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GRINDING A DIAMOND – THE ITERATIVE DEVELOPMENT OF CITIZEN-INITIATED SERVICES

Research in Progress

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Abstract

Many city administrations follow the smart city concept to grasp the potential of citizen participation. However, most participation concepts are not developed thoroughly, this leading to unexploited potential. Citizens are experts of their everyday life and are best aware of their personal needs. However, current forms of citizen participation stop at the idea phase of service engineering. Following design science research, we iteratively build and evaluate a so-called "digitalization street" which aims to systematically guide the citizens through the refinement and further development of their services. This digitalization street is implemented in a mid-size European city and integrates five modules which let citizens (1) describe their project proposal, (2) concretise according strengths, weaknesses, opportunities and threats, (3) identify the gain creators and pain relievers, (4) create their solution, (5) present their solution. Based on literature and a requirement elicitation workshop, a first instantiation of the artefact was developed. We contribute to the existing body of knowledge by presenting a framework for creating services based on a citizen-centric approach. We exhibit how the digitalization street can be implemented into existing processes in the city administration and help to increase the citizen participation from a project to an evaluated prototype.

Keywords: smart city, service engineering, citizen participation, design science research, citizen-initiated services.

1 Introduction

With the world's population estimated at 9.8 billion in 2050 (United Nations, Department of Economic and Social Affairs, Population Division, 2017), cities face major challenges in terms of livelihoods, competitiveness, growth, and performance (Letaifa, 2015). Governments hope, on the one hand, to preserve the knowledge of citizens through participation and to involve citizens in political decision-making processes in order to improve decision-making for themselves and, on the other hand, to achieve a transformational effect through the use of web technology (Lönn et al., 2016). Furthermore, the digitalization of everyday life offers the following advantages for a civil society with a strong need for dialogue, self-realization, and cooperation: there is a considerable untapped potential to drive forward the design of cities into sustainable, versatile, and liveable areas (Castelnovo, 2016). To counteract this and increase the sustainability and performance of cities, the concept of a "smart city" is to be pursued. It will provide resources and services more efficiently to citizens, public authorities, and businesses in a new socio-economic environment (Letaifa, 2015). In particular, a growing willingness to participate in the creation and provision of services as well as in the joint use of resources and offers, combined with digital networking, offers the opportunity to create new high-quality services,

infrastructures, and projects that meet the markets' needs (Peters et al., 2018). These can strengthen the community, involve citizens productively, satisfy their needs, counteract negative effects of demographic development and, thus, create more viable and sustainable living, working, and recreation areas (Castelnovo, 2016).

In the search for a general definition of "smart city", it becomes clear that there are many different explanations in literature. No uniform definition of a smart city has been introduced so far (Castelnovo, 2016). According to Cosgrave et al. (2013), a major component of smart cities is a worldwide, continuous access to information with constant control and data acquisition. This applies to information and communication technologies (ICT) sensors as well as data storage and processing and the use of mobile devices. For effective service delivery, governments rely on e-government approaches using new ICT to ensure a positive change in the quality of life and public value creation (Paskaleva et al., 2018; Peters et al., 2018; Yeh, 2017). The use of ICT alone is not enough to transform a city into a smart city (van Waart et al., 2016). Smart cities have underwent a change from a focused technological infrastructure to the use of intelligent technologies for service development through the use of citizens and an intelligent administrative government (Paskaleva et al., 2018).

By smart city we mean, in a narrower sense, the intelligent use of ICT for a better quality of life for citizens. Citizens are actively involved in the development and design of services as participants and experts of their everyday life and new forms of citizen participation are encouraged.

