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3-5-2015

Self-Services - Do Not Leave Your Customers Alone with the Technology

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Abstract. New arising technologies change the modes of interaction between companies and their customers. So-called self-service technologies (SSTs) allow integrating customers as active participants into companies' business processes and thereby are expected to generate not only more efficient processes but also positive effects on customer satisfaction. As some customers do not consider their integration as an improvement and others are not able to use the SSTs, companies have to provide personal support offering direct response, assurance and social interaction. As for many companies the corresponding economic effects remain unclear, the aim of this paper is to develop a quantitative decision model that allows to decide on the integration of customers in business processes while considering of the necessary customer support on an economically well-grounded basis. To demonstrate the applicability of the model and its practical utility, we conduct a case study.

Keywords: customer integration, self-service technologies, customer support

1 Introduction

Customers nowadays increasingly value technology-facilitated interactions and transactions and hence the use and importance of SSTs is constantly growing. According to Gartner [1], web self-services have grown from US $600 million in 2011 to US $1 billion in 2012 and annual transactions at retail self-checkout terminals are at US $250 billion and continue to grow [2]. There are several current trends fostering the use of self-services, like the increase in personal costs, the emerging digitalization, and the new self-understanding of the customers. The increase in personal costs in the developed countries makes an efficient use of personal resources necessary and forces employees to concentrate on value-generating activities [3]. This leads to customers taking over various responsibilities which formerly resided in the scope of the company. The emerging digitalization enables not only new technologies but also new communication channels which allow customers to act independently and produce value largely for themselves, on their own and without direct assistance from a service provider [4]. This by large meets with the new self-understanding of the customers [5]. Considering the introduction of self-services, organizations face the challenge that not

12th International Conference on Wirtschaftsinformatik,
March 4-6 2015, Osnabrück, Germany

Engel, D.; Kryzhanivska, L.; Mueller, A.; Rupprecht, L. (2015): Self-Services - Do Not Leave Your Customers Alone with the Technology, in: Thomas. O.; Teuteberg, F. (Hrsg.): Proceedings der 12. Internationalen Tagung Wirtschaftsinformatik (WI 2015), Osnabrück, S. 317-331

all business processes are suitable for the usage of SSTs and that it is uncertain how customers react to self-services.

Hence, over recent years, researchers have studied the various effects of self-service on the internal organization and the customers, e. g. the direct contribution to competitive advantage [6] or reduced costs [7]. Based on this knowledge [8][1] developed a quantitative economic decision model that determines where customer integration via SST should take place. Further approaches deal with the diverse methods of supporting the customers using self-services, e. g. web-based customer support systems [9] or support from front-line employees [10] were suggested. But no integrated view on economically well-founded decisions regarding the selection of those parts of a process which can and should be performed by the customers considering the corresponding support has been evolved. As customer support has become an important factor for companies' competitiveness [9] with direct economic effects on the profit, it need to be considered in an economic model deciding on customers' integration. On the one hand customer support generates additional costs for services which influence the cash outflows. On the other hand support has positive effects on the perceived service quality and thereby animates customers to use the SSTs [11], [12] which leads to higher customer-related cash inflows. Thus, the aim of this paper is to develop a quantitative decision model which extends the model of [8] by the effects of customer support and so allows for economically well-founded decisions on the integration of customers in business processes considering the corresponding customer support.

The remainder of this paper is structured as follows. In the next section, we provide an overview of the research background related to SSTs and support. On this basis, we develop a quantitative economic decision model. Then, we demonstrate the practical application of the model using the example of a global travel solutions provider. After a critical discussion of the results, we conclude with a brief summary and provide an outlook on future research.

