SEPP: A Service Evaluation Programming Platform Used for Value-based Service Pricing

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Abstract. *The ever increasing importance of services for the market success of companies sector-independently evokes new challenges when it comes to service pricing. In search of adequate guidelines firms frequently encounter traditional and product-related techniques and apply them although they do not meet the services' specific needs. The reason can be found in the acute shortage of service pricing tools and methods, especially value-based ones which are meanwhile deemed superior to others. To address this issue this paper introduces a service evaluation programming platform that can be used by companies as auxiliary device for finding appropriate prices for their provided services.*

Keywords. Theory-driven development, perceived value, service performance, mobile app, technology acceptance, user experience, hedonic regression

1 Introduction

The expansion of the tertiary sector can be regarded as global megatrend which permits the statement that society has evolved into a service-oriented one (Ehrenhöfer et al., 2013; Neely, 2013). This led to the circumstance that products, as unique selling propositions, were pushed into the background whereas hybrid value added and product-service-bundles took on greater significance. Especially companies operating in the secondary sector are confronted with the new challenge of pricing their (new) services and, thus, their mix of goods and services. Traditional pricing techniques can, however, solely rarely be applied in the service context – a fact that operates against service pricing activities sector-independently. As a consequence, methods and heuristics are applied that are neither fully oriented towards the services' needs, systematic, nor value-based – it is even relied on gut instincts and rules of thumb.

It was already pointed out in (Pergler et al., 2015) that there is a lack of tools supporting, especially small and medium-sized, enterprises (SMEs) in their value-based service pricing efforts. A research agenda was proposed aiming at bridging this present gap in both research and practice. Given this backdrop, the article provides an insight into the current state of the research continued, i.e. a lightweight value-based service pricing approach based on the Performance Journey Mapping (PJM; Höber et al., 2015) Framework. The major challenges to be met are the consideration of (1) the service value's context dependence and (2) the dynamic interplay of price, value, and performance. By following an integrated design science (Hevner et al., 2004) and user-centered design (ISO 9241-210, 2010) approach a service evaluation programming platform (SEPP) is being developed. SEPP currently supports the survey process in respect of the customers' service value having regard to the hedonic regression analysis' data requirements. Care was taken to keep complexity for the users on a low level although data on the service activities' value and context are gathered. A first prototype of SEPP will be evaluated by means of methodological triangulation (Venkatesh, Brown, & Bala, 2013), with focus on user acceptance and experience (UX) during value data provision, to complete the first cycle in the iterative development process.

The remainder of the paper is structured as follows: In Section 2 the third generation Technology Acceptance Model (TAM3; Venkatesh & Bala, 2008) and accompanying interventions are sketched. In addition, the peculiarities of artefact development are described and how the resulting challenges are aimed to be met with a TAM3-based iterative inside-out approach constantly expanding the range of involved parties. SEPP's technical development is outlined in Section 3, including its functional requirements, architecture, and mobile user interface. Section 4 glances at price modelling by means of hedonic regression and an application concept for the real-world situation of a conference. Within the latter's

scope the SEPP Mobile App will be evaluated. The underlying design is drafted in Section 5. The paper concludes by summarizing the cornerstones of the development and highlighting the potentials of SEPP. Moreover, an outlook on the next steps to be taken as well as future research and development is conveyed.

2 Theory-driven Development

There is a huge need for tools that support companies, especially SMEs, in their value-based service pricing activities (Pergler et al., 2015). Particularly in the field of SMEs, such a tool must stand out due to both its resource-efficient and simple handling and must simultaneously yield feasible prices for services. However, the best artefact is of no use unless it is accepted and, hence, utilized by the intended users. A tool must, therefore, feature acceptance-triggering characteristics in order to be successfully implemented in the company.

Numerous explanatory models of technology acceptance and usage exist, e.g. the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003), the model of information system success (DeLone & McLean, 1992), or TAM3 (Venkatesh & Bala, 2008). TAM is the most widely employed model in this context (Venkatesh & Bala, 2008), not least because of its high explanatory power in different application scenarios. In the present case of developing SEPP, a programming platform for value-based service pricing, the third generation TAM is chosen as theoretical foundation. On the one hand, it predicts the individual adoption and use of new technologies well which is contingent on the two believes *perceived usefulness* (PU) and *perceived ease of use* (PEOU) as well as their determinants. On the other hand, it posits interventions that can make for greater acceptance and effective utilization of tools by influencing the determinants just mentioned.

