description of data science use cases in many different application domains. Although the outcomes and insights provided in this literature are relevant and a necessary precondition for value creation, there is still a gap to be filled for a systematic procedure for data-driven service design. For a given service design challenge, it is not yet clear how to apply data science for creating service value for specific customers. Howard, Zwemer, and Loukides (2012) as well as Loukides (2011) postulate that data-driven service must create actionable outcomes that help the customers reach their goals. Further research for data-driven service design is relevant and required (e.g., Peters et al. (2016), Spohrer et al. (2015)).

The approach in this paper differentiates itself from the existing literature in the following ways: It considers the end-to-end service design process taking into account all phases of Figure 2 and matches each phase with the benefits that can be provided by analytics. Additionally, it is based on a comprehensive structure of benefits that data science can provide. The paper here is based on (Meierhofer and Meier 2017), but approaches the problem from the service perspective instead of from the data perspective.

In section 2, the phases of the structured service design process are discussed. The assumption underlying this paper is that the application of data and analytics can support to solve the design challenges in these phases. The service-oriented outcomes of analytics are discussed in section 3. Section 4 then embeds these outcomes of analytics in the service design process.

2. THE SERVICE DESIGN PROCESS

Service design can be considered as an implementation of principles that are in accordance with specific aspects of the S-D logic. According to the service design principles, service is developed in co-creation mode with the customer. The evaluation of the customer needs represents a central starting point. Value propositions are designed, tested and improved together with the customer in order to provide the right benefit in the right context.

To start, we now put the focus on the problem of understanding the customer's needs and designing value propositions to meet those needs. The literature provides us with established service design tools for the creation of value for humans (e.g., Osterwalder et al. 2014, Polaine and Løvlie 2013). Service value propositions need to address not only functional, but also emotional needs (in (Osterwalder et al. 2014) so-called jobs, pains and gains, see Figure 1).

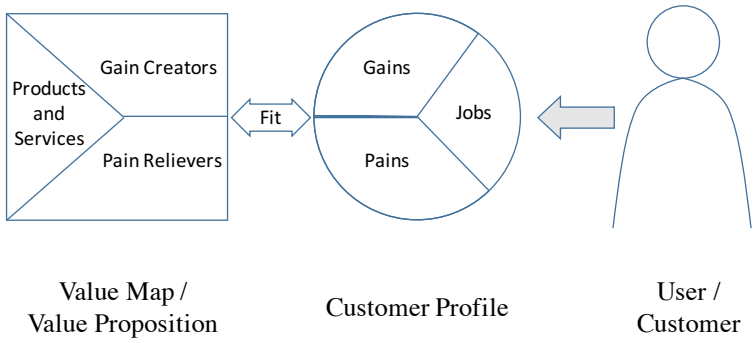

Figure 1: Designing service value propositions based on the customers job, pains, and gains

The service design process describes the systematic procedure consisting of several phases from the evaluation the customer needs over the design and testing of the value proposition to the deployment and operationalisation of the service. Although there is no standard service design process, understanding the customer needs and creating customer insights is always at the beginning. This is followed by iterations of designing, testing, and improving the service (Osterwalder et al. 2014, Polaine and Løvlie 2013, Brenner and Uebernickel 2016).

