The Explanatory Power of the Constructs of Transaction Cost Economics Theory

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ABSTRACT

This Paper analyses the explanatory power of the constructs of transaction cost economics theory (environmental uncertainty, behavioral uncertainty, asset specificity and transaction frequency) in order to determine possible constructs for an endogenous theory of ITO. To analyze this, we employ a large project data set from a German IT outsourcing vendor. We find that only environmental uncertainty and transaction frequency have a high explanatory power and therefore should be considered for an endogenous theory of ITO. Behavioral uncertainty and asset specificity are only of minor relevance. The research is limited by the fact that we employed a data set from only one vendor. We contribute to theory by suggesting possible constructs for an endogenous theory of ITO and to practice by showing that the danger of opportunistic behavior is low. This paper contributes to the ongoing discussion on the applicability of transaction cost economics theory.

Keywords

Transaction Cost Economics, IT Outsourcing, Governance Mechanisms, Choice of Contract Type

INTRODUCTION

The global information technology outsourcing (ITO) market has reached nearly $400bn in 2015 (Statista 2016). ITO is defined as the assignment of an IT task to a vendor, who charges a fee for conducting the service (Apte, Sobol, Hanaoka, Shimada, Saarinen, Salmela and Vepsalainen 1997; Lacity and Hirschheim 1993; Loh and Venkatraman 1992). These IT tasks can be various and range from "simple data entry to software development and maintenance, data center operations and full system integration" (Apte et al. 1997).

Transaction Cost Economics is one of the leading frameworks for analyzing the phenomenon of ITO (Dibbern, Goles, Hirschheim and Jayatilaka 2004; Klein 2002). It has also been frequently used for analyzing the chosen governance mechanism or for explaining the contract choice for ITO projects (e.g. Kalnins and Mayer (2004), Gefen, Wyss and Lichtenstein (2008) and Gopal, Sivaramakrishnan, Krishnan and Mukhopadhyay (2003)).

Recent studies about the role of TCE in ITO show inconsistent results (Karimi-Alaghehband, Rivard, Wu and Goyette 2011; Lacity, Willcocks and Khan 2011; Schermann, Dongus, Yetton and Krcmar 2016). Schermann et al. (2016) conducted a meta-analysis about the influence of uncertainty, which is a central construct of TCE, on contract choice. Although TCE has been used for explaining the influence of various kinds of uncertainty, they found that the operationalization of uncertainty has a significant influence on the predictability of TCE. This supports the call by Karimi-Alaghehband et al. (2011) for a more rigorous application of TCE in ITO research. They conducted a literature review on the use of TCE in ITO studies and found that only a few studies use all constructs of the theory. However, Schermann et al. (2016) also found that the predictability of TCE significantly decreased after the year 1999. This supports the call by Lacity et al. (2011) to develop a new analytical framework for the ITO

domain. In their literature review on the usage of TCE in ITO, they explain the found mixed results with the limited explanatory power of TCE.

However, there is limited empirical evidence that questions the application of TCO in ITO. Schermann et al. (2016) do not employ environmental and behavioral uncertainty, the two categories of uncertainty, mentioned by Williamson (1985). They rather focus on the construct task uncertainty. Analyzing the explanatory power of the original constructs instead of derived ones gives a better picture whether the original theory is applicable. Furthermore, other TCE constructs beyond uncertainty, such as asset specificity and transaction frequency have not been examined.

Other issues are related to meta-analyses. First, they are based on subjective coding of heterogeneous samples, differing in project and company size, time frame, and variable operationalization. Second, meta-analyses and literature analyses are subject to the file drawer problem, which might be especially an issue when examining the explanatory power of a theory (Borenstein, Hedges, Higgins and Rothstein 2009). It argues that studies with significant results tend to get published more often. Therefore, meta-analyses and literature analyses rely on a biased data basis.

Lacity et al. (2011) call for the development of a new analytical framework. However, it remains unclear which constructs should be part of this framework. TCE consists of different individual constructs, that could be part of a newly developed framework. However, the relevance of the individual constructs remains unclear. In order to address this research gap, we formulate the following research question to address the previously discussed situation: *How well do the individual TCE constructs explain the governance choice in ITO transactions?*

To address this research question, we conducted an empirical study with a unique quantitative dataset from a German ITO vendor, called ALPHA. The dataset covers all projects conducted by ALPHA between 1995 and April 2014. The initial dataset contains more than 36,000 projects for about 2,000 different clients.