From TAM's application point of view, technologies are either developed by companies themselves or commissioned service providers for the purposes of interaction with classical clients (e.g. online hotel booking website) or in-house usage (e.g. a technical aid for sales representatives). The present case is even one more level complex. SEPP is developed for SMEs. The systems' utility and acceptance on company-side is heavily dependent from the service users' acceptance and usage. This stems from the fact that any method applied for the purpose of price determination fundamentally depends on the underlying (service value) data that is directly gathered from the service users (Pergler et al., 2015). SEPP, thus, needs to be designed for two different groups of users: the company affiliates in charge and involved in service pricing as well as the service users acting as data source of the service value. This means that the actual, immediate benefit of SEPP is in the range of companies and not in the range of their customers.

Against this backdrop, the development and extension of involved parties in the process takes place gradually. The first group of users to be involved is the one of data encoders, i.e. the (potential) future customers of a particular service. For the purpose of service value assessment, SEPP needs to be easy and straightforward to use which means that the underlying instrument or questions must feature reduced complexity (this concerns the amount, text length, ambiguity, etc.). Service users might indirectly benefit from their application of SEPP (in terms of data provision) in case of the usage's alignment with, for instance, customer retention schemes. The focus of SEPP's development and evaluation regarding this user group is, thus, on the PEOU's branch of TAM. The achievement of a good UX must have priority, as this constitutes the basis for SEPP's acceptance and use on the part of the data suppliers. Not before a sufficient level of intended and actual usage is reached in this context, SEPP's development and evaluation can be expanded on the service-providing firms. At this stage, the TAM can be addressed in its entirety. Company affiliates must be convinced from the system's usefulness and ease of use so that it establishes itself as standard tool for service pricing in the firm. Fig. 1 depicts this incremental approach.

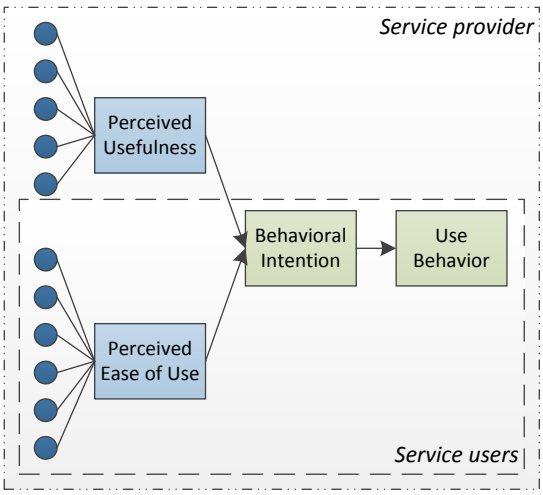

Figure 1. Stepwise TAM3-based development

As already noted, TAM3 not only provides a holistic picture of the determinants of PU and PEOU but also potential intervention measures fostering technology adoption. This research project aims at realizing interventions on multiple levels in order to increase the utilization rate and, thus, the success (e.g. market share) of SEPP.

From the researchers' perspective there are several options for implementing incentive measures fostering SEPP's adoption in SMEs – examples are outlined below. One could offer the possibility to

customize the graphical user interface (*design characteristics*) or conduct a workshop where the underlying service blueprint is jointly elaborated and potential contextual variables, scales, or pre-configuration items are determined (*user participation*). A preliminary talk with the management to introduce SEPP and express its utility helps in creating rapport. It is, then, beneficial to mandatorily integrate a manager into the envisaged workshop (direct *commitment*) – in the SME context this might happen automatically. It is apparent that these incentive dimensions interact with each other. A standardized demo version of SEPP's back-end, screencasts, manuals, or user education could be offered as *training* measures for employees. A selected company affiliate could be trained as key user in order to be available for *peer support*. Finally, SEPP's developers should supply technical *support*.