2 Theoretical Background

2.1 Customers' Use of Self-Service Technologies

Self-services are a constantly growing trend in Customer Relationship Management as they enable customers to transform from "passive audiences", who receive services and goods, to "active players", who take part in the business processes [13]. Hence, self-services change customer-company interactions significantly [4]. As illustrated by a number of terms, which characterize the concept of self-service [14], [15], like "virtual customer integration" [16], "partial employee" [17] or "mass customization" [18], [19], customers play an important role when integrating them into the companies' business

[1] This paper is based on prior work (cf. [8, 49]) which determine in which (sub-) processes customers should be integrated via SSTs. In this paper, we particularly focus on the role of customer support.

processes. The development of new technologies fosters this trend as it enables customers to participate in the organization's work and hence, researchers have recognized the critical role of technology [4], [20]. These technological interfaces that allow customers to conduct a service independent of direct service employee involvement have been labelled self-service technologies [4]. These SSTs include for example e-commerce websites, Automated Teller Machines (ATMs), or kiosks [4]. Despite the growing presence of SSTs, it is still unfamiliar for many customers to engage as active participants in the organization's work [14], and thus customers may not be able or do not want to deal with SSTs. To determine how organizations can react adequately to the customers' needs and demands, it has to be examined if the customers are able and willing to use SSTs.

2.2 Customer Acceptance and the Role of Personal Support

The aim of self-services and SSTs is to provide numerous positive effects for organizations and customers [21]. One of the main prerequisite for successful customer integration and participation is the customers' acceptance of SSTs. Therefore, a considerable part of the literature on self-services and SSTs examines determinants of customers' acceptance with e. g. the help of the technology acceptance model (TAM) [22-25]. According to TAM, the amount of technology acceptance is reflected in the strength of attitude or intention towards technology [25]. The key drivers of customers' acceptance of SSTs are perceived usefulness, perceived ease of use, reliability, and fun [26]. Moreover, there are various determinants influencing the key drivers perceived ease of use and perceived usefulness [27]: One of the most significant determinant is the personal contact between the customers and the employees as it supports those customers, who do not feel comfortable with technology, to embrace and use the new technologies [28]. Even with customers, who feel comfortable with technology, missing knowledge could diminish the use of SSTs, and hence organizations have to provide direct response, assurance, sense of control and social interaction [27]. Regarding customer support there are two different ways to assist the customers: technical support [9] and personal support [10]. *Technical support* includes e. g. web-based customer support systems, where customers have the option to access support directly through the Internet and which are open to an unlimited number of customers needing support [9]. *Personal support* in contrast to that can only be realized by personnel e. g. by front-line employees [10] who directly assist the customers in every activity or sub-process in which they engage as active participants. Hence, we focus on personal support.

2.3 Effects of Customer Support

Various researchers have investigated the different positive and negative effects of offering personal customer support from an organizational perspective (e. g. [23], [29-31]. While there are several positive effects such as the expected increase of customer satisfaction or the potential reduction of costs, there are also negative effects like the dependence on customers' demands and personality. These positives and negative effects are summed up in Table 1.

While most of the presented studies deal with the positive and negative effects of offering customer support in a self-service environment from a qualitative point of view to the best of our knowledge, so far the existing quantitative economic models only treat the determination in which processes customers can and should be integrated but do not consider where and how much support should be offered. Hence, the following study extends the previous approaches to determine in which business processes customers should be integrated while considering the corresponding customer support.

Table 1. Positive and Negative Effects of Customer Support for Companies

Effect	*Description of effects*	*Approach*
+	• increase success rate of new products • directly contribute to competitive advantage	Goffin / New [6]
+	• reduce costs • increase productivity	Alpar [7]
+	• improve competitiveness • increase market share	Kaufmann / Lally [32]
+	• rise customer satisfaction and customer loyalty	Meuter / Bitner [33]
+	• increase speed of delivery • rise precision • higher customization	Berry [29]
+	• avoid adversity • build long-term relationships	Negash et al. [9]
-	• satisfy customer expectations regarding the level of service	Yen et al. [10]
-	• dependence on customers' demands and personality	Enkel et al. [30]

3 Decision Model

For the potential integration of customers into business processes via SST, companies need to determine in which (sub-) processes customers can and should be integrated while considering the corresponding support. To assess these questions, we look at the economic effects of establishing SST and offering supporting activities and hence develop a quantitative economic decision model based on [8] that addresses the necessary investments and the related process and customer effects.

3.1 Definitions

The economic decision model presented below is based on the following definitions:

D1: *Business process and sub-process* – A business process is defined as a collection of activities in a control flow that takes one or more kinds of input and creates an output that is of value to a customer [34]. A business process can be split into n sub-processes p_i $(i = 1, \dots, n)$. These sub-processes are characterized as disjoint sub-sets of actions, which are connected in a control flow and form functional units. Sub-processes p_i can be performed either by the company ($p_i = 0$) or by customers via SSTs ($p_i = 1$).

