

# Outsourcing of Disaggregated Services in Cloud-Based Enterprise Information Systems

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## Abstract

*In this paper, we examine outsourcing of disaggregated information-intensive services. Drawing on the theoretical streams of Global Information-Intensive Service Disaggregation and Transaction-Cost Economics, we formulate our research model to understand the phenomenon of disaggregation in the context of cloud computing. The model encompasses frequency, asset specificity, uncertainty, information intensity, and need for customer contact as characteristics of tasks that we use to explain the outsourcing of disaggregated services. We are especially interested in understanding the interplay between these characteristics and the increasingly popular cloud-based systems. Our results partially support previous research on the effects of characteristics on outsourcing. The main finding of the paper is impact of the cloud-based information systems on the interaction of these characteristics.*

## 1. Introduction

In this paper, we examine the decision to outsource disaggregated information-intensive services. Specifically, we explore how different characteristics of service tasks affect the decision to outsource and how cloud-based systems impact this interaction.

Motivated by the rapid move to cloud-based computing especially in the small and medium enterprise (SME) market for enterprise information systems, our objective is to explore the implications of this move to the outsourcing decisions made by companies. Another motivation for our study is the trend towards outsourcing of business processes and the increasing focus on core competencies of the company. These trends drive the disaggregation of many services into smaller, component service tasks

that can be handled more efficiently by different parties.

The context of this study is accounting information systems. Accounting information systems are especially interesting cases because these systems allow for efficient disaggregation of accounting services, and because they are frequently outsourced in practice. Moreover, in many instances, these systems are currently being transferred to the cloud, and we do not yet have a good understanding of the drivers of this transition. Furthermore, accounting services are widely disaggregated and outsourced since they are not considered to be the core activities of the company and since there exist professional service providers focusing on delivering these services to the market at lower costs.

The paper is organized as follows. In the second section, we develop the research framework using the theories of Global Disaggregation of Information-Intensive Service and Transaction-Cost Economics. In the third section, we present the empirical study and report the findings of our survey. In the final section, we draw conclusions and suggest avenues for further research.

## 2. Literature review and development of research framework

We begin our review with an overview of the literature on information technology/systems (IT/IS) and business process outsourcing (BPO). We then build an argument for our initial framework based on the two theories: Global Information-Intensive Service Disaggregation by Apte and Mason [1] and Transaction-Cost Economics by Williamson [2].

## 2.1. IT and business process outsourcing

Outsourcing of IS and related processes has become a popular topic in research as well as practice during the last 25 years. Some authors argue that while outsourcing of IT has occurred since the 1960s, significant attention to the topic, from both academia and the business world, was drawn by Eastman Kodak's 1989 deal, when the big international company outsourced its IS functions, which were considered strategic [3], [4].

Such popularity fostered the development and branching of the subject into different sub-topics. While IS outsourcing traces its roots to wider concepts from other fields such as manufacturing, it has grown into an independent IS research domain with specific definitions and categorizations.

Apte et al. [5] simply define IS outsourcing as "turning over to a vendor some or all of the IS functions." Dibbern et al. [3] review a variety of more detailed categorizations of IS outsourcing that cover different degrees and types of the process, which can be summarized into the two categories of total and selective arrangements.

The particular type of arrangement that is most relevant to our research is BPO, as we are looking at the outsourcing of the tasks belonging to a concrete business function (financial administration). Millar [6], as cited in Dibbern et al. [3], defines BPO as a relationship in which the third party is responsible for the entire business function of the client company. Other authors argue that BPO needs a more concrete definition, one that emphasizes the strong presence of IT in the process, as opposed to bigger processes that also include some IT-enabled task [7]. Mani et al. [8] also make a clear distinction between the outsourcing of predominantly physical processes and BPO, which consists of informational tasks. For our purpose, we define BPO as *the outsourcing of IT-enabled, informational business functions or defined underlying processes*.

From a research perspective, we view BPO as a field closely related to IT outsourcing, which looks at the issue from the point of view of defined IT-enabled tasks. In this view, the BPO research answers the question of how characteristics of the task or the business function affect practices of outsourcing arrangements.