To obtain appropriate value data for pricing purposes, (potential) service users must want to use SEPP. Also in this case, incentive measures can be taken. It makes sense to involve key customers in the aforementioned workshop(s) which addresses *design characteristics* and *user participation*. Regarding the aspect of *incentive alignment* it is appropriate to tie the usage of SEPP with existing bounty systems. Alternatively an optional gaming feature could be implemented in SEPP that offers a usage incentive. From the *training*'s perspective, similar standardized demo versions (front-end) and documents (how-tos) can be supplied. The service provider has to ensure that a contact point in terms of *support* is created. *Peer support* is reliant upon the service type. It is relatively easy for the staff to act as peer when a service is provided on-site.

3 Technical Development

The development of SEPP does not only follow a theory-driven design science, but also a synergetic user-centered approach which includes the following (iterative) set of activities (ISO 9241-210, 2010):

- Analyzation and specification of the context of use
- Specification of user requirements
- Production of design solutions
- Evaluation of design

As pointed out in Section 2, the range of participating parties in this cyclic process is gradually extended. Ensuing from SEPP's current state of implementation, it can be said that the first two above-mentioned activities were performed from an internal researchers' perspective in a first step, i.e. it was slipped into the shoes of the two user groups (enterprise affiliates and service users). An overview of the resulting functional requirements, the principal software concept, and the Mobile App serving as client interface (front-end for value data gathering) is provided in the next subsections.

3.1 Functional Requirements

SEPP presently has a two-fold structure: a back-end (for enterprise affiliates determining the service to be priced) and a front-end (for clients providing data). As already noted, a minimal set of application requirements was derived from both the enterprises' and clients' point of view.

The requirements from the service provider's point of view focus mainly on SEPP's input and back-end. The latter should support, inter alia, the

- definition of either single or potentially multiple basic customer processes for different service types and/or businesses by entering the single customer activities in chronological order.
- specification of (already known) context variables, i.e. (context) attributes with their associated levels affecting service provision.
- indication of optional customer activities for the purpose of pre-configuration.
- labeling of options and basic processes for the purpose of user configuration.
- record of both physical evidence(s)/touch points and contextual factors (attributes with concrete levels) connected with each customer activity that might affect the value assessment.

The front-end, in contrast, should support editing operations, i.e. re-ordering of service process steps and making pre-selections (service configurator). Furthermore, it should be capable of providing navigation functionality, i.e. moving back and forth through the process steps. Also an overview of the service process steps (activities) and their states (values) is demanded. Of course, the valuation of service activities, touch points, and contextual factors must be possible.

3.2 SEPP Software Architecture

The requirements were transformed into an implementation whose architectural conception is depicted in Fig. 2. It relies on the Microsoft Azure Cloud, more precisely on Microsoft App Service (2016). SEPP's back-end operates on the App Service infrastructure which is composed of a Cloud Storage based upon Microsoft SQL Server and the SEPP Process Logic which administers, interprets, and executes the requests coming from the Mobile App and vice versa. The latter mediates between Mobile App and Cloud Storage via the REST (Fielding, 2000) Web Service (data exchange in JSON (ECMA-404 JSON Data Interchange Standard, 2013)) running on the cloud-based Microsoft IIS Server (2016). SEPP's Process Logic ensures that (1) both order and logic of the process steps are guaranteed and (2) data are properly delivered to the Mobile App as well as to the Cloud Storage in reverse. Communication and data exchange in SEPP rest on the pull-push request principle. Consequently, the basic create, read,

update, and delete (CRUD) functionality is realized in the implemented SEPP REST Web Service.

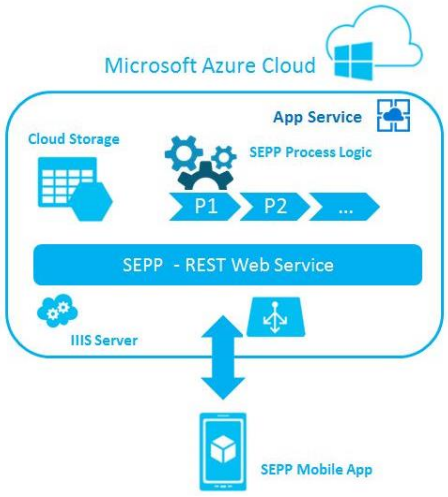

Figure 2. General implementation architecture

The most important advantage of SEPP's architecture stems from both its data schema and flexibility regarding the number and type of steps in a single service process (and associated contextual factors as well as touch points). By this means, an easy adaptation of SEPP for many different use cases of service evaluation is enabled. The SEPP Cloud Storage schema (see Fig. 3), furthermore, allows the definition of a wide range of parallel processes served by the same logic and REST Web Service interface.