We find that environmental uncertainty is the only important TCE construct that has a huge explanatory power. We conclude that a new analytical framework should contain environmental uncertainty as a central construct.

The remaining sections of this paper are structured as follows. First, we present the theoretical background of the paper and develop our hypotheses. Then, we explain our research method including the employed variables. After that the results of the data analysis are shown. Finally, the paper ends with a discussion of the found results.

THEORETICAL BACKGROUND

The three central constructs of TCE are uncertainty, transaction frequency and asset specificity (Williamson 1985). Uncertainty can be further divided into environmental and behavioral uncertainty (Williamson 1985). Environmental uncertainty is related to uncertainty that stems from the lack of knowledge about the future state regarding the environment of the transaction (Susarla, Barua and Whinston 2009). Behavioral uncertainty deals with uncertainty that originates from the lack of knowledge regarding the actions of the in the transaction involved actors (Susarla et al. 2009).

Asset specificity is defined as the "degree to which the assets used to conduct an activity can be redeployed to alternative uses and by alternative users without sacrifice of productive value" (Williamson 1996). It can be divided into site specificity (geographical site of investment), physical asset specificity (Equipment and tools) and human asset specificity (knowledge and learning of employees) (Karimi-Alaghehband et al. 2011).

Transaction frequency focuses on the recurrence of activities that are needed for the transaction (Karimi-Alaghehband et al. 2011). Transactions can occur only occasionally, but also permanently.

The extent to which TCE has been employed varies. According to Carter and Hodgson (2006), only a few studies analyze all three constructs. This is as well criticized by Lacity and Khan (2016). According to Karimi-Alaghehband et al. (2011), although transaction frequency and asset specificity might be non-significant, they should be included in studies.

TCE is used for explaining two decisions made by the customer: whether to outsource or not, which is known as the make-or-by decision, and for choosing the mode of governance (Williamson 1991). In this paper, we focus on the

second decision, namely on the chosen governance mechanism, which is predominantly determined by the type of contract.

The two prevalent types of ITO contracts are fix-price (FP) and time and material (TM) contracts (Gopal et al. 2003; Lichtenstein 2004). In FP contracts, the ITO vendor agrees to deliver a predefined result and is compensated with a certain fee (Ethiraj, Kale, Krishnan and Singh 2005). TM contracts are different because the billing is based on the agreed hourly rate and the working hours that the ITO vendor invested (Ethiraj et al. 2005).

The behavioral uncertainty component of TCE has been used to explain how the familiarity between the vendor and the client influences the contract choice. Increased familiarity decreases the danger of opportunistic behavior and therefore leads to increased TM contracting (Gefen et al. 2008; Kalnins and Mayer 2004).

Factors, such as project duration, project volume or requirements uncertainty of the project can also be assigned to the uncertainty component of TCE (Lacity and Khan 2016; Schermann et al. 2016). To be more precise, they are part of the environmental uncertainty. It has been found that higher project related uncertainty increases TM contracting (Gefen et al. 2008; Gopal et al. 2003; Kalnins and Mayer 2004; Susarla et al. 2009).

Asset specificity has been rarely used to explain the contract choice. Susarla et al. (2009) analyzed the influence of client specific investments by the vendor, but did not find a significant influence.

Recently, there have been studies that have found empirical inconsistencies between the prediction based on TCE and the observed results (Karimi-Alaghehband et al. 2011; Lacity et al. 2011). Karimi-Alaghehband et al. (2011) call for a more rigorous operationalization of TCE constructs and the usage of all constructs of the theory. Schermann et al. (2016) have shown that the magnitude of the relationship between uncertainty and the choice of governance mechanism is dependent on the operationalization of uncertainty. However, they have not used all TCE constructs, which has been criticized by Lacity and Khan (2016).

Opposed to the call of Karimi-Alaghehband et al. (2011) for a more rigorous operationalization of TCE constructs, Lacity et al. (2011) call for the development of an endogenous theory of ITO. They argue that the research on ITO has already matured to the point that an own theory makes sense. However, Lacity et al. (2011) only give broad propositions that could be part of the newly developed theory, but they argue for further research. They argue that a data driven theory development approach should be taken, as a theory based on data is more difficult to refute (Glaser and Strauss 2009).