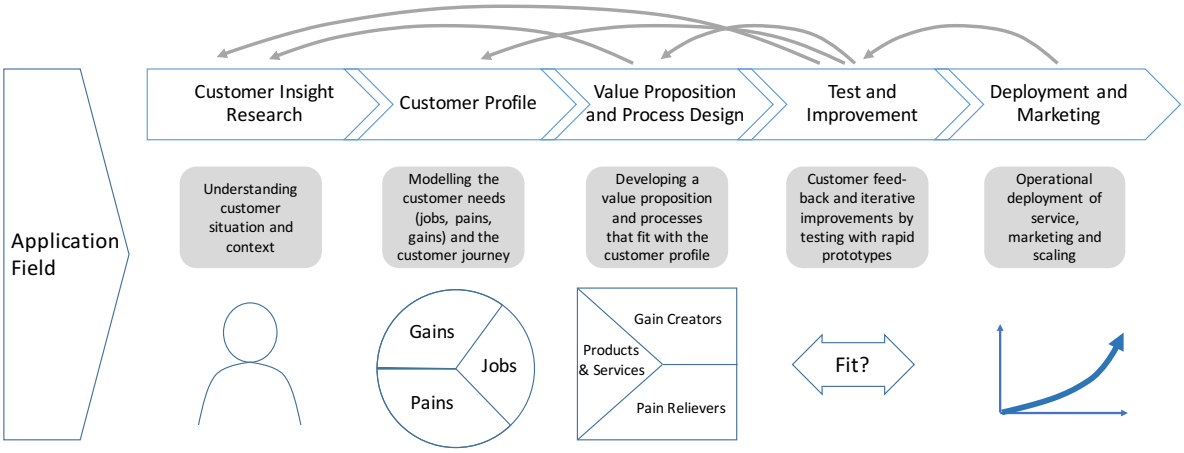

Figure 2: Phases of the service design process (derived from (Meierhofer and Meier 2017))

In this paper we use the service design process as shown by the steps in Figure 2 (based on (Meierhofer and Meier 2017). The application field describes the situation and context of the customer's problem statement. The application field may be: “the customer needs to complete a specific job during a business day”. The phases “Customer Insight Research” and "Customer Profile" provide an understanding of the customer's needs (jobs, pains, gains), which enables the service engineer to design a corresponding value proposition and service processes (phase “Value Proposition and Process Design”). The acceptance of the new service by the customer is tested in the phase “Test and Improvement” before the final deployment and operationalisation. The process typically does not proceed in a linear way, but goes back to earlier phases for adaptations when given assumptions are falsified (iterations of "design – test – improve" indicated by the arrows in Figure 2).

As stated before, each phase of this process imposes specific challenges. The approach shown in this paper searches for analytics outcomes helping to solve them (compare also to (Meierhofer and Meier2017)). Understanding and clustering the customer needs is relevant in the phase “Customer Insight Research”. Classifying the customers into segments and describing typical customer behaviour are tackled in the phase “Customer Profile”. Designing a service value proposition that fits with the customer needs of the target segment is the challenge in the phase “Value Proposition and Process Design”. First qualitative and then quantitative testing of the service value proposition is done in the phase “Test and Improvement”. Finally, in the phase “Deployment and Marketing”, a major task is to identify and contact individuals that belong to the target segment.

The question in this paper is now how the solutions to these challenges during the phases of the service design process can be supported by the application of analytics tools.

3. APPLYING ANALYTICS FOR THE CREATION OF SERVICE BENEFITS

In this section, we discuss a structure of analytics tools that can be applied in the different phases of the service design process. We consider analytics as a part of data science. For the term “data science” we use the definition according to (Stadelmann et al. 2013): “data science is the unique blend of skills from analytics, engineering and communication aiming at generating value from the data itself.” With the term “analytics” we refer to the methods and tools from data science that are directly applied to analysing, mining, or modelling the data: statistical methods, machine learning algorithms, the application of data management tools, etc.

Analytics Outcome	Contribution to Servie Benefit
Causal Modeling	Identification of influence between events or actions
Classification	Mapping of people, items, characteristics on defined groups
Regression	Estimation or prediction of numerical values
Data Reduction	Reduction of data sets (reduction of complexity)
Link Prediction	Prediction of relationships between people or items
Similarity Matching	Identification of similar people, items, characteristics
Co-occurrence Grouping	Identification of items occurring based on the same transaction
Profiling	Description of typcial behaviour / detection of deviations
Clustering	Grouping of people, items, characteristics

Figure 3: Structure of analytics-based insights with their benefits for services (adapted from (Meierhofer and Meier 2017) and based on (Provost and Fawcett 2013))

Referring back to section 1, we take the definition of service: the application of competences (knowledge and skills) for the benefit of another entity or the entity itself. In combination with considering data science as the blend of skills mentioned above, it is evident that data science lends itself to be applied for service: data-driven service is the application of data science competences for the benefit of another entity (or the entity itself).

