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# Facilitating Operational Control of Business Services: A Method for Analysing and Structuring Customer Integration

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## Abstract

*The efficient delivery of services is a major task for service companies to survive in competition. But, services are characterised by the integration of customers in the process of service delivery. In this context, operational control of business services is an important issue as business service performance often suffers from operational problems caused by customers involved. In order to react, a service company has to identify the possible options for operational control clearly. This is not easy as the impact of customer integration is ambiguous. To facilitate this, a method for analysing and structuring customer integration in business services is proposed. The aim is to cluster, quantify and qualify customer integration in business services from a production point of view. Applying this method (as demonstrated using a real business service) operational control will be facilitated due to a better transparency of customer integration.*

**Keywords**

Service, Performance Management, Operational Control, Process Mining

## INTRODUCTION

Services have gained enormous impact on the revenues of companies. Competition is increasing in many markets as customers become more and more demanding. As a result, the efficiency of service delivery is a main success factor for service companies (Grönroos 2007). The service delivery of a company is often structured in business services, i.e. bundles of business processes delivering a certain service. These are offered to other business services within a company, to other companies or end-customers (Kohlborn et al. 2009b). A main factor for the efficiency of a business service besides costs and quality is cycle time (which is determining the former ones). Usually, a certain time limit for the cycle time of a service delivery exists. The time frame is either based on a fixed contract (also known as Service Level Agreement, SLA) or a promise to the customer if not included in the contract. In both cases, it can be expensive for a company if cycle times are too high, i.e. time limits are exceeded. In the first case, usually fines have to be paid. In the latter, customers are upset and will most likely choose another service company.

When it comes to the management of business services, companies have several tasks during the lifecycle of business services (Kohlborn et al. 2009b). A company can put much effort in the design, set-up and environment of a business service. But the decisive task is the business service operation, i.e. the actual running of a business service. If this is not done efficiently a company will hardly earn money. But the control of the efficiency of a service cannot be influenced by a company solely. A decisive factor is the customer who is integrated in the service delivery (Sampson and Froehle 2006). Unfortunately, customer integration often leads to operational problems; unexpected or sudden deviations from the service delivery plan (e.g. missing customer information in a document) often reducing process performance (Heckl and Moormann 2010). In order to correct this, a company has to take action in the short-term. However, operational control of business services is not easy due to cause-and-effect relationships between customers, processes and resources (Cilliers and Simon 2005). Here, service companies are especially struggling with the identification of the impact of customer integration (Heckl and Moormann 2009).

Within this context two questions are of interest: (1) How can the impact of customer integration on service delivery leading to operational problems be made transparent and (2) how does customer integration influences operational control. To answer these questions, the objective of this paper is the development of a method to analyse and structure the influence of customers on the basic options for operational control of business services. The result of applying the method will be more information about customer integration which can be used as input for conducting operational control in business services. The development of the proposed method is based on a design science approach following the ideas of Venable (2006) and Hevner et al. (2004). According to the

framework, design research is conducted providing the structure for the organisation of the paper: (1) Theory building delivers a utility theory which specifies how the proposed solution technology helps to solve the identified research question. This will be done using the basics of operational control for business services with customer integration. (2) Based on theory building, the solution technology has to be developed. Therefore, the proposed method (solution technology) is presented based on shortcomings of existing approaches. (3) The evaluation of the solution technology can be conducted in a naturalistic way (e.g. case studies) or artificial way (e.g. computer simulations). For the evaluation of the applicability of the proposed method a case study delivering the necessary detailed data of an existing business service is most suitable (Yin 2003). (4) The results of the evaluation should be used to enhance the derived utility theory and the solution technology. Thus, shortcomings and limitations will be discussed. Finally, the paper will conclude with an outlook of how the results of the method can be used further on and provide directions for further research.

## OPERATIONAL CONTROL OF BUSINESS SERVICES

### Business services from a production point of view

A business service is characterised by a set of connected business processes necessary for delivering a defined service. Every single outcome is described by an instance incorporating the information about the required activities per output (Davenport and Short 1990). Within a business service, customers, employees, machines and IT systems are transferring inputs into outputs. These resources are connected resulting in a net of business processes within a business service (Wernerfelt 1984). A business service can have several starting and ending points as well as several connections between the business processes. Process instances entering the service at a specific starting point will have a specific way through the net (including back loops) and leave the net at a certain ending point. Figure 1 shows a generic view of a business service from a production point of view, i.e. the actual delivery of services.