If customers are integrated into business processes via SSTs, they take on a cohesive set of related tasks in the form of sub-processes [8]. For each sub-process two possible ways exist to be performed that imply different integration variants for executing the business process [8].

> D2: *Integration variant* – For each business process, there are 2^n possible integration variants $\vec{d}_j$ $(j = 1, \ldots, 2^n)$. These variants can be expressed as a vector $\vec{d}_j = (p_1, \ldots, p_n) \in \{0, 1\}^n$ and are characterized by which sub-processes p_i are executed by the company itself or by customers via SSTs.

As finally customers decide on the success of a service, the success of customer integration via SSTs depends not only on the adequate design of the process but also on the customers' attitude toward SSTs. Therefore companies should comprise the preferences and behavior of their customers or rather of the target customer group in the decision process. According to their general attitude towards technologies customers can be separated into three groups: a group of technology-friendly customers (*digital natives*), who intuitively and quickly use or adopt new technologies, a group of elderly but open-minded adopters (*digital migrants*) and a group of elderly people with many *digital deniers* [35]. Depending on their affiliation to one of these groups, customers are more or less able and willing to perform a sub-process on their own and different extents of support have to be provided. Hence, for different target groups different integration variants can be optimal. To care for this fact we additionally extend the model of [8] by considering the preferences of the target customer group.

> D3: *Target customer group* – Since customers with a similar attitude towards SSTs also have similar requirements e. g. regarding design and ease of use of SSTs and therefore a similar demand for support, this attitude can be used as a segmentation variable.

In the following, we focus on one specific target customer group. To decide whether and, if so, in which sub-processes p_i customers should be integrated via SSTs while considering the corresponding support, the following subsection presents an economic decision model that returns the optimal integration variant $\vec{d}_j^{\,*}$ for a specific target customer group.

3.2 Formulation of the Decision Model

All changes in cash flows that can be attributed to customer integration via SSTs need to be considered in an economically well-founded decision. The change of the net present value $\Delta NPV(\vec{d}_j)$ related to an integration variant $\vec{d}_j$ serves as decision criterion and can be identified according to [8] by the following three elements: The *present value of investment outflows for establishing customer integration via SSTs (investment effect)* $I(\vec{d}_j)$; the *changes in cash flows for process operations (process effect)* $\Delta PE(\vec{d}_j)$, which represent the economic consequences of the changes in conditions of the process performance; and the *indirect economic effects on customer behavior (customer effect)* $\Delta CE(\vec{d}_j)$, which reflect the effects on the customer relationships caused by customer integration via SSTs [36]. By this type of differential investment analysis, the change of the net present value $\Delta NPV(\vec{d}_j)$ can be denoted as follows:

$$\Delta NPV(\vec{d}_j) = -I(\vec{d}_j) + \Delta PE(\vec{d}_j) + \Delta CE(\vec{d}_j) \quad (1)$$

This calculation is based on the external circumstances (e.g. currently available technological configuration) at the time of the decision. As customers are not necessarily able to immediately – if ever – take over the new responsibilities that come along with the SSTs and to perform all tasks by themselves, companies need to support them. But supporting customers has direct economic effects on the cash outflows and the customer-related cash inflows and thereby affects all three components of the net present value (NPV). Thus we extend the elements identified by [8] by considering customers' support when specifying the composition of the NPV.

Investment effect: Actions to set up SSTs are considered as investments. Generally, setting up SSTs requires investments for facilities as well as organizational and technical changes (e. g. infrastructure, hardware such as self-service terminals, or software functionalities). Concretely, the *present value of investment outflows for establishing customer integration via SSTs* $I(\vec{d}_j)$ includes overarching outflows for an integration variant $\vec{d}_j$, such as investments for project and business process management $V_j^{total} \in R_+$ and particular investments $\vec{V} = (V_1, V_2, \dots, V_n)^T \in R_+^n$ for each sub-process p_i, that a customer can carry out, such as hardware or software. Furthermore, as customers need to get used to the new mode of interaction usually intensive initial support is required (e. g. initial explanation of the new tasks, providing training and advice). This go-live support causes additional one-time expenses for each sub-process p_i, which are represented by the vector $\vec{g} = (g_1, \dots, g_n)^T \in R_+^n$. In sum, $I(\vec{d}_j)$ can be described as follows:

$$I(\vec{d}_j) = V_j^{total} + \vec{d}_j \cdot \vec{V} + \vec{d}_j \cdot \vec{g} \quad (2)$$