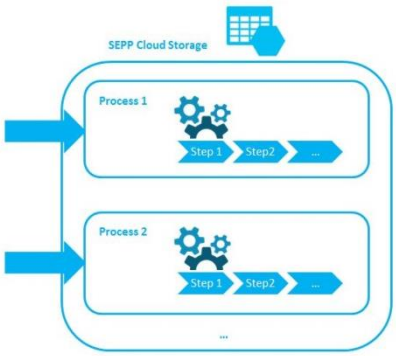

Figure 3. SEPP cloud storage schema concept

3.3 SEPP Mobile App

The Mobile App acts as front-end and customer (service user) interface of SEPP. It utilizes the back-end to enable the users to assess the value of and satisfaction with the service and its components. The app extends the demands on functionality of SEPP's back-end for the possibilities of assembling and configuring the service so that a user-specific view emerges which displays the respective customer process with its activities and touch points. This view provides the functionality previously outlined in order to ascertain the data required to perform value-based service pricing.

Besides the requirement that the app should deploy the workflow for service process rating on current mobile operating systems, it has to offer a performant platform dependent UX. Xamarin Forms is used for the consummation of the Microsoft Azure REST Web API. The main advantage of the platform-independent client solution development environment is the opportunity to fast deploy client apps with a common shared code base.

The Mobile App, in its current prototypical state, is structured in three main parts. The first one is the welcome screen which introduces the users into the app itself as well as the domain. The left hand side of Fig. 4 shows an exemplary welcome screen for the expert forum ServTec Austria with a textual introduction and a query of demographic user data. An overview of customer service activities (service process) and their states is provided by the second part of the Mobile App (see Fig. 4 on the right for the ServTec case). In addition to the single parts (activities) of the conference, their planned starting times are indicated and it is visible which of the parts have already been assessed (check vs. cross mark).

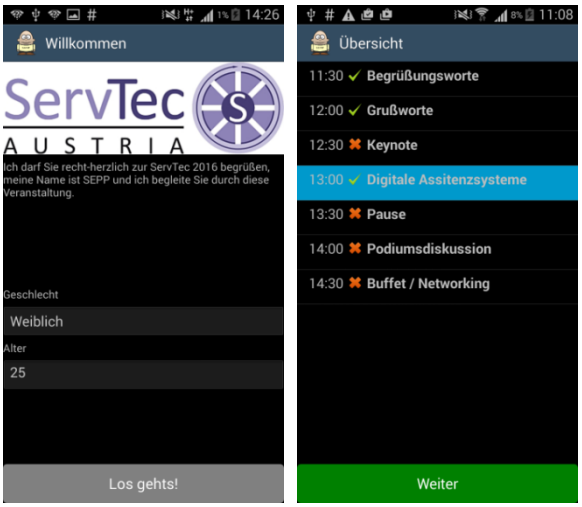

Figure 4. Welcome and overview screen

The detail screen (on the left hand side of Fig. 5), which belongs to the app's second part, shows the description of the conference's keynote activity and provides the facility to rate it in terms of satisfaction (smileys) and personal value (Euros). The final part of the Mobile App contains the conclusion screen (see Fig. 4 on the right). At this point, no more changes of the activities' order or rating are possible. Solely a comment and the estimated price for the whole process can be added. The last action to be performed by the users is to press the "Abschluss" button in order to finish the rating process and send the data to SEPP's back-end for further processing.