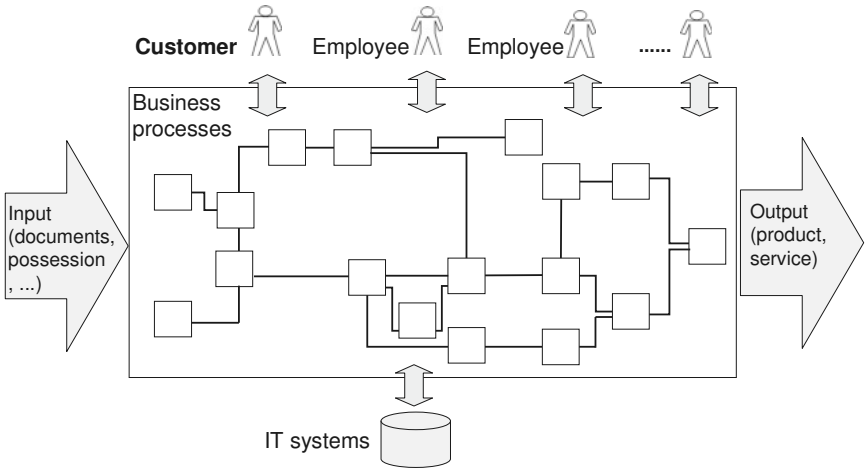


Figure 1: Generic view of a business service from a production point of view

A major characteristic of business services is the integration of customers in the service delivery (Zeithaml et al. 1985; Sampson and Froehle 2006). This means that customers are a resource necessary to provide input like information or possessions during the actual delivery of a service to perform the business service. Furthermore, a business service can not be performed until a customer demand occurs. Without a customer order a business service can not be performed in advance and also not stored if a customer input is not existent (Sampson 2010).

But customer integration does not take place in the sense of a collaborative process. Throughout a service process, it is clearly defined where a customer can be integrated and what the possible actions of this integration are. Therefore, the interaction between customers and employees is clearly defined. Certainly, there are few business services without customer integration e.g. transactional services like money transfer. But these are not in the focus of this paper.

### Characteristics of customer integration

Having the basic idea of customer integration in the delivery of business services in mind, one should have a closer look on the consequences for service companies. Usually customer orders from different customers within a business service differ from each other (Davies 1994; van Helsdingen et al. 1999):

- Customer orders have different ways through the business service, i.e. different processes are performed,
- Customer orders will enter the service at different points in time and

- Customer orders have different degrees of customer integration.

As a result of this heterogeneity, the time necessary to process customer orders differs. But this can be planned to a certain extent only. In contrast to other resources like employees and IT, customers are not under control of a company. The result will be operational problems.

Additionally, often employees work in several processes of the business service or even in different business services (Davies 1994). This causes problems in terms of availability of certain employees when they are needed to perform an activity. Consequently, the processing of one customer order within a business service can not be seen independently, i.e. if the processing of one customer order is changed this effects the processing of other customer orders in a business service or even other business services.

**Basic options of operational control**

In case of operational problems as described before, the responsible manager of a business service has to take corrective actions in the short-term. Within operational control the routing of customer orders within a business service is continuously observed (Gregory et al. 2005). In case of a deviation from defined goals actions to influence the process routing immediately are executed (Kawalek and Kueng 1997). Starting point for the basic options of operational control are the general characteristics of every customer order: (1) Order receipt, (2) sequence of orders, (3) sequence of processes and (4) completion of order. These characteristics define how and when a customer order will be processed (Adam 1998). Within operational control a company can influence the general characteristics as follows:

- The specification of the planned values for all four general characteristics will be done once an order is received from a customer within *scheduling of orders*. Either basic rules or the actual state of order processing in the business service can serve as input for the definition of the planned values.
- Within *order release* (also called *job release*) it is defined, when customer orders are actually released to be worked on. As a result, they wait for processing but do not necessarily have to be worked on. Order release can be done before the service delivery starts and before each activity.
- *Sequencing of orders* influences the prioritisation of a customer order compared to other customer orders. This can also be done before the service delivery starts and before each activity.
- A change of the *sequence of processes* for a customer order is available if it is regardless which process of two or more processes is done first for a customer order.
- Within *dispatching* the actual processing of customer orders can be influenced, i.e. at the time an employee is actually working on customer orders in an activity. The allocation of employees necessary can be conducted continuously for every activity.

