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The Potentials of Personal Data Management for Smart Service Innovation

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1. Introduction

The significance of (big) data for service value creation and service innovation is widely acknowledged (Barrett et al. 2015; Lusch and Nambisan 2015). Especially smart services highly depend on data and data analytics capabilities to infer intelligent actions based on algorithms and machine learning (Demirkan et al. 2015; Gretzel et al. 2015; Lim and Maglio 2018). Smart services have spread across a variety of industries and application scenarios, such as *smart home, smart mobility, healthcare, or smart tourism* (Lim and Maglio 2018). They deliver value by means of intelligent sensors to obtain contextual data of their surroundings and interactive feedback (Wünderlich et al. 2015; Allmendinger and Lombreglia 2005). This results in intelligent context-based service solutions and new opportunities for value co-creation between consumers and service providers in interconnected smart service systems (Beverungen et al. 2019; Dreyer et al. 2019; Lim and Maglio 2018). If smart objects are linked to an individual customer or a group of customers, they collect and process personal data. Massive digital traces of connected people have emerged driven by the rising number of smart objects and connected devices people interact with (Kunz et al. 2017; Beverungen et al. 2018). Smart services, such as fitness tracking services or health monitoring devices (Lim et al. 2019; Pikkarainen et al. 2018) utilize this data to offer customers high-quality recommendations and highly customized service features (Wünderlich et al. 2015; Demirkan et al. 2015). Service organizations can leverage this data to build deeper customer engagement and to provide dynamic real-time service personalization (Kunz et al. 2017; Lehrer et al. 2018; Ostrom et al. 2015).

Personal data management has been recently highlighted as a key concept in (smart) service innovation (Maglio/Lim 2016; Peters et al. 2016; Huhtala et al. 2019), but only a few researchers have developed promising contributions in this field (Kim et al. 2018; Lim et al. 2019). Arising volumes of data offer new service opportunities: Personal data from fitness trackers, for example, can be used with other behavioral data or external data, such as the current weather information, to create new service value for the customer. But this information needs to be systematically managed across service systems and providers (Ostrom et al. 2015; Maglio/Lim 2016; Peters et al. 2016). The systematic management of personal data in smart service systems is not yet received sufficient attention, especially since it is associated with a number of challenges (Spiekermann et al. 2015; Kim et al. 2018; Lim et al. 2019): For a comprehensive customer understanding, service organizations must integrate personal data from smart objects with data from a range of disparate systems along customer touchpoints (Stone et al. 2004; Jayachandran et al. 2005; Kunz et al. 2017). Moreover, service organizations must consider the active role of the customer to co-create value by sharing valuable information for smart service provi-

sion and improvement (Yi/Gong 2013; Alt et al. 2019) and must finally ensure privacy regulations as well as data security to create trust when working with the data of their customers (Spiekermann et al. 2015; Huhtala 2018; Bitomsky et al. 2020).Therefore researchers have raised the legitimate question of how personal data can be more adequately systematized in service innovation processes (Maglio/Lim 2016; Peters et al. 2016; Lim et al. 2019). Following this call, this contribution points out that the management of personal data for smart service innovation requires a specific focus. It has the objective to conceptualize personal data management and to integrate this field more closely into the service innovation process.Therefore, the following research question is suggested:

RQ: What is the potential of a systematic approach of personal data management for smart service innovation processes?

Based on the customer-dominant logic (Heinonen et al. 2010; Heinonen/Strandvik 2020) as a theoretical lens, key action fields of personal data management in smart service innovation will be presented along with relevant research and application examples. A stronger conceptualization of personal data management does not only contribute to the research field of smart service innovation. It also strengthens a stronger human-centered innovation process as requested by various researchers (e.g., Demirkan et al. 2015; Maglio/Lim 2016; Alt et al. 2019; Heinonen/Strandvik 2020) and offers novel approaches that empower consumers to participate in the collection, management, and consumption of their personal data for the co-creation of new service value (Chaudhry et al. 2015; Huhtala et al. 2019). Finally, the research results offer promising entry points for practitioners for the design and management of smart service systems. In section 2, the theoretical foundations are outlined that are followed by the conceptualization of personal data management in section 3. Section 4 provides a practical example by using the restaurant industry as a human-centered service industry. Finally, we end up with the conclusion and future research.

2. Theoretical Foundations

2.1 Smart Services

The rise of smart services is strongly interlinked with new technological advancements, such as the Internet of Things, wearable technologies, sharing platforms and intelligent agents based on artificial intelligence applications (Atzori et al. 2010; Demirkan et al. 2015; Yang et al. 2021). The design of novel smart services is on the agenda of a lot of different research streams, e.g., business literature (Allmendinger/Lombreglia 2005), service management and marketing (Wünderlich et al. 2015), or IS literature (Dreyer et al.

2019; Yang et al. 2021). Smart services surpass web-based and digital services (Peters et al. 2016) and take advantage of smart products (Beverungen et al. 2019) that build smart service systems via sensors, contextual data, and actuators (Peters et al. 2016). They represent *self-managing systems* with "self-detection, self-diagnostic, self-corrective, or self-corrective, or self-controlled functions through the incorporation of technologies for sensing, actuation, co-ordination, communication, control" (Maglio 2014). Smart services offer value in a variety of industries, e.g., smart home (Alaa et al. 2017), or smart tourism (Gretzel et al. 2015). However, the understanding of smart services highly differs depending on the research field and their application area (Lim/Maglio 2018; Martin et al. 2020). Martin et al. 2020 identify three main perspectives on smart services:

One perspective considers smart services in the context of the industry 4.0 and the transformation of manufacturing processes (Lee et al. 2014; Martin et al. 2020). Here, smart services are strongly connected to *product-service systems* representing value bundles of traditional products with intelligent data-based services (Becker et al. 2010). These are embedded into cyber-physical systems (Gunes et al. 2014; Lee et al. 2014) that connect the physical world with computing technologies by means of sensors, actuators, and data. Thus, smart services enable automation, self-diagnostics, optimization, and control mechanisms by the communication between smart objects and machines (Allmendinger/Lombreglia 2005; Lee et al. 2014).