In a recent review of the IT outsourcing literature, Lacity et al. [9] relate BPO research to the category of "sourcing varieties," which asks the following question: "How do practices differ when pursuing different types of outsourcing ... business process outsourcing?" Such categorization largely corresponds to our view of BPO stated previously. On

the other hand, Borman [10] argues that BPO specifically is overshadowed by IT outsourcing, and it deserves more separate attention. In the author's view, BPO research should also ask the questions of *what* (activities to outsource) and *why* (outsource particular activities) [10], which are widely researched in IT outsourcing already [9]. In our view, BPO is an expansion of already existing research on IT outsourcing, in a particular direction. Similarly, Mani et al. [8] see a lot of commonality between IT sourcing and BPO with some important distinctions in the driving forces of outsourcing decisions. IT outsourcing has been primarily driven by cost reduction and concentration on core competences [9], [11]; BPO, on the other hand, has a wider scope of motivation, including business transformation and innovation [8].

Building on our assumptions and discussion from the previous literature on BPO characteristics and research questions, we construct and test a model to characterize outsourced business processes based on their properties. Next we review two relevant theories, which are a foundation of the initial framework.

## 2.2. Cloud computing

Cloud computing has been a growing trend for the past five years in both research and industry. Several attempts to define cloud computing have been made in the literature; however, the field still lacks a firm, widely accepted definition [12], [13]. We assume that one of the main reasons for this is the wide range of aspects covered by the term, as well as the richness of potential research directions that it offers. One of the earliest and most widely cited definitions considers cloud computing as "a new computing paradigm that allows users to temporarily utilize computing infrastructure over the network, supplied as a service by the cloud provider at possibly one or more levels of abstraction" [14]. This definition, while describing the essence, fails to encompass all features of cloud computing. Other authors, such as Marston et al. [13] and Vaquero and Rodero-Merino [15], provide broader definitions covering, among others, issues of initial investment, delivery mode of the service, and service-level agreements (SLA); however, these definitions are context specific and, as a consequence, less generalizable. We provide our criteria for categorizing information systems into cloud and non-cloud categories, in the description of the empirical study. However, the purpose of this paper is not to provide a definition for cloud computing; therefore, we use the general definition mentioned previously.

In terms of outsourcing, cloud computing offers multiple avenues for research. One approach to the cloud is IT infrastructure (both software and hardware)

outsourcing. This covers issues such as Software-, Infrastructure- and Platform-as-a-Service [15], [16]. Our focus in this paper is the role of cloud computing in the outsourcing of business processes. Advances in the Web and cloud-based business services made the outsourcing of non-core functions more attractive to companies [17]. Such shifts in approaches and attitudes towards business processes suggest changes in the interaction between different factors involved in outsourcing decisions.

From the literature, we identified some advantages of the cloud to its users that have a potential to impact IT-enabled business services, their outsourcing and disaggregation potential. First, cloud computing increases availability, in terms of on-demand access to software and hardware, as well as in terms of device location, and platform independence (assuming it has basic infrastructure to access a network) [13], [18], [19]. Second, cloud computing offers flexibility through an easier implementation, scalability of systems, and relationships with service providers [18], [19]. Third, in terms of the integration of applications and data, the cloud allows users to gather all needed functionality and information to perform business tasks within one place, thus impacting the way the process is organized [13], [18]. Yet another advantage of the cloud is the potential for provision of new, additional services that were not possible before [13].

In the next sections we discuss how cloud computing affects the roles of concrete task characteristics in service disaggregation and outsourcing.

### **2.3. Information-intensive service disaggregation**

So far, we have argued that outsourcing informational, IT-enabled business functions is very distinct from the other types of physical or even IT outsourcing in its pure form. Emerging network technologies such as cloud computing provide companies with broader outsourcing options and provide opportunities to rethink underlying processes. In order to build a framework that would encompass the relevant characteristics of such outsourcing process, we take the theory of Global Information-Intensive Service Disaggregation as a basis.

Disaggregation and the similar concept of disintegration include decoupling of supporting services and processes from the core tasks of the organization [20]. The function of financial administration and its sub-processes is an example of such a service with the potential for disaggregation from the core processes.