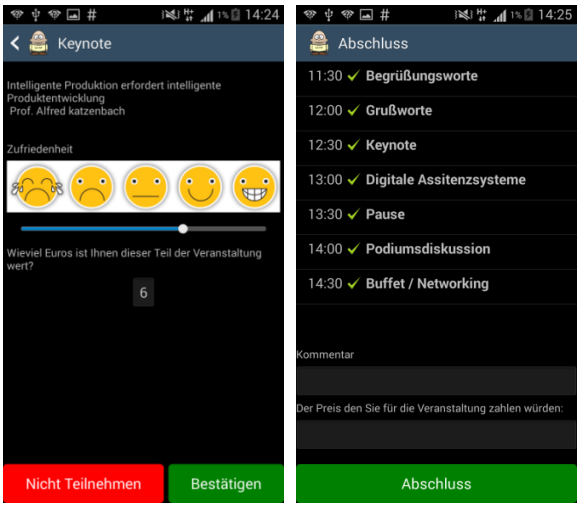

Figure 5. Detail and conclusion screen

4 Price Modeling

It was originally intended to use conjoint analysis to estimate the importance of the partial values perceived by service consumers (Pergler et al., 2015). The conjoint analysis collects data on the users' preference concerning different attribute combinations, analyzes the data through dummy variable regressions, and obtains an importance ranking of product and/or service attributes (Breidert & Hahsler, 2007; Chiam, Soutar, & Yeo, 2009; Hinterhuber, 2008). Since it is of particular interest to also know how much extent the quality of these attributes could affect the partial value attached by the users, it was decided to switch from conjoint analysis to hedonic regression which is able to provide both kinds of information (importance and impact). Hedonic regression analysis combines the idea of hedonic pricing and the technique of regression with the result that the goal of hunting for partial values perceived by different users and/or user groups is not disturbed.

4.1 Hedonic Regression

The value of some products, such as mobile phones or laptops, is highly related to the quality of its certain key components and characteristics respectively (Dewenter et al., 2007; Nelson, Tanguay, & Patterson, 1994). For instance, other things equal, a laptop with faster processor is of a higher price than that with a slower processor. Hedonic pricing methods assume that the price of a certain product depends on the partial value, or shadow prices, of its components: the better the quality of the components is, the higher the price of the product.

Regression analysis provides the possibility of assessing quality-related value for the product components attached by its users. It takes the quality of the product components as independent variables. The value assigned by the users for the product depends on these variables (Andersson, 2010). Regression analysis is, also, able to distinguish different values assigned by different groups of users. User attributes, like gender or age groups can be used as dummy variables in a regression model. Through regressing against these dummy variables, information on different user groups of the product can be gathered and it can, further, be estimated how varying user groups evaluate the products differently.

4.2 Real-life Implementation

Based on the deliberations in Section 2, the pilot testing of SEPP and, thus, the value-based service pricing concept takes place internally at first thereby, however, involving service users. For this purpose, the ServTec Austria 2016 – an expert forum for innovative services and new technologies – was chosen as real-life scenario. The aim is to calculate a notional value-based price for the conference which can traditionally be visited for free. The conference is, hence, considered as a service product and the participants represent the users of this product. The whole conference consists of single components, e.g. keynote speech, guest presentations, discussion, register and buffet. The value of the conference, thus, depends on the quality of these elements. Under the assumption that the hedonic regression model is applied on the ServTec, it is aimed at finding out how the value attached by the participants is related to the quality of the conference's components.

4.2.1 The Model

Conference components as scaled variables: Each of the conference components (keynote speech, guest presentations, discussion, etc.) is to be evaluated by the participants as scaled variables through smileys (see Fig. 5 on the left). The participants are also asked to give a total and partial prices (or price changes) they are willing to pay for the conference as a whole and for the single elements. By regressing the given price against these scaled variables, it is attempted to assess how much more value the participants are willing to pay for a better quality of a certain component of the conference.

Context elements as dummy variables: Besides the hidden marginal willingness to pay for the conference components, there is also a keen interest in the effects of some context elements on the value attached. In the case of a professional conference, context elements can be, e.g., the conference participants' educational background, age, or gender. Different participant groups, such as females and males, may assign different values to the same conference. To find out whether certain valuing difference exists between varying groups and how large such a group valuing difference is, dummy variables are included into the regression model to represent the context elements. The chosen dummy variables for the purpose of pilot

testing in the ServTec conference setting are gender and age groups. This information is also asked to be given by the conference participants in the service evaluation process via the Mobile App (see Fig. 4 on the left for an example).