The "smart city" concept opens new business opportunities and potential services. In 2020, for example, the market, which is being created on the basis of "smart cities", is estimated to be worth about 1.565 trillion dollars (Castelnovo, 2016). It should be noted, however, that any direct or indirect intervention in the lifestyle of citizens with the design and implementation of new innovative ideas may affect the behavior of citizens (Castelnovo, 2016; Yeh, 2017). In most cases, citizens are currently not involved in the participation process of business, politics, and administration. If so, in most cases current forms of citizen participation stop at the idea phase of service engineering (Letaifa, 2015). For this reason, governments are looking for a new way to actively involve citizens in decision-making processes. However, the top-down approaches fail as the government's invitation to participate is not accepted by citizens, while citizens fight against bottom-up approaches for the attention and support of governments (van Waart et al., 2016).

The unexploited potentials of citizens as experts of their everyday life and the new business opportunities concerning the smart city lead to the following research question (RQ): How can an IT artefact support citizen-initiated services in the context of smart cities?

To answer the research question, we establish an extensible and transferable portal, which guides citizens to refine and further develop their own services from the description to the solution presentation. This is comparable to grinding a rough diamond into a high-grade diamond. In return for that, we use a design science research approach for building and providing an artefact, which is an IT-supported process for the development of citizen-initiated services on a so-called digitalization street. The building as well as the evaluation of the artefact is the iterative development of the digitalization street in combination with a requirement elicitation workshop. The workshop-setting is carried out with experts from the city administration of two major cities as well as employees of university institutions and companies. The application of the artefact is the pass through the digitalization street.

In this research in progress paper, we first give a theoretical background of citizen participation and service engineering. In the next section, we explain our design science research methodology, which is based on the three cycles of design science research (Hevner, 2007) for developing our artefact. The evaluation of the artefact is based on the FEDS framework, which is a framework for evaluation in design science research (Venable et al., 2016). After that, we present our artefact with its five modules. Subsequently, we demonstrate future research possibilities and further development of the artefact including its limitations. Finally, we give a summary of our findings in our conclusion and an outlook of theoretical as well as practical contributions.

2 Theoretical Background

2.1 Citizen Participation

The role of the citizen has changed in recent years from passive to active players, so that citizen participation in general has come into the focus of city development. Citizens' participation means the active participation and integration of citizens in urban and political planning and decision-making processes (Hilgers and Ihl, 2010). Citizen participation aims to make urban areas more liveable and intelligent (Mueller et al., 2018). Frecks (2015) has identified three important factors that have to be fulfilled in the development of citizen participation. The first factor is the existence of a terminology that can be applied to policy. In this case, it would be active citizen participation in government work. The second factor is that participation control is guaranteed for citizens during implementation work. In the third and last factor, a common understanding of the individual participation roles in the cooperation process is to be defined by categories. This requires a systematic change in the relationship between citizens and political institutions as well as a common vision (van Waart et al., 2016). In doing so, a cooperation between citizens and public institutions takes place to contribute to public value creation and to refine the decision-making processes. Involving citizens in decision-making processes through the use of information and communication technologies (ICT) has the aim to make city administration more collaborative, integrative, and participatory for instrumental and intrinsic purposes (Naranjo Zolotov et al., 2018) and to improve the quality of the relationship between citizens and the city administration (Viale Pereira et al., 2017).

For both citizens and the government, participation systems in the e-government sector have a positive effect on convenient and diverse access for users, the exchange of information between authorities and services, and the efficient and faster process flow (Olphert and Damodaran, 2007). The approach of open innovations is also included in the development processes: It aims to achieve an open design of innovation processes. This expands the approach of citizen participation by not only drawing on citizens' potential for problem localisation and brainstorming, but also on the potential for implementation, quality assurance, and continuous improvement (Hilgers and Ihl, 2010).