Companies are motivated to perform service disaggregation in order to gain flexibility, reduce costs, and concentrate on core processes [1], [20–22]. However, the disaggregation potential of different tasks varies, as do the benefits yielded from the process. Apte and Mason [1] propose a taxonomy and a framework to help decision-makers define information-intensive services and activities that are most suitable for successful disaggregation. Some of the propositions from the framework were utilized by Mithas and Whitaker [23], who used a modified framework to predict the service occupations most susceptible to disaggregation. We, in turn, look at the outsourcing patterns of disaggregated services.

Out of the three characteristics of service disaggregation potential proposed in the original framework, we adopt *information intensity* and *need of customer contact*. We omit *need of physical contact* in the context of this study, as according to the definition, the need arises from manipulation of a physical object [1], which is absent in a case of informational services.

*Information intensity* in the context of our research marks the amount of information that needs to be exchanged between the client and the third party managing the function, and the ratio of time needed to process raw information into a workable form. In the literature, information intensity is defined as the “*ratio of time spent in dealing with information in an activity to the total time spent in that activity*” [1]. The original concept of information intensity [24] uses similar measures of information exchange and processing between parties. However, in the concept information intensity is viewed on the level of the whole value chain and information is generated by the activities performed on the product. This problem is addressed in the study on information disaggregation [1], where a clear separation between physical and informational value-adding activities is made.

*Need of customer contact* measures the ratio between time spent with the customer and total time need to create the service [1], [25]. While IT-enabled, informational tasks assume a high degree of automation and a minimum of customer interaction, we argue that in the context of outsourcing arrangements different tasks involve different degree of contact, which in turn has an influence on the final decision.

Based on assumptions of Apte and Mason [1], we developed the following hypotheses about outsourcing of disaggregated services:

**H1a: Tasks with high information intensity within disaggregated services are more likely to be outsourced to a third party.**

**H2a: Tasks with low need of customer contact within disaggregated services are more likely to be outsourced to third party.**

Previous literature suggests a number of key advantages of cloud-based systems. Among them are data and application integration into one cloud service, and device-, location-, and platform-independent availability. Based on these assumptions, we propose the following hypotheses:

**H1b: The use of cloud-based enterprise information systems to perform tasks within disaggregated services reduces the effect of information intensity on outsourcing decisions.**

**H2b: The use of cloud-based enterprise information systems to perform tasks within disaggregated services reduces the effect of need of customer contact on outsourcing decisions.**

## 2.4. Transaction-Cost Economics

The theory of Transaction-Cost Economics (TCE), developed by Williamson [2], [26], highlights the role of transaction costs in the decision process on whether to produce something internally or purchase it on the open market. TCE became one of the fundamental theories used in studies related to IS/IT outsourcing [3], [27]. The theory has been modified and used generously in different contexts of outsourcing. However, reviewing the studies that use the TCE framework, one can find contradicting conclusions on seemingly similar issues. For example, Thouin et al. [28] find empirical support for the original claims of Williamson's theory in the context of IT outsourcing, while Aubert et al. [29] claim a bigger role of uncertainty compared to asset specificity, which is completely opposite to the original TCE theory.

Some authors attempt to explain the discrepancy. Karimi-Alagheband et al. [30] conducted an extensive literature review highlighting the contradictory results of TCE-based studies in the field of IT outsourcing. The authors argue that the main cause lies in unfaithful use of TCE and insufficient coverage of all elements of the theory in modified models, and they call for more extensive use of the framework in the field.

In our view, however, the problem comes from the variety of contexts in which IT/IS outsourcing occurs, and from attempts to fit TCE and its original claims to all situations. As a countermeasure to this, we propose the expansion of the standard measurements of TCE with other dimensions related to disaggregated services, which would fill the missing parts in the puzzle. Similar views are presented by Lacity et al. [27], who argue that researchers in IT outsourcing are demanding more from TCE than it can provide, calling for development of a more comprehensive framework that would meet the demands of current research.

For the purpose of this study, we use all three original measures, *asset specificity*, *frequency*, and *uncertainty*, proposed by Williamson [2], [26], and provide clear assumptions behind them in order to avoid confusion.