According to (Provost and Fawcett 2013) data science supports decision making. At this point, it is not yet clear how to turn these decisions into services by applying them for specific customer problems. Therefore, derived from Meierhofer and Meier (2017), we describe a way how to systematically apply analytics-based outcomes when designing services. For this goal, we structure the data science-based tools according to their contribution to service benefit (Figure 3). We use the nine drivers shown on the left-hand side of Figure 3 as the elements of analytics-based outcomes and benefits (Provost and Fawcett 2013). We need to point out that the nine outcomes of Figure 3 are not the analytics algorithms themselves. The terms (like “clustering” or “classification”, etc.) taken from (Provost and Fawcett 2013) refer to analytics outcomes that provide value for services from a business perspective. The underlying algorithms may be referred to by similar terms, however in a different context.

The right-hand side of Figure 3 links possible service elements to the nine basic elements of analytics outcomes. These service elements are generalised from the extensive list of examples provided by Siegel (2016). As described in (Meierhofer and Meier 2017), Figure 3 provides a lookup table for the identification of service elements that can be supported by analytics tools. In contrast to (Meierhofer and Meier 2017), in this paper we start with the service design process, i.e., we need to identify the analytics tools that are appropriate for the given challenges along the process of Figure 2. Therefore, we embed the analytics tools in the service design process in section 4.

4. EMBEDDING ANALYTICS IN THE SERVICE DESIGN PROCESS

In section 2 the steps of the service design process and the corresponding design challenges were discussed. In section 3 the basic elements of analytics were structured and their outcomes were mapped to potential data-driven service elements.

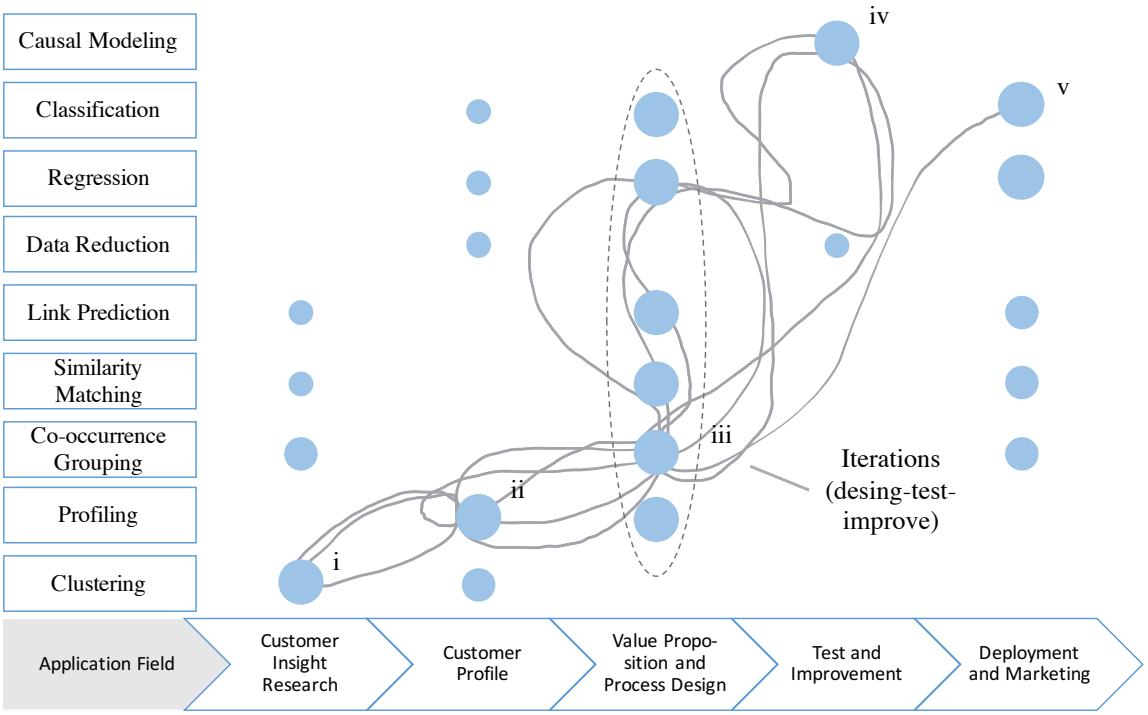

Figure 4: Embedding analytics outcomes in the phases of the service design process (adapted from (Meierhofer and Meier 2017))