Process effect: Furthermore, independent of whether sub-processes are performed by the company or by customers, it is necessary to ensure that the process can be successfully completed. Depending on the integration variant, there are changes in cash flows for process operations, for e. g. materials, rent, personal payments, and maintenance for each sub-process $\overrightarrow{\Delta B} = (\overrightarrow{\Delta B}_1, \overrightarrow{\Delta B}_2, \dots, \overrightarrow{\Delta B}_n) \in R^n$. Besides these payments, additional expenses for customer support occur for each sub-process where customer integration takes place. These expenses for customer support can be expressed by a company-specific cost rate $\vec{c} = (c_1, c_2, \dots, c_n) \in R_+^n$ representing the present value of the wage of staff in relevant service and support functions. For each sub-process p_i, c_i corresponds to the costs if 100% support is required (*do-it-all-for-them*). How much support really needs to be provided depends on the customers' ability to use SSTs which in turn is determined by their knowledge regarding the specific sub-processes and their willingness to perform [38]. Since SSTs foster learning and knowledge creation [39], customers' knowledge about a specific sub-process develops over the time [40]. Furthermore, customers' knowledge is influenced by different factors such as the complexity, the frequency of the executions [41], [42], and the general awareness level of the sub-process. These influencing factors are represented in the following by a sub-process specific growth factor $b_i \in (0,1)$. Precisely, customers' knowledge $k_{i,t}$ about a specific sub-process p_i at the beginning of the period $t \in (1,2,\dots,T)$ corresponds to their knowledge about p_i at the end of the previous period t. Within a period t, $k_{i,t}$ develops according to the sub-process specific growth factor b_i. Thereby, the first units of knowledge can be acquired more quickly [40] as the basics about a specific sub-process are easier to learn than the further expert knowledge. We then assume a phase of declining growth until an upper bound k_i^{max} is converged. This sub-process specific upper bound k_i^{max} represents the maximum of knowledge about the sub-process p_i customers may have. Thereby, we exclude the special case that the customers already hold the maximum knowledge k_i^{max} about a sub-process before the first execution. Hence, customers' knowledge at a specific period can be described as follows:

$$\boldsymbol{k_{i,t} = k_i^{max} - \left(k_i^{max} - k_{i,t-1}\right) \cdot e^{-b_i}} \tag{3}$$

with
$k_{i,t}$: customers' knowledge about sub-process p_i in period t with $k_{i,t} \in \left(k_{i,0}, k_i^{max}\right) \; \forall \; i = 1,..,n$
$k_{i,0}$: initial knowledge about sub-process p_i before the first execution with $k_{i,0} \in (0, k_i^{max})$

The total sub-process specific customers' knowledge K_i is determined as the average of these periodic values:

$$K_i = \left(\sum_{t=0}^{T} k_{i,t}\right) \cdot \frac{1}{T} \tag{4}$$

As mentioned above, the customers' willingness is a further important influencing factor of customer support. Different stimulations – represented by support – can be used to motivate customers to execute more active work than before [39]. If customers do not want to perform, they will need more support (*do-it-all-for-them*) than if they like to do it but require help e. g. because of a lack of knowledge (*support-on-demand*). This customers' willingness to use SSTs is affected by their attitude towards SSTs which in turn can be expressed by their technology affinity $a \in [0,1]$ [25]. Depending on the regarded target customer group, a can range from skepticism ($a = 0$) to excitement ($a = 1$) [43]. Customers who like to use SSTs, so-called "digital natives" ($a = 1$), just need support depending on their knowledge about the process. Customers with a low technology affinity, the "digital migrants" and "digital deniers" ($a < 1$), in contrast need more support as required on the basis of their knowledge to execute the process successfully. Thus, depending on the integration variant $\vec{d_j}$, the level of customer support $\vec{s_j}$ can be determined by the following formula:

$$\overrightarrow{s_j} = diag\left(\vec{d_j}\right) \cdot \left(\overrightarrow{1_n} - \vec{K} \cdot a\right) \tag{5}$$

with $\vec{K} = (K_1, K_2, \dots, K_n)^T \in R_+^n$,

$\overrightarrow{1_n} = (1,1,\dots,1)^T \in \{1\}^n$ as the unit vector,

$diag\left(\vec{d_j}\right) = \mathrm{I_n} \cdot \vec{d_j} = \begin{pmatrix} p_1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & p_n \end{pmatrix}$ with I_n as the identity matrix,

since customers only need to be supported within those sub-processes p_i, where customer integration takes place ($p_i = 1$).

Finally, customer support can be interpreted as the maximum of 100% support (*do-it-all-for-them*) minus the percentage customers are able to perform on their own depending not only on their knowledge but also on their willingness $(\overrightarrow{1_n} - \vec{K} * a)$. As each unit of support provided to a customer causes additional personnel expenses, support should be considered by the economic decision model for the optimal level of customer integration. Summarized, $\Delta PE(\vec{d_j})$ can be denoted as follows:

$$\Delta PE(\vec{d_j}) = \vec{d_j} \cdot \overrightarrow{\Delta B} - \vec{s_j} \cdot \vec{c} \qquad (6)$$

Customer effect: Customers perceive a subjective total process experience [28] that depends on which sub-processes are executed by the customers themselves and thus differs for each integration variant $\vec{d_j}$. More precisely, the conformity of SSTs to the key drivers of customer acceptance (such as perceived usefulness, perceived ease of use, reliability and fun [26]), influences the customers' experience regarding the whole process. Personal support is thereby a significant determinant influencing the perceived ease of use and perceived usefulness. It not only provides direct response, assurance, sense of control and social interaction for customers who do not feel comfortable with the SST [28] but also for customers who feel comfortable but are not able to use the SST alone because of missing knowledge and experience [27]. Creating superior experience for the customers is of importance, as it results in higher customer satisfaction which in turn may lead to an increase in customer-specific sales and recommendation rates [44] and hence generates higher expected customer cash flows. Contrary, if customers are dissatisfied or scared of to the SST and the provided support does not succeed in compensating the inconveniences on customers' side, negative customer experience could also decrease the expected cash flows. The resulting changes in customer-related cash flows are reflected in the corresponding change in customer equity which is defined as the sum of the discounted cash flows of all customer relationships [45] and represents the amount these customer relationships contribute to corporate value. Hence, customer support affects $\Delta CE(\vec{d_j})$.

Considering customer support in the economic decision model to determine the optimal integration variant $\overrightarrow{d_j}^*$, which indicates in which sub-processes p_i customers of a certain target group should be integrated via self-service from an economic point of view, can be expressed on the basis of the above defined assumptions and terms as follows:

$$\Delta NPV(\vec{d_j}) = -(V_j^{total} + \vec{d_j} \cdot \vec{V} + \vec{d_j} \cdot \vec{g}) + \vec{d_j} \cdot \overrightarrow{\Delta B} - \vec{s_j} \cdot \vec{c} + \Delta CE(\vec{d_j}) \qquad (7)$$

with
$$\vec{d_j}^* = arg \max_j NPV(\vec{d_j}) \qquad (8)$$

maximizing the net present value of the whole business process.

As described in D2 a maximum of 2^n integration variants $\vec{d_j}$ are possible for each business process. For the determination of the optimal integration variant $\vec{d_j}^*$, it is possible to use combinatorial methods or a full enumeration of all realizable integration variants $\vec{d_j}$. To simplify this approach it can be helpful to eliminate integration variants which are not feasible, as some sub-processes should not be handed over to the customers.

4 Case Study

4.1 Case Setting and Unit of Analysis

To test our model practically we conducted a case study with the fictional setting of a global travel solutions provider for business customers. The company develops customized travel management solutions along the entire travel booking value chain – from flight and hotel procurement to processing bookings and innovative payment solutions. The core process of the company is the booking of business travels. Figure 1 illustrates the sub-processes of this booking process.