Taking the second perspective, smart services are associated with *user-centric services* (Martin et al. 2020) that take advantage of (real-time) data about customer needs and field intelligence (Allmendiger/Lombreglia 2005) to adapt to the individual's requirements (Lehrer et al. 2018; Martin et al. 2020). They offer convenience for customers (Dreyer et al. 2019), help them to improve their decision-making processes, offer personal high-quality recommendations (Demirkan et al. 2015) or even transform data into useful information for the customer (Saarijärvi et al. 2014). Smart services are understood as user-centric as they consider the personal context of the individual customer (Allmendinger/ Lombreglia 2005; Alt et al. 2019). Thus, they are inseparably connected with the concept of service personalization or individualization (Rust/Huang 2014). Service individualization is characterized by trigger-based service automation or preference-based personalization and can improve customer interaction processes (Kunz et al. 2017; Lehrer et al. 2018) to result in deeper customer relationships (Rust/Huang 2014; Ostrom et al. 2015). Compared to the first perspective, user-centric smart services significantly differ in the level of customer involvement. While self-regulating services in cyber-physical systems do not require any active customer participation, user-centric smart services are characterized by a high level of interaction between the customer and the service provider (Wünderlich et al. 2013). In human-centered service industries, e.g., medicine or tourism, personal inter-action usually takes place in close service processes between the customer and the respective service employees and represent an important part of the service delivery process (Wünderlich et al. 2013; Lim/Maglio 2018). Here, user-centric smart services can provide value on a new level based on the automatic ex-

change of personal data for service co-creation and a proactive individualization of the service provision at the right time (Korho-nen et al. 2018; Lehrer et al. 2018).

Finally, the third perspective highlights the role of (big) data and analytics for smart services (Demirkan et al. 2015; Lehrer et al. 2018; Martin et al. 2020). Data analytics is key for smart service systems for the effective and efficient use of data in continuous learning processes (Lim/Maglio 2018). In this context, there are strongly connected to information-intensive, knowledge-based services (Lim/Kim 2015; Peters et al. 2016) or analytics-based services (Hunke et al. 2019). Thereby the term "smart" is highly associated with artificial intelligence (Allmendiger/Lombreglia 2005; Gretzl et al. 2015) that is deployed to analyze and intelligently take advantage of collected data.

2.2 Personal Data

If smart objects are linked to an individual customer or a group of customers (Wünderlich et al. 2015), smart services collect and process personal data. Personal data is defined as data that can be linked to a specific person (European Commission 2016) and include not only the customer's demographic or contact information, but also refer to behavioral data, such as the customer's purchase history or device usage data, that can be associated with a person. Even if this type of data has long been applied by companies for customer relationship management or data-driven marketing (Stone et al. 2004; Wedel/Kannan 2016) the use of personal data to design new services in innovation initiatives is still in its infancy (Kim et al. 2018; Lim et al. 2019). Traditionally, this source of data resulted from transactional processes between organizations and their customers. But the rising amounts of smart devices people interact with has led to an increasing number of digital traces of connected people on the customer side (Beverungen et al. 2019; Lim/ Maglio 2019; Lim et al. 2019). At the same time, companies are creating new *data ecosystems of suppliers, partners, and platforms* to deploy promising customer interaction software or to store and analyze personal data in external systems (Kunz et al. 2017; Stone et al. 2017). Personal data have transformed into a design material itself (Saarijärvi et al. 2014; Seidelin et al. 2020) and new types of data-based services emerge, e.g., for content personalization or self-monitoring services (Huhtala 2018; Lim et al. 2019). For example, personal assistants transform personal data into valuable information to augment human capabilities and to improve the customers' quality of living (Demirkan et al. 2015; Alt et al. 2021).

While the explosion of data availability has led to an increasing focus on personal customer data (Demirkan et al. 2015; Peters et al. 2016), smart service organizations face the challenge of how to leverage data and analytics to create new customer value (Schüritz et al. 2017), especially since the use of personal data is associated with certain challenges: First, personal data collected from smart objects must be integrated with data from other disparate systems along existing customer touchpoints, e.g., customer service, marketing channels, or POS systems, to reach an integrated view and understanding of

the customer (Stone et al. 2004; Payne and Frow 2005).Yet, personal data is often located in various internal and external applications systems and data bases of the organization's data ecosystem where data ownership, accessibility, and the missing interoperability between systems often impede the integration of available data (Kunz et al. 2017; Stone et al. 2017). Second, (smart) service organizations must consider the active role of the customer to co-create value by sharing valuable information for smart service provision and improvement (Yi/Gong 2013; Alt et al. 2019). Third, smart service providers must ensure privacy regulations as well as data security and need to create trust when working with personal data (Spiekermann et al. 2015; Kunz et al. 2017). Processes for consent management to ensure compliance with data protection regulations (Basin et al. 2018; GDPR.EU 2021) and the appropriate architecture and data management procedures must guarantee data security (Lopes et al. 2019). To ensure these requirements are being addressed, *integrated data governance processes* must be defined and implemented to guarantee the appropriate and legal management of personal data (Basin et al. 2018; GDPR.EU 2021). Klicken oder tippen Sie hier, um Text einzugeben..