As a result, the model takes the following semi-logarithm form (eq. 1):

$$\log P = a_0 + a_1 x_1 + \cdots + a_i x_i + b_1 y_1 + b_2 y_2 + \varepsilon \quad (1)$$

where P is the sum of the starting price and the value changed by the participants for each component. This sum is compared with the total value given by the participants to the whole conference in order to control whether some other attributes are ignored or not. x_1 to x_i are independent variables and the quality of the conference's components i is evaluated through the smileys. y_1 and y_2 are the dummy variables for gender and age groups. ε is the standard variance of the model.

4.2.2 Results of the Model

The constant a_0, the coefficients $a_1, a_2, \ldots, a_i$, b_1 and b_2 are to be estimated by the regression model. a_1 provides information about how much more value (in Euros) is attached, e.g., to a one-level higher evaluated keynote speech. The estimated b_1 is about the different value assigned by a distinct gender group of participants. a_0 is the constant value attached by the participants.

5 User Experience Evaluation

SEPP's serviceableness for SMEs does not only depend on aspects such as usability or economical exploitation of resources but also on active assistance of customers by means of service feedback. The system cannot be profitably utilized by service providers unless service users choose to employ its valuation functionality. The first evaluation cycle, therefore, puts emphasis on the data suppliers and the TAM's PEOU branch (cf. remarks in Section 2), the consequence being that the SEPP Mobile App is examined as a first step to achieve technology acceptance. UX – "*a person's perceptions and responses resulting from the use […] of a product, system or service*" (ISO 9241-210, 2010, p. 3) – can make an essential contribution in this regard. It is, meanwhile, reckoned as one of the key drivers of product, service, and system design (Vermeeren et al., 2010). The measurement and analysis of SEPP's UX, however, requires an appropriate, frequently tailored, evaluation design.

Academia and practice offer a plethora of methods to evaluate UX, see e.g. (Vermeeren et al., 2010) for an overview. This is, inter alia, a result of UX's multifacetedness and dynamism (Vermeeren et al., 2010). As a general rule it is the outcome of the user's encounter with a company and its provided goods, services, and/or systems in a special context of use, with all three parties' featuring specific characteristics and capabilities (ISO 9241-210, 2010). This circumstance makes it necessary to identify those factors which coin UX the most. The Roman architect Vitruvius defined three UX requirements that also hold true for the information technology context (Tractinsky, 2004): strength, utility, and beauty. Given the current state of SEPP's development the focus of evaluation is on the utility dimension which encompasses usefulness and usability.

Two questions can be derived out of this for the purpose of evaluation: How satisfied are the users with SEPP? Is actual user behavior consistent with and the planned one? Answers should be given by means of a theory-driven evaluation instrument that considers TAM3 (Venkatesh & Bala, 2008) as well as aspects of usability and user-centered design, e.g. (Nielsen, 1993) or (ISO 9241-210, 2010).

To obtain a valid and reliable evaluation, methodological triangulation, also known as mixed methods approach, is applied. It is increasingly claimed in the research field of information systems (Venkatesh, Brown, & Bala, 2013). In this way, weaknesses of data collection methods are compensated with the use and combination of several measurement methods for the same phenomenon.

Due to UX's content-dependence, a field study (Roto, Obrist, & Väänänen-Vainio-Mattila, 2009) is performed. As mentioned in Section 4, the ServTec Austria 2016 acts as real life situation. It is planned that the participants rate the relative satisfaction of each element of the conference, such as keynotes, discussions, or showcases, via the SEPP Mobile App and smiley face scales. In addition, personal prices for each conference element and the ServTec in total will be queried. Afterwards the research team will analyze the data by means of hedonic regression to obtain a value-based price of admission, composed of partial values for each of the elements.

Prior to the event, the registered persons will be informed by email about the purpose and goal of SEPP's application within the scope of the ServTec. An information desk will be available at the conference as single point of contact regarding SEPP and its usage thereby providing accurate background and technical information. Conference participants will have the possibility to download the app on their mobile phone with the aid of a quick response code or web link as part of the conference materials.