As some of the TCE constructs have received empirical support (Karimi-Alaghehband et al. 2011; Lacity et al. 2011), we focus on the evaluation which of the TCE constructs could be part of a newly developed endogenous theory of ITO. Therefore, we analyze the explanatory power of environmental uncertainty, behavioral uncertainty, asset specificity and transaction frequency for choosing the governance mechanism.

IT projects are characterized by a high degree of uncertainty, such as the certainty of the requirements or changing technology (Nidumolu 1995; Schwartz and Zozaya-Gorostiza 2003). In general, the environmental uncertainty of transactions is very high in the ITO domain. The governance mechanism determines the flexibility of the transaction. For instance, it is quite easy to change requirements in a TM contract, but it is hardly possible under a FP contract (Gefen et al. 2008; Gopal et al. 2003). Environmental uncertainty has a high relevance in the ITO domain. Therefore, we formulate the following hypothesis:

H1: Environmental uncertainty has a high level of explanatory power

According to Williamson (1985), behavioral uncertainty is paramount to environmental uncertainty. It has been used by several ITO studies (e.g. Kalnins and Mayer (2004), Gopal et al. (2003) or Gefen et al. (2008)) for explaining the development of the ratio of TM and FP contracts over the customer lifetime. However, we argue that behavioral uncertainty is not of high relevance in the ITO domain. The ITO market is characterized with a high degree of competition (Manning, Lewin and Schuerch 2011). Acting opportunistically always has the danger that it comes out. This would destroy the reputation of the vendor and might even be fatal (Dibbern, Winkler and Heinzl 2008; Dongus, Yetton, Schermann and Krcmar 2014). ITO vendor extensively focus on building up a good reputation in their relationship with their customer, as this is a source for future business (Goles 2001; Levina and Ross 2003).

Therefore, it is quite unrealistic that there is a high danger of opportunistic behavior by the vendor. Because of this, the following second hypothesis is formulated:

H2: Behavioral uncertainty has a low level of explanatory power

According to Riordan and Williamson (1985), asset specificity has the greatest impact of all four TCE constructs. However, it remains unclear, whether this is also the case in the ITO domain. We argue that asset specificity has a low explanatory power in the ITO domain. Most of the asset specificity of an ITO vendor is related to human asset specificity. As IT employees are quite mobile and can easily work for other customers, the asset specificity in the ITO domain is not important. Furthermore, due to the high demand of ITO during the last years, it is easily possible to find a second best use for an IT employee. Therefore, we formulate the following third hypothesis:

H3: Asset specificity has a low level of explanatory power.

Transaction frequency has not received any empirical support (Karimi-Alaghehband et al. 2011; Lacity et al. 2011). A high frequency brings economies of scale regarding governance costs (Miranda and Kim 2006). For instance, FP contracts are more expensive to set up than TM contracts. These costs can be distributed over several contracts, if the transaction frequency is high. Due to the missing empirical support, we expect a low explanatory power of transaction frequency. Therefore, we formulate the following first hypothesis:

H4: Transaction frequency has a low level of explanatory power.
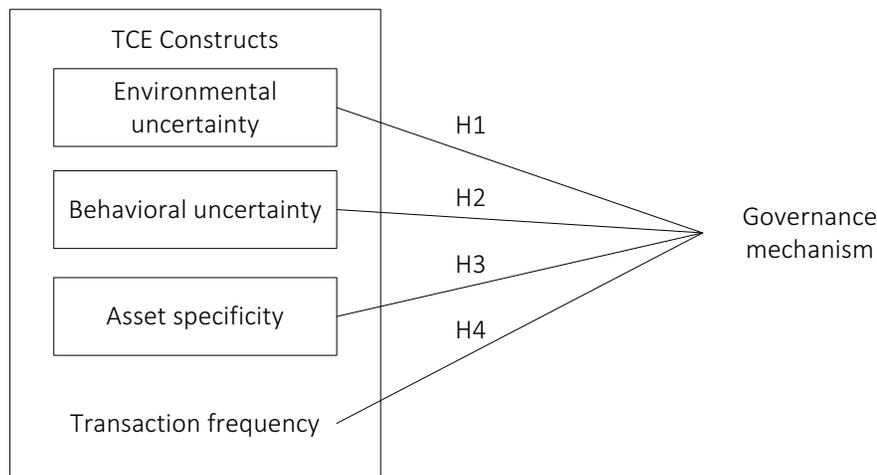

Figure 2: Research Model

RESEARCH METHOD

To address these hypotheses, we collected quantitative data from ALPHA, a large German IT service provider. ALPHA generates most of its revenue through consulting projects, software development and hosting for clients from various industries, such as insurance, banking and automotive. It has offices in more than 20 countries, but the majority of the business is conducted in Germany, Switzerland, Austria and the US. ALPHA has been founded in the early 1980s and therefore can be seen as a successful and established company.