2.3 Smart Service Innovation

Service innovation represents the "rebundling of diverse resources that create novel resources that are beneficial (i.e., value experiencing) to some actors" (Lusch/Nambisan 2015). Service innovation takes places within a service system and its actors and results from the transformation of the service system or even the creation of new systems (Maglio/Lim 2016). The significance of (big) data for service value creation and service innovation is widely acknowledged (Barrett et al. 2015; Lusch/Nambisan 2015). *Data-driven service innovation* (DDSI) has emerged as a particular research stream that includes (big) data and analytics as a driving resource in the innovation process (Lim et al. 2018; Engel/ Ebel 2019; Schymanietz 2020). Especially smart services highly depend on data and analytics capabilities to infer intelligent actions based on algorithms and machine learning (Demirkan et al. 2015; Lim/Maglio 2018). Data and analytics have the potential to create value in many ways: First, the use of data and analytics provide valuable customer insights to support organizations to explore and to empirically validate new opportunities for service value propositions (Engel/Ebel 2019). Second, data represents the value proposition itself, e.g., in the form of valuable information content based on raw and aggregated data (Saarijärvi et al. 2014; Kim et al. 2018) or analytical-based offerings that additionally provide the analytical methods (Fromm et al. 2012; Hunke et al. 2019). Service design (Ostrom et al. 2015; Patrício et al. 2018) and service engineering (Bullinger/ Schreiner 2006) – both streams of the service science discipline (Maglio/Spohrer 2008) – strive to systematically create new value propositions for service innovation. Service design takes a human-centered, multidisciplinary perspective and represents a holistic design thinking approach by understanding customers and their specific context. The discipline guides the exploration, conceptualization, and evaluation of new service ideas (Ostrom et al. 2015; Patrício et al. 2018; Joly et al. 2019). *Service engineering*

originates from the engineering disciplines and software development and strives to systematically develop new services (Fähnrich/Opitz 2006; Beverungen et al. 2018). Both research streams have developed a range of different process frameworks, methods, and collaborative tools with the aim to systematically develop novel value propositions for service (systems) or product-service systems. A generic innovation process in service design consists, for example, of process phases, such as opportunity identification, customer understanding, concept development, process design, refinement, and implementation (Kim/Meiren 2010). Key aspects that are embedded in relevant conceptual instruments are (1) strong customer orientation (Ostrom et al. 2015; Alt et al. 2019), (2) the customer's active role in the value creation process (Prahalad/Ramaswamy 2004; Barrett et al. 2015), and (3) mutual resource mobilization in service systems (Maglio 2014; Patrício et al. 2018).Yet, research on methodological support that integrates data and analytics more deeply into service innovation activities is only about to gain momentum (Engel/Ebel 2019; Fruhwirth et al. 2020b) and only a few researchers provide assistance how to focus on the use of (personal) data (Maglio/Lim 2016; Kim et al. 2018; Lim et al. 2019; Blöcher et al. 2020). But companies still lack the comprehensive knowledge of how to fully take advantage of data and analytics for data-driven service offerings (Schüritz et al. 2017). Therefore, more conceptual work is necessary that support service organizations with the appropriate instruments to integrate data and in specific personal data into the development process of smart services (Lim/Maglio 2016).

3. Personal Data Management and Smart Service Innovation

Personal data has been recognized as a key concept in (smart) service innovation and researchers call for more systematic approaches in this field (Peters et al. 2016; Lim et al. 2019; Lim/Maglio 2016; Huhtala et al. 2019). Arising volumes of data offer new service opportunities (Kunz et al. 2017; Ostrom et al. 2015), but they need to be systematically managed across service systems and providers (Alt et al. 2019; Maglio/Lim 2016). Therefore, this contribution proposes a systematic approach of personal data management for smart service innovation processes. We understand personal data management as *the encompassing systematic management of personal data in all service innovation activities for the development of smart services.*

Thereby, a customer-dominant view on personal data management that is founded on the backbone of the customer-dominant logic as the theoretical lenses. The authors argue that such a customer-dominant perspective on personal data management is associated with several potentials for the service innovation process and can *empower the design of data-rich smart services*. First, it strengthens the user-centric perspective on smart services – a research discipline that is still strongly connected to the industry 4.0. and ma-

chine-driven cyber-physical systems. Instead, the focus on personal data management has the purpose of a stronger human-centered innovation process of smart services as requested by various researchers (e.g., Demirkan et al. 2015; Peters et al. 2016; Heinonen/ Strandvik 2020). Second, it highlights the value of all personal data sources for smart service organizations and emphasizes the need of systematically analyzing and combining data from smart devices with other personal data resources during the smart service innovation process (Lim/Maglio 2016; Lim et al. 2019). In order to create innovative solutions for the customer, service providers must overcome data silos in the service system instead of simply developing separated service solutions. Third, it minimizes the risks of the wrong handling of personal data that are related to data breaches and the loss of trust and image value and reduces complexity by offering the appropriate instruments in handling personal data processes. Finally, it introduces novel approaches that empower consumers to participate in the collection, management, and consumption of their personal data for the co-creation of new service value (Chaudhry et al. 2015; Beverungen et al. 2019; Huhtala et al. 2019). In the following chapter, we shortly introduce the customer-dominant logic and relate the theoretical perspective to personal data management. Subsequently, personal data management is conceptualized by proposing particular action fields. Those action fields are specified on the basis of a customer-dominant view and related to the different phases of the smart service innovation process.

3.1 A Customer-dominant Perspective

The customer-dominant logic (CDL) represents a managerial perspective on service management that originates from the business and marketing field (Heinonen et al. 2010; Hei-nonen/Strandvik 2015; 2020). A range of diverse studies from disciplines, such as service management, marketing, and consumer research, take advantage of the perspective and its conceptual underpinnings (Heinonen/Strandvik 2020). In contrast to the service-dominant logic, CDL does not focus on the single service situation and interaction process between service providers and their customers (Vargo/Lusch 2007). Instead, it positions the customer and the understanding of their daily life in the center of all organizational activities.