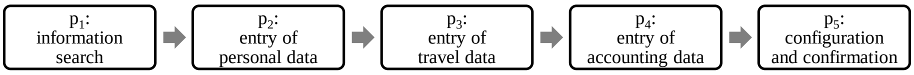

Fig. 1. Booking Process

To date, customers are not integrated in the booking process but generally they could take over the responsibility for certain sub-processes of the whole booking process. Thereby some sub-processes such as providing personal data are straight forward but others such as the correct accounting data require expertise (either by the customers themselves or by employees). Hence the success of SSTs and the economic value of the customers' integration cannot directly be predicted but needs to be analyzed in detail. Basically, customer integration via SSTs is possible in p_1, p_2, p_3, p_4. The sub-process p_5 is the core service delivery of the regarded company and requires internal information and authorizations (e.g. special price conditions). Because of its strategic relevance, the company decides not to integrate any customer in sub-process p_5. Therefore, there are $2^4 = 16$ possible integration variants $\vec{d}_j$ to be investigated.

Genuine values for the theoretically developed model parameters were acquired via a case study and experienced estimation. First, a case study with 34 test users has been conducted in order to determine input parameters such as initial knowledge about sub-process p_i before the first process execution $k_{i,0}$, sub-process specific upper bound of the maximum of knowledge about the sub-process p_i customers may have k_i^{max}, sub-process specific growth factor b_i and technology affinity a. Thereby, the participants had to complete surveys with questions about their person, their technology affinity, and their experience. Additionally, they executed the whole process on their own (with the option to ask for personal support at any time). On the basis of the estimations of subject matter experts, the company specific cash-flow components were determined. For confidentiality reasons, the data were slightly modified, but without compromising the basic results.

4.2 Determining the Model Parameters

As presented in chapter 3, the core parameters of the model are the present value of the investment outflows for establishing customer integration via SSTs $I(\vec{d}_j)$ (*investment effect*), the changes in cash flows in process operations $\Delta PE(\vec{d}_j)$ (*process effect*) as well as the indirect economic effects on customer behavior $\Delta CE(\vec{d_j})$ (*customer effect*). These parameters were operationalized and determined for each integration variant $\vec{d_j}$ as described in the following. For the calculations, we assume an imputed interest rate of 2% p. a. and a calculation period of five years.

Investment effect: As the interviews revealed, integrating customers in the sub-processes $p_1, \dots, p_4$ requires no self-service terminals, but new software functionalities for the search steps and the various data entries. The experts' estimation provided the following data: Designing new software or extending existing tools results in immediately effective expenses of € 300,000. Project management to establish customers' integration can be assumed (comparing to empirical values from previous projects) to be 200 in-house person-days (200 * € 500 = € 100,000). Additionally, expenses for training of employees have to be considered when at least one sub-process is performed by the customers. Regularly, seven employees perform the regarded process but taking replacements (e.g. due to vacations) into account ten employees should possess the knowledge required and hence have to be trained. For the necessary training of three days, one training day was calculated with an average in-house per diem of € 500. So, the estimated training costs amount to € 15,000. Furthermore, initial intensive customer support (go-live support e. g. for initial explanation of what customers should do or where they can find information) causes one-time additional expenses for each sub-process. These are for the customer integration in e.g. sub-process p_3 € 50,000.

Process effect: Regarding the process operations, self-services result on the one hand in savings due to the change of personnel payments and reduced printing costs. On the other hand, expenses for IT systems and customer support occur. In detail, according to the estimations, the savings in personnel costs result from a decrease in working hours per process execution and the present value of the hourly wage rates of the staff working in the corresponding sub-process. For the customer integration in e. g. sub-process p_3 these potential savings are € 1,277,165. The savings of printing costs (forms of two pages for p_2, p_3 and p_4) are caused by the removal of the required forms as physical hard copies. Assuming 500,000 bookings of business travels a year and € 0.03 printing costs per page, the potential savings for e. g. sub-process p_3 are € 30,000 p.a. ($500{,}000 * 2 * € 0.03$). The additional costs for IT occur because the regarded company needs further computing capacity and storage volume which result in expenses of € 24,000 p.a. Furthermore, expenses for customer support arise for each sub-process with customer integration. Customer support $\vec{s_j}$ is calculated according to the terms (3)-(5). The necessary model parameters (sub-process specific initial knowledge $k_{i,0}$, growth factor b_i, upper bound for the customers' knowledge k_i^{max} and technology affinity a) were derived from the customer surveys. From the captured data, the expenses for customer support for e.g. sub-process p_3 amount to € 203,848.