The data have been extracted directly from the project controlling system of ALPHA who granted us access to all 36,413 projects conducted between January 1995 and April 2014. The information on the projects is of high quality because it was extracted from the project controlling system of ALPHA, which is also used for billing clients. Additionally, directly accessing quantitative data is not subject to recall bias, which could be a problem in case studies and surveys (Gefen et al. 2008).

We removed the years before 1997, in order to calibrate the dataset. The first project of a customer should really be the first one and not simply the start of the dataset. The number of short projects increases towards the end of the

dataset as it includes only finished projects. To address this issue, the projects from 2013 and 2014 were removed to have a realistic composition of projects. Additionally, we filtered out internal projects and removed projects with incomplete data. The final dataset contains 22,701 projects for 1,736 different customers. Figure 2 shows the distribution of these projects over the years 1997 to 2012.
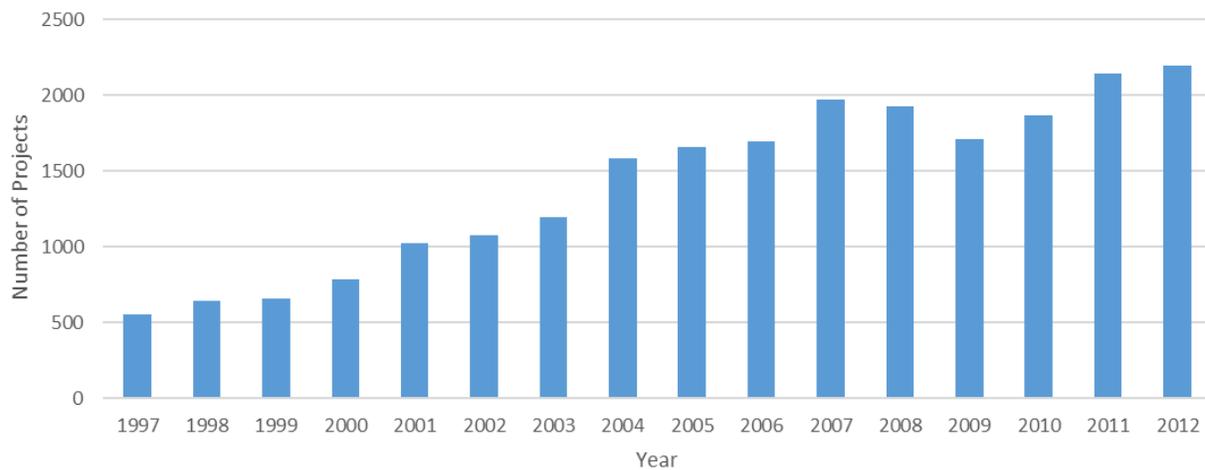
Figure 3: Distribution of Projects over the years

Variables

The dependent variable is the chosen *governance mechanism* of the transaction. This is mostly determined by the contract type of the project. The contract type has also been used by other TCE studies as a proxy for the chosen governance mechanism (Schermann et al. 2016). We focused on the two prevalent types of ITO contracts, namely FP and TM contracts (Gopal et al. 2003; Lichtenstein 2004). We coded FP as 1 and TM as 0. The type of ITO contract determines which party has to bear additional costs in case a realignment of the transaction is necessary (Hoermann, Hlavka, Schermann and Krcmar 2015).

The independent variables are environmental uncertainty, behavioral uncertainty, asset specificity and transaction frequency, that are described in the following paragraphs.

Environmental uncertainty: We used the volume of the project as a proxy for the uncertainty of the project which largely determines environmental uncertainty (Tiwana and Bush 2007). Larger projects tend to have a higher uncertainty and to be more complex (Banerjee and Duflo 2000; Gopal et al. 2003). As TM contracts allow more flexibility, the costs for realigning the transactions are lower. We employed the total hours worked for the project for approximating the project volume.