In order to support both approaches and give citizens the opportunity to develop their own innovative projects, thus, facilitating communication with the city administration, and to ensure real-time feedback and generate citizen-initiated projects, a suitable participatory system is necessary (Khan et al., 2017). Continuous improvement based on a limited rationality of available information usually slows down radical innovations in the development process. An overcoming of the limited search is controlled by means of open calls for tenders by submitting contributions on the basis of the broadcast search and is in connection with citizen sourcing. Citizen sourcing uses new principles from the public sector to shape the relationship between citizens and urban / political institutions in a different way. Existing tasks from the public sector are outsourced and transferred as an open design to an undefined, often large group of people. The integration of external input and information into public affairs and problem solving is unclear (Hilgers and Ihl, 2010).

As experts of their everyday lives, citizens have an untapped potential that needs to be developed. City administrations are facing an ever-increasing challenge when it comes to the involvement of citizens in the creation and provision of services in city decision-making processes (Schmidthuber et al., 2017b). City administrations resort to crowd sourcing and outsource existing tasks to undefined large groups of people (Hilgers and Ihl, 2010). The principle of crowdsourcing is used here whenever a system owner has a problem processed by the crowd (May and Ross, 2018). Applied to the public sector, crowd-sourcing is called citizen sourcing and aims to create citizen-oriented services (Lönn et al., 2016). In this context citizen sourcing is often associated with citizen science, where in a broader or scientific context the citizen is seen as a sensor (May and Ross, 2018). An opportunity in Citizen-sourcing lies, on the one hand, in the cost-effective possibility for citizens to contact the government directly via web technology and, on the other hand, governments are inspired by the distributed development of services via the crowd to use new possibilities (Abu-Tayeh et al., 2018).

2.2 Service Systems Engineering

There are many examples of services in a city: transport services such as flights and taxi journeys, hospitality services such as hotel accommodation and restaurant visits, infrastructure services such as energy and communication provision, and expert services such as medical or lawyer's consultations. Although these examples are very different from each other, they all share the same characteristics: they all depend on suppliers and customers working together for mutual benefit. Even though there is no universally accepted definition, services are characterized by the application of competences (knowledge and skills) for the benefit of others or oneself in actions, processes, and services (Peters et al., 2016). The added value of the service is created by several players in cooperation (value cocreation) and is produced in the context (Böhmann et al., 2014).

The service systems consist of "configurations of people, information, organizations and technologies that operate together for mutual benefit" (Maglio et al., 2015, p. 2). Service delivery systems are therefore complex socio-technical systems that enable an interactive and joint creation of value (Böhmann et al., 2014). By appropriately configuring actors and other resources, value creation in the service system is made possible (Peters, 2016). Stakeholder skills as well as the interaction and engagement in the service system are fundamental to this value creation. Typically, the main actors are human agents (with knowledge and skills) who participate in the common creation of value (Böhmann et al., 2014). Value cocreation is indispensable for the creation of added value and services. In our case, the people are the citizens and employees of the city and can be both service providers and users. The information is any information about users and the use of services that are relevant from the citizens' and the city administrations' point of view. The existing guidelines and laws of the administration must also be observed. The organizations are companies and other internal and external service systems. The technology component consists of the technical implementation for the generation and collection of service ideas as well as a communication platform. In the smart city context, this concerns inter alia the cooperation of the city administration with the individual citizens, whose commitment, interaction, and ability are valuable and should be taken into account accordingly.

A special kind of service systems are human-centered service systems. These are focused on personal services and human interaction (Maglio et al., 2015) and differ in the way the actors interact with each other during the creation of value. Thus, they play a decisive role in everyday life and society (Peters et al., 2016).

In order to communicate the value of a service system to service designers and customers in an understandable way, the generation of services and marketable information can take place on the basis of a company's value-added components (Kleinschmidt et al., 2016). This usually takes place in a business model in which the relevant activities of an enterprise are presented in a simplified and aggregated manner (Kleinschmidt et al., 2016).