Customer Logic and Deep Knowledge: The managerial perspective of CDL proposes a holistic view on the customer logic that contains the history, presence, and future of service consumption in the customer's ecosystem, their individual aims, and daily processes, and finally the sense-making behind their choices, practices, and activities (Heinonen et al. 2010, Heinonen/Strandvik 2020). Consideration of the individual context of the customer requires deep knowledge who the customer is and why they are acting in a specific way (Drucker 1974). Service providers must understand each customer's daily processes and experience embedded in their social system of multiple service providers. According to CDL, this knowledge of valuable customer insights must be the center of the

service offering. With the rising amounts of digital touchpoints, customers produce data in each of their processes and interactions with multiple service providers (Berendes et al. 2018; Lim et al. 2019). By taking advantage of these growing personal data resources, e.g., via sensors, social media, etc., the analysis of personal data allows organizations to create such a deep understanding of the customer's ecosystem (Heinonen et al. 2010; Ostrom et al. 2015; Heinonen/ Strandvik 2020; Ostrom et al. 2015). This requires the analysis of relevant data describing customer activities and processes, and the identification of behavioural patterns (Berendes et al. 2018; Blöcher et al. 2020; Heinonen/Strandvik 2020).

Personal Value: The CDL underlines the need of understanding the diversity of existing logics, each specific situation, and experiences individually. This comprehensive knowledge allows "to participate in and support customer's processes" with the aid of individual service offerings (Heinonen et al. 2010). If service providers aim to consider different customer logics, expectations, and processes, they must align their business models, but also their offerings and activities to the individual requirements of the customer (Heinonen/Strandvik 2020). Consequently, smart services must apply logics and intelligence to translate knowledge into supportive data-driven value propositions using analytics and algorithms (Demirkan et al. 2015). Simultaneously, service value must enrich or facilitate the customer's processes, so that available data assets must be matched with existing customer needs and personal goals (Saarijärvi et al. 2014; Lim et al. 2019).

Active Role: Moreover, the CDL strengthens the role of the customer and underlines that customers are not only co-creators of value in service processes like in SDL (Vargo/Lusch 2007). Instead, they are the initiators that utilize and control service processes for pursuing their objectives (Heinonen et al. 2010; Heinonen/Strandvik 2020). This signifies that they are not only fully in control of their resources. Data management processes must also be designed to allow customers to initiate and control the services and active delivery of their data (Blöcher/Alt 2018; Poikola et al. 2020).

Interconnectivity: Paying attention to daily routines and activities also means that services should be integrated smoothly into the customer's life. Smart services, such as personal assistants or information services, support daily activities when technologies are strongly interconnected with daily activities and routines of the customer (Wünderlich et al. 2015; Cena et al. 2018; Alt et al. 2021). This include smartphones, but also other smart devices, such as screens or tables that are embedded into relevant objects to integrate service provision as deeply as possible into daily life activities. Thus, smart services assist customers in their daily activities at their best when technologies are deeply embedded into their lives and information provision is convenient for the customer (Wünderlich et al. 2015; Lim et al. 2018). This requires a holistic process design so that services are device independent and usable on any suitable device to enable omnichannel service experiences (Barwitz/Maas 2018; Wulf 2020).

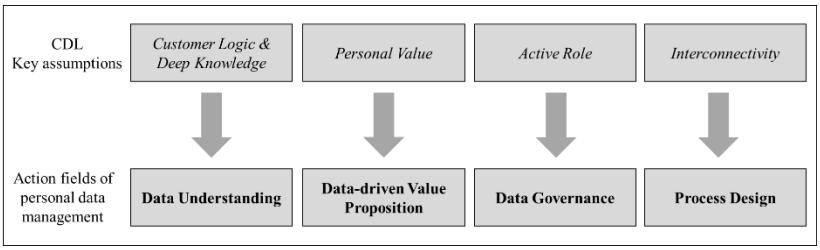

Figure 1: Deduction of action fields of personal data management based on the CDL.

3.2 Action Fields of Personal Data Management

The following paragraph describes a customer-dominant approach of personal data management for smart service innovation initiatives. With the aim of integrating personal data management more strongly into the innovation process, four particular action fields for personal data management are proposed. Those are related to key assumptions of the CDL and specified by using the CDL as the conceptual underpinning.

Data Understanding

Understanding available data is central to the successful extraction of knowledge from data (Mathis/Köbler 2015; Lim et al. 2018). In data analytics, the term data understanding is used for the process of building up *detailed knowledge* about available data. For example, the well-established cross-industry standard process (CRISP) for data mining emphasizes the careful evaluation of data at the beginning of an analysis with respect to the traceability of results and the efficiency of data science projects (Larose 2006). Data understanding is inseparably interconnected to business understanding and builds the basis for the analysis and finally sensemaking (Chapman et al. 2000).

This contribution points out the importance of *data understanding* as the first action field This contribution points out the importance of *data understanding* as the first action field at the beginning of the service innovation process. Researchers insists that service organizations need to explore available data sources first when they create novel services with the aid of data (Mathis/Köbler 2015; Maglio/Lim 2016; Kayser et al. 2019). A comprehensive data understanding from all relevant internal and external data sources enables smart service organizations to creatively combine novel and existing data resources when designing novel service value propositions (Mathis/Köbler 2015; Beverungen et al. 2017; Blöcher et al. 2020). Building up data understanding is specifically relevant for personal data to extract relevant customer insights as the “heart of the service offering” (Heinonen/Strandvik 2015) and to build up a holistic view on the customer and their needs and daily activities. A customer-dominant view in creating data understanding

demands the analysis of all relevant customer interactions at multiple contact points. An integrated analysis on the customer's individual history is necessary to deduct valuable customer insights and to reach an integrated single view of the customer (Payne/Frow 2005; Heinonen/Strandvik 2020). Understanding available data is central to build up customer knowledge and to successfully utilize this data for the design of smart services (Lim/Maglio 2016; Peters et al. 2016; Lim et al. 2018). Furthermore, smart service organizations should leverage the personal data sources from smart devices (Kim et al. 2018; Lim et al. 2019; Blöcher et al. 2020). Finally, a customer-dominant view implies that service companies need to broaden their view and look at data from other service partners when this data is relevant to understand the customer's objectives, processes, and experiences (Huhtala et al. 2019; Heinonen/Strandvik 2020).