The planned values will be defined once before the start of processing a customer order. But these values can be changed continuously during the actual processing e.g. to deal with operational problems.

Operational control of a business service is complex due to multiple connected processes within processing different customer orders that are characterised by operational problems. To enable an effective operational control it has to be clearly defined which possible actions within the basic options are available at which part in a business service. To ensure this, customer integration has to be structured, quantified, qualified and its impact on operational control has to be made transparent.

## RELATED WORK

Quite a lot of research has taken place in recent decades in the area of service operations management. But there is still a lack of methodological grounding. Particularly in the area of operational control of services, only few approaches can be found (Johnston 2005; Smith et al. 2007). Existing approaches considering customer integration for operational control of services focus on:

- *Simulation*: Davies (1994), for example, focuses on paper process flows in offices of financial service companies, i.e. information-processing services. Although customer integration is considered, this is not further specified as the approach aims at developing a simulation model generator on a technical level.
- *Capacity management*: How service companies can plan the capacity needed is analysed by Goodale and Tunc (1998). But their approach is limited to considering customer integration at the beginning of the service delivery only by using customer arrival-rate patterns.
- *Modularisation*: Heckl and Moormann (2009; 2010) present an approach how heterogeneous customer integration should be considered within operational control of service processes. They distinguish between

two major types of information a customer is providing during service delivery: (1) Non-impacting process information which is needed for the service delivery but has no influence on the process flow (e.g. demographic data of the customer). (2) Process-impacting information that determine which processes will be needed for the service delivery due to customer needs (e.g. flying with or without luggage). Based on this, differentiation modules of service processes should be built to isolate customer integration. The strength of the approach is the perspective how the expected usage of different processes for a service delivery can be planned in an early stage of a service delivery. This seems very promising, but customers are still integrated in the service delivery and a differentiation of this heterogeneity to facilitate operational control is missing.

On a technical level, approaches to conduct simulation as an instrument for operational control can be found. Rozinat et al. (2008) describe how design, historic and state information can be gathered using tools from process mining and used for simulation. Process mining is an analytical technique allowing for the extraction of information out of event-logs (van der Aalst et al. 2003). Event-logs (automatic timestamps documenting order processing by employees) are usually generated by workflow management systems which are implemented for business processes. Event-logs deliver a huge amount of historical process data allowing for an extraction of information like the process model, performance indicators (e.g. cycle times) or routings of customer orders.

However, these approaches are very useful according to their focus, but they do not take a detailed analysis and structuring of customer involvement to facilitate operational control into account. Nevertheless, the approach by Heckl and Moormann (2010) delivers a starting point for the proposed method. From a technical point of view, ideas from process mining seem very promising and will be applied throughout the analysis.

## METHOD FOR ANALYSING CO-CREATION IN BUSINESS SERVICES

### Phase 1: Cluster different types of business processes

Business processes incorporated in a business service can be divided into a variety of different heterogeneous service types. Differentiation is based e.g. on constitutive characteristics, like intangibility and customer integration, individualisation and customer interaction or front and back-office processes. The aim of many authors is to provide a general characterisation of services (Sampson and Froehle 2006; Silvestro et al. 1992). Despite these attempts, there is no common agreement on what constitutes services until now.

But the question is whether this is necessary. Essential for a characterisation and classification of services is the chosen perspective. As this method is focussing on operational control of business services, the process of delivering services is of interest. According to this perspective, one can distinguish three basic types of services (Lovelock and Yip 1996). Information, possessions and people are included in almost every service delivery. Nevertheless, the focus of the differentiation is on the main subject or object on which the service is performed. Each type is characterised by different restrictions with respect to the service delivery process (Table 1). Information-processing services, for instance, are not dependent on a local geographic availability. In contrast to physical objects or people, information can be duplicated, and thus, processed in parallel.