Customer effect: As achieving customer satisfaction is one of the central business policy goals, the operationalization of the customer effect of customer integration uses customer satisfaction as a metric. Personal contact between the customers and the employees is a significant determinant influencing the perceived ease of use and perceived usefulness and can hence increase customer satisfaction. In the context of the case study, this was captured via customer surveys using differentiation based on a five-step Likert scale (1 = very satisfied; 5 = very dissatisfied). One result, for example, was that an integration in sub-processes p_1, p_2, p_3 improved customer satisfaction from 3.2 (status quo) to 2.9. In order to achieve a corresponding change in customer satisfaction in another way, experiential values indicated that it would be necessary to make alternative marketing investments of approximately € 180,000 p.a.

4.3 Results and Discussion

On the basis of the identified parameters, the optimal integration variant $\vec{d_j}^{\,*}$ can be determined corresponding to terms (7) and (8). The optimal integration variant maximizes the NPV of all cash flow changes attributable to customer integration via SSTs in the analysis period. Table 2 shows the 16 possible integration variants for the booking process with their respective change to the net present value $\Delta NPV(\vec{d_j})$.

Table 2. Possible Integration Variants $\vec{d_j}$ and Changes in Net Present Value $\Delta NPV(\vec{d_j})$ (in €)

Integration variant $\vec{d_j}$ (customer integration in dark grey)		$-\mathbf{I}(\vec{d_j})$	$\Delta\mathbf{PE}(\vec{d_j})$	$\Delta\mathbf{CE}(\vec{d_j})$	$\Delta\mathbf{NPV}(\vec{d_j})$
$\vec{d_1}$	p_1 → p_2 → p_3 → p_4 → p_5	0	0	0	0
$\vec{d_2}$	**p_1** → p_2 → p_3 → p_4 → p_5	-165,000	2,954,305	188,538	2,977,844
$\vec{d_3}$	p_1 → **p_2** → p_3 → p_4 → p_5	-465,000	6,706,678	471,346	6,713,024
$\vec{d_4}$	p_1 → p_2 → **p_3** → p_4 → p_5	-465,000	5,087,316	282,808	4,905,124
$\vec{d_5}$	p_1 → p_2 → p_3 → **p_4** → p_5	-465,000	-1,084,056	-235,673	-1,784,729
$\vec{d_6}$	**p_1** → **p_2** → p_3 → p_4 → p_5	-475,000	9,774,107	593,896	9,893,003
$\vec{d_7}$	**p_1** → p_2 → **p_3** → p_4 → p_5	-475,000	8,154,744	424,211	8,103,956
$\vec{d_8}$	**p_1** → p_2 → p_3 → **p_4** → p_5	-475,000	1,983,372	-164,971	1,343,401
$\vec{d_9}$	p_1 → **p_2** → **p_3** → p_4 → p_5	-475,000	11,907,118	678,738	12,110,856
$\vec{d_{10}}$	p_1 → **p_2** → p_3 → **p_4** → p_5	-475,000	5,735,746	117,836	5,378,582
$\vec{d_{11}}$	p_1 → p_2 → **p_3** → **p_4** → p_5	-475,000	4,116,383	-70,702	3,570,682
$\vec{d_{12}}$	**p_1** → **p_2** → **p_3** → p_4 → p_5	-485,000	14,974,546	848,423	15,337,969
$\vec{d_{13}}$	**p_1** → p_2 → **p_3** → **p_4** → p_5	-485,000	7,183,812	70,702	6,769,514
$\vec{d_{14}}$	**p_1** → **p_2** → p_3 → **p_4** → p_5	-485,000	8,803,174	240,386	8,558,560
$\vec{d_{15}}$	p_1 → **p_2** → **p_3** → **p_4** → p_5	-485,000	10,936,185	325,229	10,776,413
$\vec{d_{16}}$	**p_1** → **p_2** → **p_3** → **p_4** → p_5	-495,000	14,003,613	494,913	14,003,526

It becomes clear that integration variant $\vec{d}_{12}$, which yields a NPV increase of approximately € 15.34 million, is the optimal variant. Accordingly, the considered company should integrate its customers via SSTs in the sub-processes p_1 (information search), p_2 (entry of personal data) and p_3 (entry of travel data). Only the fourth sub-process "entry of accounting data" should be performed by the accounting assistants as knowledge is required, which the customers usually do not have. Analyzing the sensitivity of the model with respect to the estimated parameters influencing the determination of the support, we find that estimation errors do not change the optimal solution.