Data-driven Value Proposition Design

The systematic design of value propositions is at the core of every service innovation process (Osterwalder et al. 2014; Beverungen et al. 2018). After analyzing all relevant data sources, smart service organizations must think of how to transform available resources into value for the customer. The second proposed action field – *a data-driven value proposition design* – aligns identified customer needs and goals with available data to create novel smart services (Mathis/Köbler 2015; Kronsbein/Mueller 2019). This action field is located in the phase of idea management.

Taking a customer-dominant perspective, the use of personal data for novel value propositions lead to an improvement of customer processes or decision-making (Demirkan et al. 2015; Lim et al. 2019). When designing new value propositions, valuable *"data-need-fits"* must be identified on how data can specifically help customers to achieve their personal goals (Mathis/Köbler 2015; Lim et al. 2019). Personal data has become a design material itself that can be used in reverse to create new value for the customer and to increase customer engagement (Saarijärvi et al. 2014; Kunz et al. 2017; Seidelin et al. 2020). As mentioned above, the data from smart devices should not be the only data source to consider. By recombining existing data with novel smart device data, valuable information services can be combinatorial generated and can extend the value for the customer (Beverungen et al. 2018). Furthermore, partnerships are getting at the forefront of the design of new service value (Lusch/Nambisan 2015; Huhtala et al. 2019). According to CDL, the customer interacts with multiple service providers. Thus, resulting personal data is located in application systems of multiple actors in the customer's ecosystem. This makes it necessary for companies to share this data across corporate boundaries in order to meet customer needs in service networks. (Fromm et al. 2012; Pikkarainen et al. 2019). Moreover personal data – either contextual data from smart devices or from other data sources – represent the foundation for the personalization of the service (Dreyer et al. 2019). For this purpose, a customer profile and appropriate business rules are criticial for service personalization (Fan/Poole 2006; Lehrer et al. 2018).

Data Governance

Data governance represents a cross-functional framework (Abraham et al. 2019; Alhassan et al. 2019) for managing data as a strategic enterprise asset of an organization. The management approach takes care of the "valuation, creation, collection, analysis, distribution, storage, use and control of information" (Kooper et al. 2011, p.196). Data governance practices strive to maximize the value of data for organizations (Kooper et al. 2011) and to minimize data-related costs and risks (Abraham et al. 2019). A data governance approach formalizes data policies, standards, and procedures and encourages good data practices (Sammon/ Nagle 2017; Alhassan et al. 2019).

This contribution suggests that data governance should be a fundamental component for all data-driven innovation initiatives. It follows other researchers that aspects of data quality and security need to be incorporated when designing data-driven value propositions for the customer (Sammon/Nagle 2017; Kühne/Böhmann 2018). Ensuring data privacy and security is specifically relevant for personal data due to legal and ethical reasons (Spiekermann et al. 2015). Thus, data governance should represent a key action field of personal data management. It is not only be important in the phase of analyzing requirements, but also in the actual service (concept) implementation itself. A customer-dominant approach of personal data management maximizes the value of data for the customer and not for the organization: It strengthens the necessity to ensure *data privacy by design* (Cavoukian 2009; Bitomsky et al. 2020) including an appropriate permission and identity management (Godin 1999; Poikola et al. 2020; Sitra 2021), but goes further and emphasizes the aspects of data agency, traceability, and portability for the customer (Mortier et al. 2014; Poikola et al. 2020; IEEE 2021).

A customer-dominant perspective on this action field underlines the active role of the customer when designing new value propositions based on personal data. The customer as the initiator of the service process utilizes and control data processes in order to receive and co-create the service value (Yi/Gong 2013; Blöcher/Alt 2018; Alt et al. 2019). Consequently, data processes are required that support the self-management of personal data and human-centered approaches of good data practices (Poikola et al. 2020). Those hu-man-centered approaches must ensure that customers comprehend which personal data are collected and how this information is being used (Poikola et al. 2020; IEEE 2021). This includes making data analytics and algorithms as transparent and comprehensible as possible (Mortier et al. 2014; IEEE 2021), e.g., by simple data visualizations for data interpretation (Mortier et al. 2014), the logging of data processes for the customer or the disclosure of algorithmic decisions (Crabtree et al. 2016; IEEE 2021; Sitra 2021). Furthermore, people should be able to easily access and transfer their data to other providers when this is required (Langford et al. 2020; Poikola et al. 2020). This *data portability* allows customers to re-use their personal data about them and to benefit from the value that the data offer (Hert et al. 2018; Poikola et al. 2020).