3 Research Approach

We follow a design science research approach (Hevner et al., 2004) and explicitly consider and implement Hevner's (2007) three cycles of design science research, i.e., the relevance cycle, the rigor cycle, and the design cycle for the iterative development of our artefact. The relevance cycle creates a link between the requirements of the contextual practical environment of the research projects, the design activities as well as the research artefacts of science in which environmental field tests are carried out (Hevner, 2007). This presupposes on the one hand the identification of problems and opportunities from the real application environment and on the other hand the definition of acceptance criteria for a final evaluation of the research results (Hevner, 2007). The achievement of the objectives is achieved through the joint interaction of technical systems, organizational systems, and persons in the application domain. The rigor cycle establishes a link between the existing knowledge base and design activities. This means that additional knowledge from the knowledge database is transferred, on the one hand, from domain experience and expertise and, on the other hand, from well-founded methods and theories of the application domain (Hevner, 2007). The knowledge database is constantly being

expanded by the knowledge gained through research and design activities (Gregor and Hevner, 2013). In order to ensure innovation, the produced design must be based on research contributions (Hevner, 2007). The central design cycle focuses on the construction and evaluation of the design processes and the artefacts to be designed in a close iteration of research activities (Hevner, 2007). The evaluation of the alternatives takes place by using requirements. Another element in the design cycle is the feedback that follows to refine the design. The cycle is run through until the design can be declared satisfactory. Note that although the design cycle is dependent on the other two cycles, it acts independently in creating the artefact (Hevner, 2007). Furthermore, the arguments for constructing a new artefact as well as the subsequent, comprehensible, and very good evaluation must be very well-founded. Before carrying out the field tests and submitting contributions to the relevance cycle and rigor cycle, the artefact should first be extensively tested in an experiment or laboratory. In the development of the digitalization street, we underwent an iteration to provide a framework for the provision of citizen-initiated services. The iteration included a relevance cycle, a rigorous cycle, and a design cycle. On the one hand, the necessary information were transferred from the knowledge base via the rigor cycle and, on the other hand, from the environment via the relevance cycle to the development of the digitalization street in the design cycle. The knowledge base contains existing methods and instruments for analyzing and creating services. After the iteration, the knowledge base was expanded with the resulting connections of methods and instruments. At the environment, the elicitation of needs was collected via a requirement elicitation workshop conducted by us. In the offline workshop setting, we involved 12 experts to go through the digitalization street. Five experts were from the city administration of two major cities, another five were employees of two universities, and the last two were employees of a software company. The aim of the workshop was to evaluate and validate the digitalization street by experts, to validate digital ideas at an early stage, to gather requirements as well as to get rapid feedback on how to optimize the individual steps of the digitalization street. The result of the design cycle - the digitalization street with its five steps - will be explained in more detail in the next chapter. The evaluation of the artefact is based on a framework for evaluation in design science (FEDS) Research (Venable et al., 2016) and will also be part of future research.

4 Artefact Description

4.1 Problem Identification & Motivation

However, in the current status it is unclear how external input and information by citizens are embedded in city administration processes. This means that the development from citizens' input to already usable concepts or even ready-made services is a prolonged and constant digitalization process. The citizen's input before the first step is comparable to the process of modifying the carbon into a rough diamond. In order to get from a rough diamond to a high-grade diamond, a well-thought-out service, it takes a few steps of grinding work until the desired result of a high-quality specific service is finally achieved. This requires that the problem statements and the challenges of existing solutions will be analyzed in advance to create an appropriately adapted basis for creating services. Kleinschmidt et al. (2016) identified seven core challenges in the context of human-centered service systems and corresponding business models using service design, business model design and human-centered service systems. (1) In order to coordinate the existing components in the service system, experience and customer expectations must be defined on the basis of several iterations. This problem is assigned to service design and requires a high demand on resources for the definition. (2) In service design, the definition of the standard service is not comparable to the individual provision of personalized services but takes place between the service providers. The ability to plan individual service provision can therefore not be guaranteed. This can lead to too many exceptions in the service process due to standardized service provision and also requires a constant comparison of the results. (3) In the area of business model design, the solution product is not checked for accuracy of fit, which means that no comparison is carried out in the existing service system during iterations in the design. This means that there is no information about whether the targeted solution was successfully created in the service system or not.