*Asset specificity* measures the specificity of the assets utilized to complete particular tasks and the potential of redeploying them to other tasks. Williamson [26] defines three types of specificity, *site*, *physical*, and *human asset*. In the context of our study, when we refer to asset specificity, we assume human (expertise in financial administration) and IT asset specificity, as they are most relevant.

**H3a: Tasks with low asset specificity within disaggregated services are more likely to be outsourced to a third party.**

As cloud computing provides greater accessibility to data, which in turn enables more efficient and transparent collaborative work between different parties, we propose the following hypothesis:

**H3b: The use of cloud-based enterprise information systems to perform tasks within disaggregated services reduces the effect of asset specificity on outsourcing decisions.**

*Frequency* refers to the recurrence of the activity needed for the transaction [30]. In our context, it is the frequency with which defined processes need to be completed. Financial administration covers a wide variety of tasks, some of which are performed on a continuous, daily basis, while others are monthly or annual.

**H4a: Tasks with low frequency within disaggregated services are more likely to be outsourced to a third party.**

The simultaneous and real-time availability of cloud-based services from geographically distributed locations, suggests that concerns that may arise with outsourcing frequently performed tasks could be impacted. Therefore we propose the following hypothesis:

**H4b: The use of cloud-based enterprise information systems to perform tasks within disaggregated services reduces the effect of frequency on outsourcing decisions.**

*Uncertainty* is of two types, behavioral and environmental. Williamson [31] sees uncertainty as a random event that cannot be calculated or anticipated by the company. In this study, uncertainty mainly refers to the inability to predict or lack of confidence of client companies related to the outcome of some processes, such as reporting to authorities.

**H5a: Tasks with low uncertainty are more likely to be outsourced to a third party.**

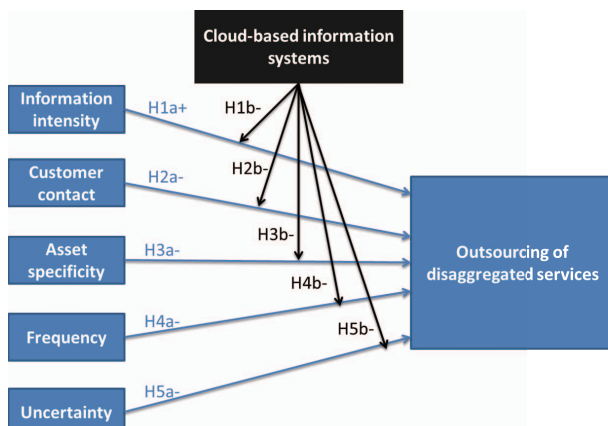
Similar to asset specificity, data integration, accessibility, and the possibility of introducing new services to enhance control over the process provided by cloud computing could impact the decision to outsource in terms of uncertainty. Therefore our hypothesis states the following:

**H5b: The use of cloud-based enterprise information systems to perform tasks within disaggregated services reduces the effect of uncertainty on outsourcing decisions.**

In the next section, we present the framework of the study and place concepts reviewed in this section into a clear context.

## 2.5. Theoretical framework

Based on the theories of Global Information-Intensive Service Disaggregation and Transaction-Cost Economics, we identified five characteristics of the tasks that may have an effect on disaggregation. The tasks together form the service system. We hypothesized that each of the five characteristics affects the decision to disaggregate services and that together the five form a decision-making framework. Figure 1 shows a summary of the framework, while Table 1 provides short descriptions of the five characteristics.



**Figure 1. Theoretical framework**

**Table 1. Characteristics of the tasks**

Characteristics	Description
<i>Information intensity</i>	Amount of information needed in order to successfully perform the task.
<i>Customer contact</i>	Need for contact between a customer and a third party, for successful accomplishment of a task.
<i>Frequency</i>	Frequency with which a task is performed.
<i>Asset specificity</i>	Need for specific human and IT assets to perform the task.
<i>Uncertainty</i>	Inability to predict an outcome of the process and severity of consequences in case of failure.