Process Design

The process design is proposed as the final action field of personal data management which is located in the last phase of the smart service innovation process. Whereas the design of service processes is well-established in service design and innovation activities (Shostack 1982) personal data management requires the consideration of procedural and technical process aspects: first, it must design how to best possibly embed personal data management into the smart service usage process. Second, technical processes are required to specify how personal data is collected, processed, analyzed, and shared via the necessary technical infrastructure, APIs, and application systems. A customer-dominant perspective on process design demands the deep integration of the smart service and the associated exchange of personal data into the customer's actions and to overcome organization-centric processes. Smart services, such as personal assistants or information services, support daily activities at their best when technologies are strongly interconnected with daily activities and routines of the customer (Wünderlich et al. 2015; Cena et al. 2018; Alt et al. 2021). This include smartphones, but also other smart devices, such as screens or tables that are embedded into relevant objects to integrate service provision as deeply as possible into daily life activities. This engagement of smart devices with everyday processes requires simple and user-controlled identification procedures, e.g., via e-mail addresses, voice, and facial or fingerprint recognition (Birrell/Schneider 2013; Sitra 2021). It also demands convenient forms of information exchange (Lim et al. 2018): Customers should be able to easy access and share their personal data for service provision at natural user interfaces. Moreover, service providers should visualize provided service information appropriately to enhance the comprehensibility and legibility of the service output upon data, e.g., by easily readable reports (Mortier et al. 2014; Lim et al. 2018). The service delivery process is supposed to be enjoyable and comfortable for customers (Zomerdijk and Voss 2010; Lim et al. 2018). Moreover, a comprehensive customer feedback process needs to be implemented to steadily enhance the service output with the aid of the customer as an active feedback provider and co-developer (Dörner et al. 2011; Zheng et al. 2018). Second, smart services must be usable across contact points or devices so that customers can make use of the service at every relevant device or contact point (Wodall et al. 2017). Smart services designed as omnichannel services (Verhoef et al. 2015; Wulf 2020) across different channels require the integration of personal data from smart devices and other touchpoints to reach a consistent customer-centric service experience (Jayachandran et al. 2005; Wulf 2020). Finally, the action field considers the interplay of the customer, the smart device, and the interaction with employees if those are involved in the delivery process of data or information-based smart services. If self-service or personal assistant functionalities replace activities that are previously executed by the service employee, e.g., the provision of information or consulting, smart service organizations should weigh out advantages and disadvantages just as the future role of the service employee and his competencies (Blöcher/Alt 2020).

Existing service processes should be redesigned to successfully integrate novel technologies into business operations which requires a high degree of transformational activities. Employees must learn how to handle novel technologies and to adopt new working routines (Vom Brocke et al. 2016). Moreover, the use of data results in new opportunities for the service employee to provide proactive service practices such as proactive advice or highly individualized customer support (Lehrer et al. 2018).

The technical design of processes should be founded on the open interoperable, even decentralized infrastructure for *customer-centered data management* (Poikola et al. 2020). This design of customer-dominant data processing must allow customers to access and control datasets containing their personal information at any time (Poikola et al. 2020; Sitra 2021) and to manage their identity or even identities and multiple consents (Allen 2016). Furthermore, interoperability and metadata exchange must be supported so that customers are able to share and benefit from their data across organizations (Hert et al. 2018; Poikola et al. 2020). If customers or service employees demand timely information across different devices for service provision, real-time capabilities and associated data processing of IT-systems are required (Chandy/Schulte 2010; Cundius/Alt 2017). The following table summarizes the proposed action fields and specifies the characteristics of a customer-dominant approach of personal data management.

Action Field	Customer-Dominant Implications for Personal Data Management	
Data Understanding	Building up data understanding by understanding customer processes and the respective customer touchpoints	Heinonen et al. 2010; Heinonen and Strandvik 2020; Lim et al. 2019; Blöcher et al. 2019
	Holistic view of the customer: Integration of all potential personal data in a single customer view	Jayachandran et al. 2005; Kunz et al. 2017; Stone et al. 2017
	Consideration of external data from other service providers in the service ecosystem	e.g., Huhtala et al. 2020
	Deep customer insights at the center of the service require the analysis of patterns and the deduction of context.	e.g., Heinonen and Strandvik 2015; Alt et al. 2019
Data-driven Value Proposition Design	Improving customer processes in the customer's life	e.g., Heinonen and Strandvik 2020; Lim et al. 2019; Alt et al. 2021
	Identification of data-need-fits for the customer	Mathis and Köbler 2015
	Development of a customer profile and the definition of business rules for service personalization	Fan and Poole 2005; Lehrer et al. 2018
	Partnerships in the service system	e.g., Huhtala et al. 2020; Poikola et al. 2020
Data Governance	Maximizing value of data for the customer	e.g., Poikola et al. 2015, 2020
	Privacy by design & data security	e.g., Kühne and Böhmann 2018; Spiekermann et al. 2015; Covoukian 2009; Bitkomsky et al. 2020
	Self-management of personal data	e.g., Poikola et al. 2015, 2020
	Human-centered approaches of good data practices including data control, portability, and traceability	e.g., Poikola et al. 2015,2020; IEEE 2020; GDPR 2021, De Hert et al. 2017; Mortier et al. 2014
Process Design	Embedding of smart services into daily processes of the customer	e.g., Wünderlich et al. 2018; Heinonen and Strandvik 2020
	Omni-Channel Management: Service Orchestration and data exchange across different channels	e.g., Jayachandran et al. 2005; Stone et al. 2017; Wodall et al. 2017; Verhoef et al. 2015
	Interplay of technology, service employees, and the customer in human-centered services systems	e.g., Lehrer et al. 2018; Blöcher and Alt 2020; Korhonen et al. 2018
	Design of technical processes on an interoperable open business architecture	e.g., Poikola et al. 2015, 2020; Sitra 2021