(4) The operationalization of business models requires iterations, but the design and alignment of business models may nevertheless be subject to limitations: the origin of which can be found in service innovations with special features in human-centered service systems. The reason for the limited iteration is due to end user intervention in human interaction. (5) In addition to the expected support of ICT, requirements and expectations for personal services are constantly rising. ICT support and human interaction are prerequisites for value creation. (6) Replacing ICT limits the dependence of human interaction. This means that traditional approaches to automation and optimization of human-centered service systems are resisted. (7) The employees in the service system are in regular contact with the customer and, thus, exactly know their needs. In most cases, however, the design knowledge is not available.

4.2 Objectives of the Solution

Based on the core challenges of Kleinschmidt et al. (2016), seven resulting objectives of the solution are obtained. (1) The non-plannability of individual service provision is counteracted by selecting the solution with the greatest potential. Accordingly, it makes sense to align the service system according to the iterations and identify the focused tools of the service system. (2) A range of service experiences and scenarios could be included in an optimization model based on operation research with approximations. The solution can be easily established due to the not yet verified accuracy of fit. (3) This would be the case if the defined customer benefit of the design principles is anchored in the human-centered service systems and business model. The implementation of the high-level-process is declared insecure, since a distinction is made between the actual implemented model and the conceptual model. At the end of the service innovation it is therefore necessary to check the promised customer benefit. (4) Existing solutions can be used to solve the various problems that have arisen in connection with human-centered service systems. Various implementation approaches from planning and coordination can be used for this, so that the service design to be built up can be designed in concrete terms. (5) If there is no foresighted optimization planning, resistance to traditional automation and optimization becomes a severe problem. It is, therefore, necessary to define the demand and scope of service innovation in advance in order to counteract rising demand and expectations and, thus, prevent productivity problems. (6) In the field of service innovation, actions between technology and people should be carefully regulated and coordinated. In order to guarantee this, operational service staff of the human-centered service system and corresponding business models should be included, even if they do not have sufficient design knowledge. (7) Finally, an independent validation of the results should be carried out by service design and business model design experts.

4.3 Design and Development: Preliminary Artefact

Based on the problems of existing solutions and the resulting objectives of the solution, an artefact will be constructed in the context of smart city and citizen participation using Hevner's (2007) three cycle of design science research. The artefact is an IT-supported process for the development of citizen-initiated services on the digitalization street. The building as well as the evaluation of the artefact is an iterative development of the digitalization street and the application of the artefact corresponds to the pass through the digitalization street. The concept around the digitalization street can be divided into three consecutive categories. Within the first category, the citizen is seen as a sensor that provides an unstructured but valuable input and needs to be sharpened. The process of the digitization street is assigned to the second category and contains five steps that overlap the individual steps with the first and the last category. The third category is the appreciation of the participation and commitment of the citizens, which are opened up during the process. Before the service is created by the citizen on the digitization street, the citizen can assign a name to the process and select the appropriate category for his or her input. The categories are linked to the existing structures of the city administration by means of making an allocation of the pending service to the respective department. It is up to the citizen to decide how far he or she wants to involve the city departments in the development process on the digitalization street. The digitalization street is divided into five consecutive steps, whose respective out-