As the central subject of our research is information-intensive services, we also observe effects of cloud-based information systems on the relationships between characteristics and disaggregation decision. We make an assumption that moving information-intensive services to the cloud has an impact on the decision of outsourcing, by changing the weights of characteristics involved in the process. Key features of the cloud such as universal accessibility to services and data, real-time collaboration with multiple actors, and the ability to check and control the actions of the third party performing outsourced tasks are all connected to the characteristics provided in the framework, in the context of information-intensive services.

We define more precise criteria of cloud-based enterprise systems in the description of the study in the next section.

## 3. Empirical study

We tested the five research hypotheses using survey data from 456 SMEs operating in Finland. We used the definition of SME provided by the European Commission, which states that a SME is a company with no more than 250 employees and annual turnover of less than €50 M [32]. The survey was conducted in collaboration with OP-Pohjola, a large retail bank, and the Confederation of Finnish Industries. The respondents were randomly chosen from the databases of the members/customer companies and represented various industries

In the survey questionnaire, the informants were presented a list of 22 tasks related to financial administration and requested to indicate which of these the company had outsourced. In addition, the respondents were asked to indicate which information systems they used to perform these tasks. The respondents were given the list of the most common

accounting information systems used in Finland as well as a free-text option in order to include systems that were not covered in the list. Information systems were then categorized into cloud-based and non-cloud-based systems, using interviews with industry experts and information publicly available from software producers. Criteria used to define *cloud-based system* were (1) service is delivered on-demand over the network, independent of device and location; (2) resources and functionality are dynamically scalable; (3) no significant upfront investment is required to use the system; (4) full system functionality is available through the network; and (5) the system provides the ability to disaggregate tasks between two or more actors.

We combined the data from the survey with another dataset that we collected using an expert panel, consisting of four top specialists in Finland with a broad experience in working in the financial administration: A board member of the Association of Finnish Accounting Firms, the development director of the Association of Finnish Accounting Firms, and two owners of accounting firms. In this dataset, the experts rated each of the 22 tasks on the five process characteristics, described earlier, on a three-point scale (high, medium, low), used by Apte and Mason [1]. The datasets were combined to obtain a single dataset where the unit of analysis was a decision to outsource a process, and these datasets were further nested in firms. The number of observations was thus  $22 \times 456 = 10,032$ .

We analyzed the data using mixed effects logistic regression using the LME4 package of the R statistical programming environment [33]. The dependent variable received the value 1 if a firm had outsourced the process and 0 if the process was not outsourced. We included the five process characteristics as fixed effects and included a random intercept as a firm-level parameter. In other words, we modeled the decision to outsource as depending on the characteristics of the process but allowed each firm to have a unique, general propensity to outsource any of the processes. Table 2 provides descriptive statistics and correlations of the data.

**Table 2. Descriptive statistics**

	Mean	SD	Correlations					
			Outsourced	Cloud	FREQ	INFINT	CUSCON	ASPEC
Outsourced	0.31	0.46						
Cloud	0.14	0.35	0.06					
FREQ	1.90	0.70	-0.31	0.00				
INFINT	1.50	0.59	0.15	0.00	-0.12			
CUSCON	1.75	0.62	-0.11	0.00	-0.06	0.61		
ASPEC	1.70	0.71	0.18	0.00	0.04	0.59	0.51	
UNCER	2.00	0.77	0.43	0.00	-0.55	0.44	0.21	0.27

We estimated three models by varying the data: In the first model, all firms were included, and in the

second and third models we restricted the data to companies that were not using cloud computing and those that did use these services respectively. We estimated the models with the maximum likelihood estimator with Laplace approximation.

Table 3 shows the estimation results. We started interpreting the results by analyzing whether the process characteristics or firm-level differences were stronger determinants for the outsourcing decisions. Our comparison of the variance of the predicted logit link function values from the fixed effects only to the variance of the firm-level random intercept revealed that for all of the models the process characteristics were slightly stronger determinants of outsourcing than any firm-level differences.