Data on the SEPP-users UX are collected both directly and indirectly. As solely inaudible data collection methods can be utilized during the event, the following twofold strategy will be pursued for answering the second evaluation question. On the one hand, observations in the sense of shadowing (Stickdorn & Schneider, 2011) are to be performed by the researchers to gain insights into the user's behavior when using SEPP. On the other hand, it is

drawn on functionalities of the Mobile App to additionally analyze user behavior by means of log files. It is, thus, possible to track the individual steps taken by the app users concerning time and chronology.

With regard to the users' satisfaction – the first evaluation question – single semi-structured interviews (Straits & Singleton, 2011) are conducted prior to and during the social program of the conference. The questions concern the users' prior experiences and present emotions with SEPP to gain a deeper understanding of their UX. Moreover, it is planned to perform an online survey (Straits & Singleton, 2011). For this purpose, a web link to an online questionnaire will be distributed the next day to all participants that used the SEPP during the event. Furthermore, the information desk serves as source of data, as queries and given feedback can be recorded by the responsible person.

In this regard it is also planned to deploy incentives and to analyze their impact. The information email, aiming at arousing the participants' curiosity, can be construed as a kind of *management support*. The information desk serves as *organizational support* facility. *Peer support* is achieved in the way that the research team and SEPP developers are ever-present at the conference and can, hence, assist in the operating of SEPP on demand. As *training* measures a demo version of SEPP's front-end, manuals, and/or online help are contemplated. There is, furthermore, the possibility to realize *incentive alignment* by means of a playful approach (gamification), i.e. the usage of SEPP should be a challenge where rewards can be gained.

6 Conclusions and Outlook

This article provides insight into a research project aiming at developing a tool for value-based service pricing specifically targeted for SMEs. The resulting system, abbreviated as SEPP, is an advancement of the PJM framework (Höber et al., 2015). Its development rests upon the design science principles of Hevner et al. (2004) to ensure that the process itself as well as its outcome is scientific. It is, moreover, theory-driven in order to have guidance for deriving evaluation criteria at hand, i.e. TAM3 (Venkatesh & Bala, 2008). The intended service pricing approach is unique in its kind: it is tool-based, user-centric designed for the special needs of SMEs, and computes – for the first time – a service price based upon the sum of the service components' partial values assessed by the consumers.

It was described how SEPP will be applied and evaluated within the use case of the ServTec Austria 2016. This is the first build-and-evaluate loop initiated (in a kind of protected internal environment) to obtain feedback of service users regarding UX when using SEPP's front-end. This is a result of the iterative inside-out approach followed that constantly expands the range of involved parties. Starting with the integration of future data suppliers has multiple reasons: First, it is a necessary step to validate the internally specified functional requirements. Within the meaning of user-centered design (ISO 9241-210, 2010), existing requirements might be adapted or new ones may be directly derived from the concrete needs of the users. This information serves as input for the next iteration in development process. Second, the precondition for achieving a high level of acceptance and usage of SEPP on part of the enterprises is addressed. Service users must want to utilize SEPP in order to have appropriate and suitable service value data on hand for the purpose of pricing. Not until both acceptance and usage are guaranteed on part of (potential) future service users, the enterprise perspective can be considered and, thus, the next level in the development process attained. At this point, the next logical step would be to perform value-based service pricing for a service offered by colleagues of the paper's authors thereby involving their real-life clientele. After further experience was gained through semi-internal tests and corresponding evaluations, SEPP's application can be extended to the corporate sector. In the end, reliable statements regarding the utility of SEPP for companies can only be made after its use in different sectors and for varying service types.

Although the SEPP Mobile App should be offered in a platform and mobile device independent manner, a smoothly running and visually appealing basic version is developed which can be adapted for the various needs of the target devices in advanced development stages. It is currently distributed for mobile devices with Android operating system due to the simplicity of publication and Android's market share. The app was, however, already tested on other devices (tablets) and operating systems. From a data science perspective it is the long-term goal to evolve SEPP into a community-based living platform. It is intended to establish a pool of service value data which can be used, for instance, to estimate service prices on the basis of known partial values of related services. Companies would, thus, not have the need for collecting data on their own.

Finally, the project extends research in the field of technology acceptance, as the effects of interventions on the dimensions of PU and PEOU were postulated but not yet broadly examined. Empirical findings are available on the impact of training. The remaining intervention measures were, however, most widely neglected. This gap is addressed by realizing and evaluating multi-level intervention measures.

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