put generated by the process is simultaneously the input for the next step. The first step takes up the citizen's input and serves to create a short description on the basis of the business analysis (Leimeister, 2012). The citizen should identify and explain what it is, for whom it is suitable (target group), and what it should be used for (reason for use). The business analysis is transferred to the concretisation process in which a SWOT analysis (Leimeister, 2012) is carried out. The citizen determines the strengths, weaknesses, opportunities, and threats of his individual business analysis. In the third process step, a derivation of actions takes place. The first step is to determine the benefits (gains) from the strengths and opportunities, and the problems (pains) from the weaknesses and threats. After defining the benefits and problems, the citizen determines how the benefits can be achieved (gain creators) and how the problems should be solved (pain relievers). Determining the gains, the pains, the gain creators and pain relievers is part of a value proposition canvas (Leimeister, 2012). A solution is then sought in the penultimate step. Here, the citizen describes the solution based on gain creators and pain relievers and can optionally make a sketch (mock-up or even prototyping). In the final and fifth step, the citizen summarizes in a solution presentation for whom it is (target group), which problem (pains) is solved, and how it will be solved (solution). This can be done by a simple description or on the basis of an optional short video. The evaluated framework is based on the elevator pitch framework. Following the fifth step of the digitalization street, the citizen is given an overview of all the steps and has then the opportunity to make adjustments to the individual steps. Figure 1. summarizes the process and the description of and around the digitalization street.

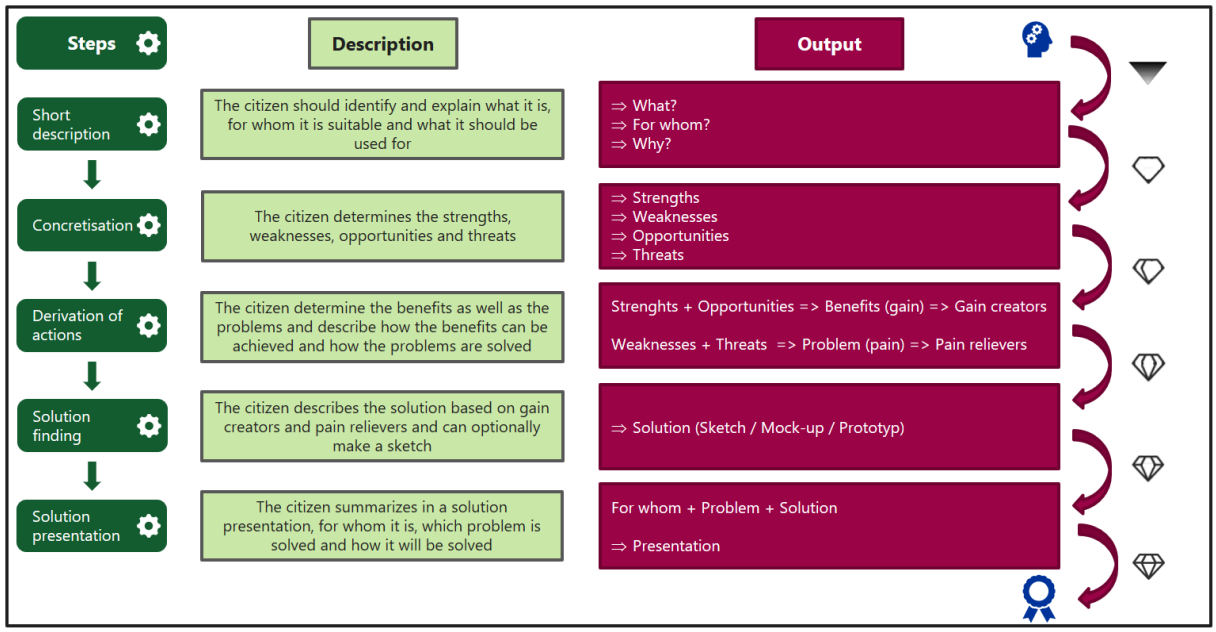

Figure 1. The digitalization street with its five steps.