Table 1. Characteristics of service types from a production point of view (Lovelock and Yip 1996)

| | Possession-processing | People-processing | Information-processing |
|---|---|---|---|
| Description | Tangible actions to physical objects and transport of objects (e.g. car repairs) | Tangible actions to people and transport of people (e.g. haircuts, flights) | Collection, production and transfer of information (e.g. granting of a loan) |
| Local geographic dependency on physical objects | Yes | Yes | No |
| Local geographic dependency on customers | Low | High | Low to medium |
| Degree of customer integration | Medium | High | Low to medium |

The intention of the differentiation between the three different types is not to give an exhaustive classification of all possible types of services. Each of the three service types contains a variety of heterogeneous processes. In fact, the service types are the first step in dividing different types of processes which should be considered because they influence the options in managing business services. Figure 3 gives a generic example of clustering different service types in a business service. This could be e.g. the business service “Flying” in which the booking takes place first (information), followed by check-in and transport of the person (people) or his/her

luggage (possession-processing) and the administrative tasks necessary e.g. airport contact or trouble shooting (information-processing).

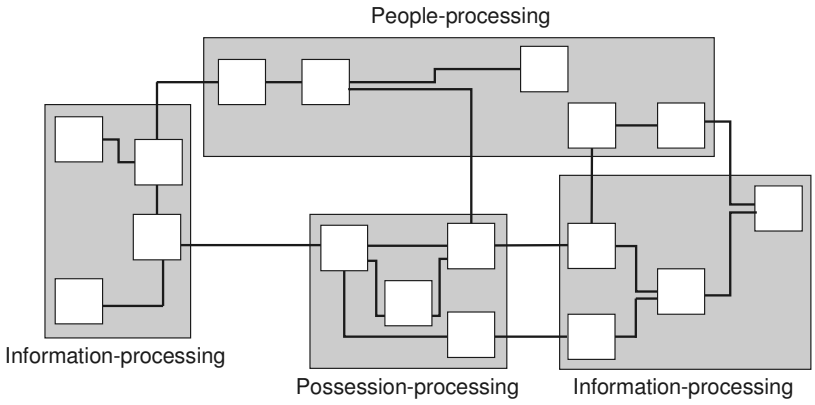


Figure 2: Clustering different service types in a business service

**Phase 2: Specify customer integration**

In this phase, the characteristics of customer integration for each cluster have to be analysed further on. The aim is to quantify customer integration to measure the effect on the performance of the business service and to qualify customer integration in order to determine possible restrictions for operational control. To conduct the quantitative analysis, a significant amount of historic processing data should be gathered and analysed using techniques of process mining (van der Aalst et al. 2003). Using this data, it has to be analysed

- which processes have a connection to the customer,
- which types of employees are involved,
- how often is customer integration happening and
- what is the impact on the average cycle time.

Based on this data, only customer integration that has an impact on the business service performance should be analysed further on. The aim is to find distributions that explain the time delays, and thus, make customer integration more predictable i.e. better to control. By applying the commonly used Kolmogorov-Smirnov-test of goodness of fit it can be tested for normal, equal, Poisson and exponential distributions.

For the qualitative analysis the relevant customer integration has to be specified in terms of

- *Type of customer involved*: If customers are within the same company, the manager of a business service will have better possibilities to influence the occurrence of operational problems. Nevertheless, indirect integration of end customers should be considered.
- *Storability of results*: In the event of an operational problem, the question is whether the previously achieved results achieved can be stored until the processing of a customer order continues. If this is the case, processing can proceed straightforward and time consuming back loops can be avoided.
- *Contextual factors*: Here the question is if there are specific external factors that determine operational problems and the length of time until the processing can continue. Based on this, typical scenarios can be derived allowing for a better estimation of operational problems. A scenario is an external setting for a certain time period characterised by the same influencing factors. This could be e.g. the summer holiday period or a certain type of customer.

**Phase 3: Identify the restrictions for operational control**

The purpose of this phase is to summarise the previous results and to draw conclusions in terms of restrictions for operational control. Here, availability of employees should also be considered. The applicability of the basic options for operational control and the influencing factors should be evaluated for each activity if necessary. Therefore, the quantitative results of phase 2 can be used. Requests for customer activity can be linked to sequencing of orders as they restrict the possibilities of sequencing if orders can not be worked on. A further analysis using techniques of process mining has to be conducted for order release. Order release is restricted if an order is waiting for a necessary input of a customer. Thus, it should be analysed in which business process the work on an order is continued after customer integration.

# CASE STUDY: BUSINESS SERVICE "PROCESSING OF COMMERCIAL LOANS"

## Basic information

Lending is a core service of banks usually characterised by two major types of business services. Due to legal restrictions, the "selling of loans" is strictly separated from the "processing of loans". This leads to a differentiation in front- and back-office, whereas back-office business services often have no contact to the end customer (Chase and Bowen 1991). Nevertheless, the customer is integrated in the processing by providing personal information, documents and signatures, which often lead to back loops in the service delivery.