**Table 3. Estimation results of the models**

	All firms	Non-cloud users	Cloud users
FREQ	-0.49*** (0.04)	-0.54*** (0.04)	-0.25** (0.09)
INFINT	0.23*** (0.05)	0.26*** (0.05)	0.07 (0.12)
CUSCON	-1.07*** (0.04)	-1.10*** (0.05)	-0.91*** (0.10)
ASPEC	0.71*** (0.04)	0.75*** (0.05)	0.52*** (0.10)
UNCER	1.17*** (0.05)	1.16*** (0.05)	1.21*** (0.12)
(Intercept)	-1.41*** (0.09)	-1.52*** (0.09)	-0.82*** (0.20)
AIC	7280.01	6093.55	1178.70
BIC	7329.84	6142.34	1214.67
Log Likelihood	-3633.01	-3039.77	-582.35
Deviance	7266.01	6079.55	1164.70
Num. obs.	9120	7860	1260
Num. groups: Firm	456	393	63
Variance: Firm.(Intercept)	2.76	2.81	2.23

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

We used z-tests to analyze the statistical significance of the differences of the regression estimates between cloud users and non-cloud users. Table 4 presents the results of our analysis of significance of differences between the cloud and non-cloud users, according to each of the five characteristics.

**Table 4. Differences between cloud users and non-cloud users ( $p$ -values)**

(Intercept)	FREQ	INFINT	CUSCON	ASPEC	UNCER
0.001	0.003	0.073	0.052	0.019	0.359

Results indicate a statistically significant, positive relationship between information intensity (INFINT) and outsourcing, in the case of the non-cloud users, which supports H1a. With users of the cloud-based systems, however, the results are not statistically significant, indicating that information intensity loses its importance in the outsourcing decision. H1b suggested the decreased effect of information intensity

on outsourcing of the task in this situation, and this result confirms it.

There is a negative relationship between need of customer contact (CUSCON) and outsourcing, suggesting that tasks that require intensive contact between parties are less eligible for disaggregation. These results support H2a. There were no statistically significant differences between cloud and non-cloud users in terms of the effect of the need of customer contact; thus, H2b is rejected.

Results show an association between asset specificity (ASPEC) and outsourcing. This finding conflicts with the proposal of classical TCE, thus not supporting H3a. However, asset specificity has significantly lower influence on the cloud users, thus reducing the effect of the characteristic and confirming H3b.

Consistent with H4a, the frequency of task performance (FREQ) is negatively associated with outsourcing. This suggests that companies are less likely to outsource frequently performed tasks, which likely require faster reaction and feedback. In the case of cloud-based systems, where real-time collaboration is possible with the third party, frequency maintains influence, but it is significantly lower; thus, H4b is confirmed as well.

H5a is not supported by the results indicating a positive relationship between uncertainty (UNCER) related to task accomplishment and outsourcing. There is no difference between cloud and non-cloud users, indicating that H5b is also rejected.

Table 4 summarizes the results of tests indicating the accepted/rejected hypotheses.

**Table 4. Summary of the hypotheses tests**

	Effects on outsourcing of disaggregated services (a)	Impact of cloud-based information systems on the interaction (b)
H1	<i>Supported</i>	<i>Supported</i>
H2	<i>Supported</i>	<i>Not Supported</i>
H3	<i>Not Supported</i>	<i>Supported</i>
H4	<i>Supported</i>	<i>Supported</i>
H5	<i>Not Supported</i>	<i>Not Supported</i>

## 4. Discussion and conclusions

In this paper, we set out to examine the outsourcing of disaggregated services. We identified five characteristics of tasks that could impact a company's decision to outsource a task associated with disaggregated service. Furthermore, we were interested in exploring the differences between cloud users and non-cloud users. Overall, we found strong support for these characteristics; all of them have an effect on the outsourcing decision. Their direction, however, was, in

some cases, contrary to existing research. Results also identified the areas, within given characteristics, where further research is needed.

### 4.1 Theoretical implications

The effect of *Frequency* was significant and negative, meaning that more frequently performed tasks within disaggregated services are less likely to be outsourced. This is in line with existing research in Transaction-Cost Economics. For cloud users, *Frequency* was also negative; however, it was significantly lower compared to the non-cloud users. We argue that this difference is caused by the advantages of availability and accessibility of the data, which allow users to reduce possible lag-time threats associated with disaggregation and outsourcing of time-sensitive frequent tasks.