5 Further Work and Limitations

In the next steps, the digitization street will go through further iterations in the three cycles of (Hevner, 2007) in order to constantly refine it. This applies, in particular, the further steps after the digitalization street including the integration into the city administration. Therefore, experiments and laboratory tests are planned with a digital prototype. The digital prototype is already under development and will be extensively tested with other experts before a field test with citizens takes place. Furthermore, the aspect of collaborative work will be more focused in the current setting. As already mentioned in the research approach, we will use the FEDS framework for further evaluation. In addition, all further activities for the demonstration will be operationalized with the framework. The FEDS framework of Venable et al. (2016) serves to ensure the accuracy and correctness of the design science research project and a constant feedback. This is done via the four steps of the framework: The evaluation goals

are explained in the first step. The second step then comprises the evaluation strategy to be chosen. Step three defines the characteristics of the evaluation and in the final step, individual evaluation episodes are designed. The evaluation is intended to establish the digitalization street in order to design the development of citizen-initiated services for citizen's user-, use-, utility-centricity approach. For this purpose, a formative and formal evaluation is carried out by experts in order to check the structure and the procedure at an early stage. Thereafter, the acceptance is validated by domain experts in a naturalistic and formative evaluation with interviews. Finally, the digitalization street is tested in field trials with potential citizens using the application and compared with other similar approaches. The abstraction of the identified problems in relation to the individual evaluation phases results in the following characteristics: citizen satisfaction, quality assurance, and citizen resource utilization. The specific evaluation episodes have not yet been determined and are part of further research. The aim of the digitalization street is to help citizens, as experts of their everyday lives, develop their own potential and grind services from a rough diamond into high-grade diamonds - independently. To achieve this, the digitalization street must be user-oriented in order to guarantee citizens easy access to the provision of services. The digitalization street, which can be seen as a diamond itself, is still in its raw state and has some corners and edges. The consolidation in the requirement elicitation workshop has shown that there are: "too many redundancies in the steps", "too much detail, duration and complexity" and "unclear tasks, terminology and appreciation". Furthermore, the individual steps are too scientific and have too much detail and complexity. The systematic connection of the digitalization street to the city administration processes cannot be carried out one-to-one, since the processes and structures in the individual cities differ from each other. Although the basic concept of the digitalization street is logical and helpful, it needs to be further grinded in order to counteract the limitations. 85% of all IT projects fail due to various factors such as a lack of administrative support, lack of management quality, poor planning, lack of competence as well as a weak business case or incorrectly set organizational goals and project goals (Nam and Pardo, 2011). This risk also exists for technology-driven projects in the public sector as there are innovation-unfriendly conditions which contradict innovation. Furthermore, there is no room for experimentation and testing in the public sector, as accountability is intended to avoid failures (Nam and Pardo, 2011). In addition, there are innovation-unfriendly conditions in the public sector which contradict innovation in the public sector. In further research, it will be necessary to analyze the impact of citizens' individual contributions on the quality of public services and suitable business models (Peters et al., 2015). Furthermore, it would be interesting to apply the artefact to other contexts. Another interesting point for research constitutes the evaluation of the provision of services and the measurement of citizens' satisfaction with the government, which also coincides with Schmidthuber et al. (2017a).

6 Conclusion and Contribution

The goal of this research in progress paper was to extend the design knowledge in service systems engineering and to build and evaluate a new portal iteratively with the aim to guide the citizens systematically to refine and further develop their services on the digitalization street. Therefore, the three cycles of Hevner (2007) were used as a research approach and reinforced with a requirement elicitation workshop in the environment over the relevance cycle. We expect further relevant contributions from the completed research project. Within the current status, our paper offers several practical implications and theoretical contributions in the areas of "citizen participation" and "service engineering" We contribute to literature by presenting a framework for creating services based on a citizen-centric participation approach. The digitalization street itself is a design theory contribution, which extends the existing knowledge base by an improvement of citizen participation with a new solution approach for an existing problem (Gregor and Hevner, 2013). We set out how the digitalization street can be implemented into existing processes in the city administration for helping to increase citizen participation in a new citizen-oriented way. The nascent design theory and the presented contributions represent a nascent theory of design and action (Gregor and Jones, 2007; Vaishnavi et al., 2004/17). It is important, however, to note that it can take years before a design theory can be described as mature and all-encompassing.

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