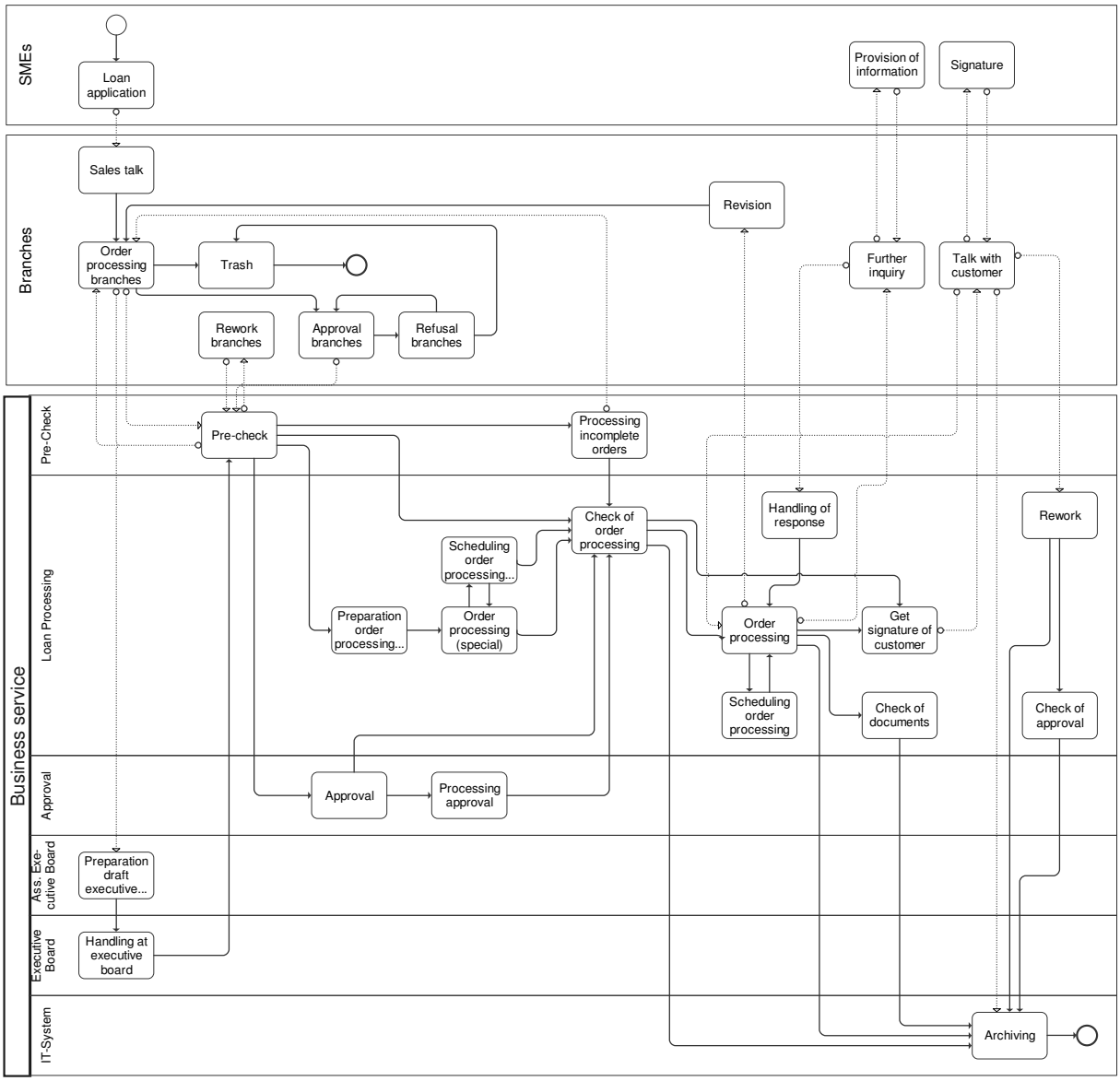


Figure 3: Business service "Processing of commercial loans"

The case presented is a real life business service from a mid-sized bank. The business service offers the processing of commercial loans for small and middle sized companies without any collateral needed. Customers of the business service are 22 branches of the bank selling the loans to those companies. If information or documents from the end customer are needed the contact takes place via the branches as intermediary.