Figure 2. Customer-dominant action fields of personal data management

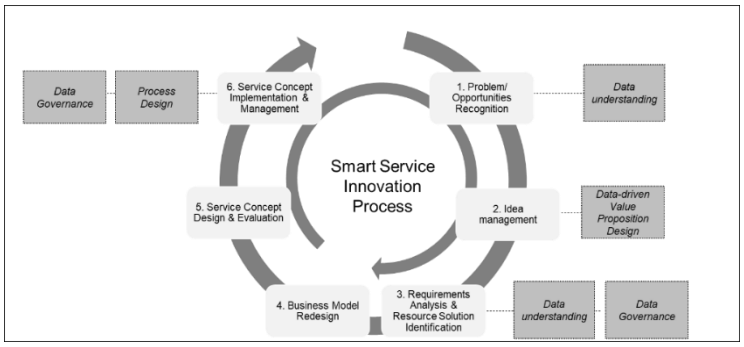

Figure 3. Alignment of the proposed action fields to the smart service innovation process (adapted from Beverungen et al. 2018)

4. Application Scenario in the Restaurant Industry

The restaurant industry is a traditional people-driven business, and thus a typical *human-centered service industry* (Maglio et al. 2015) where a high level of personal contact is at the forefront of the service value itself and the foundation for excellence in hospitality, customer satisfaction and loyalty (Prentice 2014; Prentice et al. 2020). The ongoing digital revolution is transforming the restaurant industry with the result of a variety of novel digital solutions in all restaurant processes (Rosenheim 2021; Alt 2021) and a broad range of personal data in different application systems, such as POS systems, reservation systems, or third-party delivery services. Moreover, the Internet of Things has brought innovative sensor-based digital contact points, such as interactive tables, bars, or digital signages (Kodisoft 2021), which results in novel digital traces, but also new opportunities for smart services in traditional face-to-face encounters.

This potential of novel smart technologies and personal data resources is opposed by a complex technical infrastructure of different technical providers and a diverse mix of stakeholders in the service ecosystem that currently store personal data. Not only restaurateurs with a generally low digital expertise require assistance in how to tap into the world of their personal data for novel smart service experiences. Simultaneously, external service providers striving to develop new innovative solutions for the industry may benefit from a systematic and *customer-dominant approach of personal data management*. Thus, the restaurant industry represents an exciting playground for innovation, but simultaneously a good application scenario to demonstrate the action fields of personal data management as well as the potentials of a customer-dominant view on personal data

management for smart service innovation. In the following paragraph, the proposed action fields are described including examples how a customer-dominant view on personal data management can enrich the innovation process and which instruments exist that can support smart service providers in this process.

Data Understanding

The restaurant landscape is characterized by a wealth of diverse application systems where personal data is stored. For the design of data-driven or smart services, restaurateurs or external service providers should first understand which data resources are available. The first action field of *data understanding* supports potential innovation initiatives in building an overview of available data sources. While the analysis of technical data models or data extracts is often not tangible enough for participants with no data expertise (Kronsbein/Mueller 2019), a customer-dominant view on data understanding concentrates on the analysis of customer processes at relevant touchpoints to deduct the corresponding data traces from this perspective. Methods and visual tools, such as customer data mapping (Blöcher et al. 2020) or (data-driven) customer journey mapping (Berendes et al. 2018) may support in this action field. Typical customer processes around the restaurant visit are the reservation or the ordering process, but also the sharing of customers' experiences on social media. Moreover, a customer-dominant perspective implies the subsequent deduction of customer insights for the exploration of new service ideas and possible service personalization. Patterns of eating habits or spending behaviour can be extracted, for example, from ordering behaviour. In addition, the analysis of relevant touchpoints and the corresponding application systems allows restaurateurs or service providers to think of how this data can be creatively combined with data that can be generated from smart devices. Eating habits extracted from POS systems can be combined for example with health data from fitness trackers to design a service around personalized menu recommendations promoting a healthier nutrition.

Data-driven Value Proposition Design

This action field aligns relevant customer needs with available personal data to design *novel data-driven service value*. A customer-dominant view not only highlights the need to improve customer processes when creating smart services and to personalize the service experience whenever it generates added value. Restaurateurs or service providers also need to think about how they can identify relevant partners to add value for the customer, even beyond their own organizational operations.

When starting new service innovation initiatives, restaurateurs should strive to enhance the customer's processes at the restaurant, e.g., the seating or ordering processes. They need to think about how the restaurant visit is *embedded into the customer's life* and which other processes, such as their shopping or working routines surround the restaurant visit or the external ordering of food for delivery and how personal data from smart devices and other data sources may facilitate those activities. Furthermore, restaurateurs can take advantage of their personal data resources for new service value even outside

the restaurant. Identified food preferences can be used to provide visual recommendations on smart tables at the restaurant, but also to suggest recipes to recreate similar dishes at home. Moreover, a collaboration with an online grocery service provider could allow customers to order the ingredients relevant to the dish. These are automatically delivered to the customer when he or she desires to prepare certain dishes. Data from smart devices can additionally be utilized for the analysis of movement patterns: By taking advantage of this data, the service employees are automatically notified when the customer arrives at the restaurant to design a smooth welcome process.

There are several *visual service design tools* that can support smart service organizations in this phase of the innovation process: These offer a structured process in assessing available data and matching this data to a specific use case or value proposition. Examples are the data insight generator (Kühne/Böhmann 2020) and the data innovation board (Kronsbein/Müller 2019) that offer assistance in the generation of appropriate data-need-fits between business value propositions and available data resources.