In contrast to that, the model of [8], which does not explicitly determine the corresponding customer support, would generate the following results: Integration variant $\vec{d}_{16}$ is the optimal solution and yields a NPV of € 19.18 million. Thereby, the present value of investment outflows $I^{model\ of\ [8]}(\vec{d}_{16})$ amounts to 415,000 and is lower than $I(\vec{d}_{12})$ as no go-live support is provided. The changes in cash flows for process operations $\Delta PE^{model\ of\ [8]}(\vec{d}_{16})$ are 19,458,555 and so considerable higher then $\Delta PE(\vec{d}_{12})$ as no additional expenses for customer support are regarded. Finally, the indirect economic effects on customer behavior $\Delta CE^{model\ of\ [8]}(\vec{d}_{16})$ are 141,404 and thereby smaller then $\Delta CE(\vec{d}_{12})$. According to the integration variant $\vec{d}_{16}$ the customers should additionally be integrated in the fourth sub-process. As mentioned above, performing this sub-process requires expertise and advanced knowledge on customers' side which can vary depending on the target customer group. If the customers do not possess this knowledge and do not get any support, they may avoid using the SST or be dissatisfied. Hence, the customers' ability and need for support also has to be considered in the decision model. Otherwise further expenses (e.g. costs for additional support or losings through customer churn), which were not taken into account by [8] and which affect the calculated NPV negatively, will arise. Thus, not considering the target customer group and their need for support leads to false estimations of the related cash flows and thereby to another optimal solution.

This case illustrates that the economic decision model can be successfully applied in practice and that the parameters can be operationalized and determined. Nevertheless, it should be noted that the application of the model and, above all, the determination of the parameters can involve very substantial efforts and hence cause significant expenses. There are also some aspects of the case study that warrant critical discussion. For example, the analysis of the surveys revealed that the regarded customers have a comparatively favorable attitude towards technologies. This could be explained by the age group of the respondents (mainly 25 to 40 years) but does certainly not represent society. Hence, companies first have to investigate their customers' attitude towards technology and then they have to decide how they can deal with less technology-affine customers and how to motive them to use self-services. All the same, the main scientific contribution is the proposed quantitative economic decision model. This model allows for economically well-founded decisions when deciding on the implementation of SSTs by focusing on both the process perspective and the customer perspective; thus addressing the central dimensions of the impact of SSTs.

5 Conclusion

Current trends such as the emerging digitalization and the new self-understanding of the customers lead to an increasing use of self-services and enable customers to take part in the service delivery independent of direct involvement of an organization's employee [4]. The challenge for companies to introduce SSTs successfully is to understand the effects of SSTs on customers. If customers do not feel comfortable with SSTs or have too little knowledge about how to use it, companies can facilitate the use of SSTs by offering customer support. For many companies the economic effects of SSTs and offering support are still unclear, and so decisions made without the necessary economic grounding. Therefore, this paper has presented a quantitative economic decision model that enables to evaluate the economic effects of self-services, while considering customer support. The model shows in which sub-processes customers should be integrated including additionally the expenses for the necessary customer support of each sub-process. In addition to that, we presented a possibility to calculate the customer support. Hence, our research complements prior research in the field of SSTs that considered only singular effects such as productivity and efficiency [46] or customer satisfaction [47], [48] as the predominant factors when deciding on customer self-service. The applicability of the model and its practical benefit have been illustrated by the example of a global travel solutions provider. Although this model pictures reality in a constrained way, it provides a basis for organizations to plan and improve their introduction and management of SSTs. Thereby, it is not only of high relevance to business practice, but also provides a theoretical approach to improve the quality of self-services for organizations and customers. We hope that our paper will stimulate further research on that fascinating topic and will serve as a proper starting point for future works.

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