Data from the underlying workflow management system was gathered for half a year. Within this time period 265 customer orders were processed by the business service. To ensure an independent and valid procedure the log was split in two halves. The first one was used to mine and generate the model of the business service inductively. The second half was used to check whether the model of the business service was conformant with the data. The result of a conformance check showed a conformance of 93 per cent, which can be seen as sufficient for a representative model of the business service. The model of the business service derived from the event-logs gathered (and additionally validated with the process owner of the bank) is depicted in Figure 3.

If an end customer applies for a loan the employees working in the branches prepare the loan application to be forwarded to the business service. In the beginning of the processing, customer orders can either start with a pre-check or be approved by the executive board first, if there is an exception. Within the pre-check it is inspected, if the necessary documents and information are complete. The pre-check can lead to several back loops with customers if this is not the case. Otherwise, special processing activities or another approval might be necessary before the main processing of the application starts. During the following processing, some further information from customers, a signature from the end customer (if not done in the very beginning) and some final checks might be necessary until the final archiving of customer orders.

**Phase 1: Cluster different types of business processes**

In the case presented, the whole business service consists of information-processing processes only. Therefore, no further analysis is necessary to cluster the different types. Within the business service, the customer integration can be categorised as medium, as there are several in- and outgoing connections. Concerning local geographic dependency on customers, there is no evidence as customers do not need to be locally present.

**Phase 2: Specify customer integration**

The average cycle time for customer orders of the business service is almost 18 days incorporating an average working time in processes of 187 minutes only. There is a huge discrepancy between the time a customer order is finished and the working time needed. Having a closer look on the customer integration, it is revealed that there are fourteen in- and outgoing connections to the customers of the business service. These connections occur at different parts throughout the business service. Nevertheless, customer integration can be attributed to four processes and two types of employees directly involved. During the analysis it occurred that the process "Get signature of customer" has 100 per cent customer integration. Thus, this process is following a request for customer information of the previous process "Order processing".

The results of the analysis are presented in Table 2. For each customer involvement in the business service the originating process and the related employee are documented. Each type of customer involvement is specified and tagged with a number for clear identification which is also used in Table 3. Furthermore the number of occurrence is quantified and its impact on cycle time provided in hours as well as in days. In the last column the result of the Kolmogorov-Smirnov-test of goodness of fit for each customer integration is shown.

Table 2. Influence of customer integration in the business service

| Originating process in business service | Type of employee | Type of customer involvement | Number of Occurence | Time lag (Hours/Days) | Distribution |
|---|---|---|---|---|---|
| Pre-Check | Pre-Check | Rework branches [1] | 21 | 39/1.6 | Normal (Exponential) |
| Pre-Check | Pre-Check | Order processing branches [2] | 68 | 107/4.5 | Exponential |
| Processing incomplete orders | Pre-Check | Order processing branches [3] | 15 | 234/9.7 | Exponential (Normal) |
| Order processing | Loan processing | Revision [4] | 2 | 39/1.6 | - |
| Order processing | Loan processing | Further inquiry [5] | 1 | 0,2/n.a. | - |
| Order processing | Loan processing | Talk with Customer/ Signature [6] | 101 | 223/9.3 | No significance |

As a result of the analysis the customer involvement of activity "processing" can be neglected. The other types of customer involvement seem to have a major impact on the discrepancy between the cycle time of the service delivery and the processing time. For those, possible distributions are analysed using the Kolmogorov-Smirnov-test of goodness of fit and the results are summarised in the last column of Table 2 (in case of brackets the asymptotic significance of the second result is weaker). Except for "Talk with customer/Signature" the customer involvement can be described by common distributions.

Concerning the relevant types of customer integration the results of the qualitative analysis are as follows:

- *Type of customer involved*: The customers integrated in the business services are always the employees of the banks' branches. Nevertheless, it has to be considered that "Talk with customer/Signature" is dependent on the input of end customers.
- *Storability of results*: If there is a disruption in the processing of a customer order the previous results can be stored at anytime except for the pre-check. If a customer order is looped back due to operational problems in the pre-check, the pre-check has to be conducted again from the beginning.
- *Contextual factors*: As the bank is not documenting any contextual factors, this can not be evaluated.