Data Governance

Data governance policies offer restaurants or service providers valuable design strategies for novel smart services. A customer-dominant data governance approach strives to maximize the data value for the customer and provides customers with tools to self-manage and track their data processes. Restaurants and external service providers must think of how to actively involve the customer in the exchange of personal data for value creation. The customer is not only a provider of his personal data, he or she actively manages and controls their own resources. If restaurants design novel services, they need to consider *human-centered approaches of good data practices*. Privacy by design and ensuring data security, for example, requires a properly implemented consent management for all relevant channels and the anonymization and pseudonymization of personal data whenever this is possible (GDPR 2021). Moreover, transparency and traceability of data usage must be key guiding principles: Algorithmic-based recommendations of digital assistants, for example, require the possibility to comprehend why guests receive specific recommendations, e.g., due to my allergies or last purchases. Simple visualizations of the data history of previous restaurant visits and orders can be included so that the given recommendations are comprehensible for the customer. In addition, the principle of data portability can lead to novel value propositions for the customer. The consumed calories at the restaurant could be transferred to a fitness tracker in use to align the customer's eating habits out of home to their behavior. If the customer is willing to share data between restaurants and grocery stores, restaurants could offer specific recommendations or promotions based on frequently bought products at the supermarket. Finally, grocery stores may provide shopping lists based on recipes for favorite dishes at the restaurant. Tools, such as the data insight generator (Kühne/Böhmann 2020) or the data value map (Sammon/Nagle 2017) facilitate the consideration of data governance aspects in the design process. However, those tools must be extended to include human-centered good data practices into the design process.

Process Design

Finally, restaurateurs need to design the processes considering the systematic and customer-dominant management of personal data. When restaurants build, for example, a service based upon the customers' health data for menu recommendations, processes at the restaurant must cover the smooth identification of customers and possibilities how those can easily *share their data* with the restaurant, e.g., from the customer's smart watch to the operating systems at the restaurant. For example, an easy check-in process via any smart device at the restaurant can improve the seating process for the customer. When guests arrive at the restaurant, they can actively identify themselves and share their personal profile including allergies and preferences. After the check-in, they automatically receive a personal welcome and some recommendations or even offers that are personalized to their profile. Based on their seating preferences, they are guided to their favorite seating area. This further includes an appropriate permission process to allow the restaurant to take advantage of the information. Information must subsequently be properly visualized at all relevant touchpoints at the restaurant, for example on a tablet or a smart table showing the current activity status of the customer and the resulting menu recommendation. This requires the management of information across devices and the appropriate APIs between relevant operating systems. If service employees are involved in the service de-livery process, their role must be defined in the exchange of data and information. The use of data results in new opportunities for the service employee to provide proactive service practices such as proactive advice or highly individualized customer support (Lehrer et al. 2018). Service employees can be responsible for the explanation of provided information or recommendation or facilitates the identification and check-in process, but they can also consult customers based on available information. Staff could for example take the role of a fitness or nutrition advisor if this is included in the concept of the smart service. Furthermore, the service delivery process must clarify how service employees make use of the personal information to react and consult the customer appropriately, e.g., by an own smartphone app. For this purpose, information must be synchronized best possibly in real-time across different devices for the successful provision of service value.

5. Conclusions and Future Research Potentials

This article structures the potentials of personal data management for smart service innovation processes by proposing four relevant action fields for the design of smart services using personal data. In this context, the customer-dominant logic serves as a theoretical underpinning to define a *customer-dominant approach to personal data management* in an initial conceptual framework. A stronger conceptualization of personal data management follows the call of various researchers to integrate the systematic use of personal data in the smart service innovation process (Ostrom et al. 2015; Mag-

lio/Lim 2016; Peters et al. 2016; Lim et al. 2019). This customer-dominant consideration of personal data has the potential to design data-driven value propositions from a novel perspective and to reduce risks that are associated with the handling of personal data.

First, this article contributes to the research field of smart service innovation as it strengthens a stronger *human-centered innovation process* in a field that is still strongly associated with the industry 4.0. and machine-driven cyber-physical systems. Second, it highlights the value of all personal data resources for smart service organizations and underscores the need to extend the view on smart device data to additional personal data resources in order to creatively recombine the available design material in a service system perspective (Beverungen et al. 2018; Seidelin et al. 2020). This does not only include the necessity of an integrated single customer view (e.g., Payne/Frow 2005), but also the possibility to share personal data between service partners in the service system when this is valuable for the customer (e.g., Poikola 2020). Furthermore, two key value drivers are combined in the conceptualization of data-driven value proposition design by showing that value creation can be reached by service personalization and the creation of valuable information content (Lim/Kim 2015; Kim et al. 2018; Lehrer et al. 2018). Third, a customer-dominant approach may improve the design of data-rich smart services as it offers novel approaches to empower consumers to participate in the collection, management, and consumption of their personal data for the co-creation of new service value (Alt et al. 2019; Beverungen et al. 2019; Huhtala et al. 2019).

Such early conceptualization offers the opportunity for further improvements and evolution. On the one side, the conceptual framework can be the foundation for the development of a dedicated procedure model to seamlessly work with personal data in the innovation process. Service organizations could use this model as a useful supplement besides the general phases of the smart service innovation process. Yet, it can also be integrated into the traditional phases to concretize the particular steps when personal data is involved in the innovation process. On the other side, relevant methods or visual tools that are presented in chapter 4 could be systematically assigned to the action fields to enrich the proposed methodology for personal data management in smart service innovation processes. However, those tools must be extended to include human-centered good data practices and the pecularities of personal data use into the design process

Finally, a conceptualization may be the foundation for a possible automation or semi-automation of personal data management when designing smart services. The proposed action fields can serve as the starting point for the development of a personal data management pipeline which consists, for example, of the systematic visualization and analysis of personal data in customers processes, the automatic aggregation and combination of personal data of heterogeneous data sources for customer profiling (Hirt et al. 2019) and the set-up of trigger-based automatic service measures (Lehrer et al. 2018), or the definition of customer-dominant data governance processes, e.g., the identification and consent management processes. Here, existing tools, frameworks or libraries may be used (Langford et al. 2020), to manage personal data more easily. Ultimately, this would

also mean that the potentials of digitalization and automated development are applied in smart service innovation processes themselves (Alt 2019).

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