According to (Meierhofer and Meier 2017), the matrix shown in Figure 4 can be used to link the service design process with the basic elements of analytics. Example: clustering can support the identification of customer segments with common needs ("Customer Insight Research"). In this way, the design challenges in each phase are mapped to the service contribution of the available analytics tools. The circles in Figure 4 indicate which phase of the service design process can get benefits from which analytics tool with the size of the circles qualitatively showing the strength of the constructed relationship (small, medium, large benefit). This mapping needs to be validated by ongoing studies (see also section 6). Again, the entire service design process proceeds in iterations of “design – test – improve”, as indicated by the squiggle in Figure 4.

5. CASE STUDIES

The new methodology described in section 4 was applied in first case studies, which have been evaluated in (Meierhofer and Meier 2017) starting from the data perspective. In this paragraph, we discuss two different kinds of these case studies from the perspective of service design.

First case: A service provider looking for a new offering in the area of technically assisted living in private households. In this application field it was not yet clear which service could be provided and which were the customer segments. Various data was available about the customers. In the phase “customer insight

research", a clustering analysis of the customers can show whether there are natural segments of needs (e.g., based on geographic location, frequency of presence in apartments etc.) (i in Figure 4). Profiles of customer can be set up based on their typical behaviour. These profiles may indicate opportunities for the new service (ii). With co-occurrence grouping customers can be identified who use similar services in order to bundle the new service to existing ones (phase "Customer Profile"). For the phase "Value Proposition Design and Processes", a possible value proposition can be the prediction of the household consumption by a combination of classification and regression, for example (iii). In the phase "Test and Improvement", causal modelling can be applied to exclude that test results are based correlations (iv). Classification may support personalised marketing (v, phase "Deployment and Marketing").

Second case: As mentioned, practical service design cases often do not follow the service design process in a linear way. This second case study is in the application field of customer service agents in a company providing consumer services. Technical tools for speech-to-text and natural language processing were assumed to provide benefits to the agents. Hence, this case study starts from the perspective of data and technology as described in (Meierhofer and Meier 2017). However, we turn the case around and start from the service perspective here. Thus, considering the agents as the customers of the service, the service design project then started with understanding their jobs, pains, gains, and customer journey (phase "Customer Insight Research"). Based on this, the agents can be clustered into segments (i). The typical journeys and profiles of the agents can be described (ii, phase "Customer Profile"). In the phase "Value Proposition and Process Design" services fitting the jobs, pains, and gains of the agents can be designed. Analytics support for these services can be provided based on speech-to-text and natural language processing. The resulting services help the service agents during the dialog with the customer with the following elements: automatic retrieval of customer data, estimation of the customers context, proposal of new service offers, as well as the structured recording of the conversation (elements of iii).

6. CONCLUSIONS AND FURTHER DEVELOPMENT

We discussed how to support the process of service value creation with data science. First, the service design process was outlined and related to the principles and foundational premises of the S-D logic. The design challenges specific for each phase of the process were discussed. This revealed where the service design process can be supported by the specific analytics tools. Second, a structure of analytics tools was shown with nine outcomes which enable the service value creation. Finally, the nine different analytics outcomes were embedded in the service design process.

The new methodology has been developed and validated with practical case studies of new or ongoing service development projects. In these practical case studies we encountered a couple of projects which were started from the data perspective with precise a priori ideas of using data and analytics. However, it turned out that when starting like this it was not obvious to find the relevant service value (the procedure for this data-oriented starting point is described in (Meierhofer and Meier 2017)). The opposite approach from the service perspective, which is discussed in this paper (i.e., starting with the service design challenge and then searching for appropriate analytics tools), lends itself more directly to a systematic procedure. However, in many practical situations, data-driven service is designed iteratively changing between the data and the service perspective, respectively.

Additionally, the practical case studies revealed that the customer journey, i.e., the deployment of the service value over a period of time as discussed in section 1, may provide an important field for the application of analytics. Future research will shed light on this topic.

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