**Phase 3: Identify the restrictions for operational control**

Using the results the restrictions for operational control of the business service can now be identified. *Scheduling* as well as *order release* (before processing starts) can be improved by estimating the expected delays due to customer integration. This estimation is restricted as there was no evidence for typical patterns of arrival times of customer orders within the data. Furthermore, *sequencing of processes* can not be used in the business service at all as it is not possible to conduct other processes while waiting for customers or change the sequence otherwise. *Dispatching* is influenced in general by operational problems and if employees are not available due to working in other business services. This is the case for every activity except for employees of "Pre-Check" and "Loan processing", but it is not specified further on due to missing data.

*Order release* is restricted if an activity has to wait for a customer order while the *sequencing of orders* is restricted by operational problems that occur. Therefore, a detailed observation for each process in the business service should be conducted. Using the data it has been analysed using techniques of process mining in which business process the work is continued after integrating customers. Customer involvement [6] has been split up ([6.1], [6.2] and [6.3]) as there are three processes in which work in the business service is continued (Table 3).

Table 3. Restrictions for operational control per activity due to customer integration

| Business process in business service | Order release | Sequencing (Orders) |
|---|---|---|
| Pre-Check | Arrival of customer orders (356 total but unspecified) + [1] - [4] | 25 % operational problems ([1] + [2] / 356 total usage) |
| Processing incomplete orders | None | 23,8 % operational problems ([3] / 63 total usage) |
| Preparation draft executive board | Arrival of customer orders (10 total but unspecified) | None |
| Handling at executive board | None | None |
| Approval | None | None |
| Processing approval | None | None |
| Preparation order processing (special) | None | None |
| Order processing (special) | None | None |
| Scheduling order processing (special) | None | None |
| Check of order processing | None | None |
| Order processing | [6.1] | 45 % operational problems ([4] - [6] / 231 total usage) |
| Handling of response | [5] | None |
| Scheduling order processing | None | None |
| Get signature of customer | None | None |
| Rework | [6.2] | None |
| Check of documents | None | None |
| Check of approval | None | None |
| Archiving | [6.3] | None |

The results show that the majority of the activities are not influenced by customer integration. Thus, order release and sequencing of orders can be conducted without restrictions for these processes. For the other ones customer integration has a considerable impact on order processing and thus the options to control the business service. As a result from the analysis, the influences of customer integration for the basic options of operational control are now transparent and their impact should be considered when controlling the business service.

## LIMITATIONS

The proposed method still lacks some clarification in terms of analysing the influence of contextual factors and the availability of resources. As it has been revealed, waiting times are not only caused by customers but also by employees. But, availability of employees is hard to identify as this is often not documented due to legal restrictions. These do not allow for a measurement per person but on the level of types of employees. Nevertheless, a further analysis should include an estimation of the average absence of employees (incl. other processes) and the average duration of this absence. Following this aspect, the method so far highlights business services incorporating mainly business processes which are performed by employees. Nevertheless, the method can also be applied for business services consisting of automated business processes. The added value for manual performed business processes within a business service is higher, but even highly automated business processes, e.g. the settlement process in banks, incorporate many variations concerning cycle time (Burger and Moormann 2009). Concerning the evaluation it should be marked, that the case study did not really cover the first phase as the business service consists of one service type only. Contextual factors in the second phase, representing a minor part of the analysis, were not considered either.

## OUTLOOK

The results of an analysis using the proposed method deliver more transparency on the impact of customer integration for service delivery. Thus, the identification of possible options within operational control will be more precisely as more information is available. Beyond that, the results of the analysis can be used to build a virtual work environment of the business service in which options for operational control can be simulated. This can be conducted twofold: (1) Within operational control, the consequences of applying options are not always clear due to the discussed cause-and-effect-relationships between business services, processes and resources. Thus a discrete-event simulation of possible options in the short-term is recommended (Rozinat et al. 2009). (2) If the result of the analysis reveals a too heterogeneous structure of processes within a business service, the complexity of the existing business service will be too high to allow for a satisfying operational control. In this case, a company should consider a redesign of the business service. Here, the proposed method delivers the starting points for potential improvements. The effects of different options for redesign should be simulated taking into account the relationships between business services within a company (Kohlborn et al. 2009a).

Further research will concentrate on studying possibilities for improvements in operational control of business services based on the analysis of the proposed method. The aim is to find basic strategies how to deal with customer involvement, i.e. which options for operational control are most suitable in different scenarios.

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