The effect of *Need for customer contact* is negative—the more contact is needed between the client and third party performing outsourcing tasks, the less likely those tasks are to be outsourced. This finding supports the theory of Global Information-Intensive Service Disaggregation. Results did not show any significant differences between cloud and non-cloud users, suggesting that data integration and availability do not affect the intensity of the customer contact needed to perform the service.

The effect of *Asset specificity* was positive, meaning that tasks that require more specific assets are more prone to disaggregation. This conclusion goes against the TCE, and further analysis is required to understand the reasons. One possible explanation is that specific expertise required by some individual tasks is perhaps not available in-house, thus driving companies to outsource the tasks. It also has to be taken into account that TCE was established in 1970 when outsourcing was less common and hence the potential for opportunistic behavior from the market was a threat. Today, however, a highly competitive market for business process outsourcing exists and, therefore, the potential for opportunistic behavior has possibly decreased. We do acknowledge that this effect is sensitive to the context of financial processes and SMEs: The small customer companies might want to concentrate on their core processes and to outsource the supporting processes that have high asset specificity. While the second part of the hypothesis was supported, showing the reduced effect of the asset specificity on cloud users, the result was unexpected in the light of H3a. This would also require further research to fully understand the results. Our explanation of the weaker effect of asset specificity for cloud users is that the data and service integration

offered by cloud systems may decrease in-house expertise requirements for specific tasks.

Another contradicting result was that the effect of *Uncertainty* was positive, meaning that companies prefer to outsource the tasks with higher uncertainty and risk. Again, the logic might here be the same as in asset specificity: Small customer companies want to outsource the risk to their outsourcing partners who they perceive as experts in the field of financial administration. In this case, outsourcing might have features of insurance where the risk is mitigated to third parties. We have not found differences between cloud and non-cloud users on this dimension, suggesting the need for further research on the effects of uncertainty and risk related to outsourcing of disaggregated services

Exploring the differences between cloud users and non-cloud users, *Information intensity* was the factor that had the most differing effect between these users. For users of non-cloud systems, *Information intensity* was positive, thus confirming Apte and Mason's [1] proposition on the positive effect of high intensity on disaggregation potential. For cloud users, however, information intensity did not have a statistically significant effect. This suggests that the capabilities of cloud systems to store and integrate all the information needed to perform the task make the issue of information intensity irrelevant, in the context of disaggregation decisions.

#### 4.2 Managerial implications

From the managerial point of view, these results are interesting for vendors of outsourcing services, outsourcing companies using information systems, and developers of such systems.

Our results suggest that users of cloud systems have lower barriers to outsource tasks within disaggregated services. The findings also indicate that companies may be more inclined to outsource tasks that were not outsourced before. This implies to the vendors of outsourcing services that the adoption of cloud systems in work with clients may offer new opportunities in terms of better fit to the customers' needs and a wider range of services. Our results also provide the way for vendors to characterize their services and make decisions on their development.

For the companies willing to outsource the tasks of disaggregated services, our results offer guidance to make such decisions, based on the characteristics of the processes.

This research provides insight into the impact of cloud-based computing on the decision to outsource disaggregated services. Our results indicate that cloud-based systems have concrete effects on the behavior of

users, thus providing guidance for the development of information systems according to the emerging needs of the customer.

#### 4.3 Further research and limitations

The results presented in this paper provide a rich foundation for further research. We indicate a small number of potential research opportunities.

The model we used in the paper takes into account only five characteristics of outsourcing of disaggregated services. While empirical evidence suggests that these characteristics do affect companies' outsourcing patterns, the list is not exhaustive. Further research may explore a wider range of task characteristics within service disaggregation that play a role in outsourcing decisions.

This paper establishes relationships between task characteristics and outsourcing, through the means of empirical research. However, further investigation is needed into the reasons behind the impact of cloud-based systems. One possibility for such research would be a qualitative inquiry of companies using information systems of both types (cloud and non-cloud) in outsourcing.

The context of this research only covers the outsourcing of tasks related to financial administration. Further studies could test our propositions in the context of other business functions.

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