Behavioral uncertainty: The danger of opportunistic behavior is closely linked to the business familiarity between the customer and the vendor (Gefen et al. 2008). We employed the volume of prior contracts with the same customer as a proxy for customer familiarity. Another possibility is to measure it with the number of prior contracts (Gefen et al. 2008; Gopal et al. 2003). We have chosen the volume of prior contracts, because according to Gefen et al. (2008) it is better measured as the volume of prior contracts.

Asset specificity: We employed the average customer knowledge within the team, approximated by the average hours previously worked for the customer, as a proxy for asset specificity. Project team members gain knowledge about the customer during the conductance of a project. This knowledge is a form of asset that is most of the time can only be leveraged and is specific for a single customer. We only considered human assets, as site specificity and physical specific assets only play a minor in ITO (Aubert and Rivard 2016).

Transaction frequency: The number of projects in a timeframe of 180 days prior and after the project start with the same customer has been employed as a proxy for transaction frequency. Transaction frequency describes the activity of the customer in the market. As multi-vendor sourcing has gotten the dominant type of ITO in recent years (Dibbern et al. 2004), it can be assumed that a high number of transactions between ALPHA and a customer is a

sign that this customer is an highly active customer in the market. Also future projects have been considered, because there is often a gap of several months between the first contacts between the vendor and the client, the signing of the contract and the actual project start. Furthermore, a vendor often can estimate the number of projects that will be conducted with the same customer in the following months quite well.

Data Analysis

As the dependent variable is dichotomous, we employed logistic regression. To analyze the explanatory power of the different TCE constructs several different regression models have been constructed, where each time a specific construct has been excluded. We use Nagelkerke's R2 for analyzing the explanatory power of the different constructed models (Nagelkerke 1991). We assume that a decrease in Nagelkerke's R2 by more than 10% is a sign of high explanatory power.

The following table shows some descriptive statistics of the employed subsets. Due to high skewness of project volume, customer familiarity, customer knowledge within team and transaction frequency, these variables are log-transformed (Hair, Black, Babin, Anderson and Tatham 2006).

Variable	Unit	Min	Mean	Median	Max	SD
Contract Type	0 = TM 1 = FP	0	0.4155324	0	1	0.4928244
Project Volume	Hours worked	0.25	1002.982	225.5	659172.5	6368.622
Customer familiarity	€ previous revenue	0	53,012,900	13,823,879	292,559,516	76,722,173
Customer Knowledge within Team	Hours	0	4,007.877	2,179.758	60,978.35	5,567.415
Transaction Frequency	#	1	38.29237	12	227	46.65994

Table 1. Descriptive Statistics (n=22,701)

The following tables show the correlation matrix of the employed variables.

	1)	2)	3)	4)	5)
1) Contract type	1.000				
2) log(Project Volume)	-0.130 ***	1.000			
3) log(Customer familiarity)	0.190 ***	0.168 ***	1.000		
4) log(Customer Knowledge within Team)	0.229 ***	0.145 ***	0.655 ***	1.000	
5) log(Transaction Frequency)	0.319 ***	0.022 ***	0.730 ***	0.649 ***	1.000

Table 2. Correlation Matrix (n=22,701)

RESULTS

Dependent variable: Contract type (0 = TM; 1 = FP)					
Variable	**Model 1 – Base model**	**Model 2 – H1 without environmental uncertainty**	**Model 3 – H2 without behavioral uncertainty**	**Model 4 – H3 without asset specificity**	**Model 5 – H4 without transaction frequency**

Intercept	-0.171653 ** (0.061289)	-0.906944 *** (0.049833)	-0.469704 *** (0.050874)	-0.211724 *** (0.061165)	-0.624506 *** (0.063302)
log(Project volume)	-0.181932 *** (0.008724)		-0.194560 *** (0.008604)	-0.173582 *** (0.008665)	-0.222016 *** (0.008478)
log(Customer familiarity)	-0.041345 *** (0.004957)	-0.059211 *** (0.004784)		-0.023297 *** (0.004640)	0.049687 *** (0.004324)
log(Customer Knowledge within Team)	0.063589 *** (0.005842)	0.052702 *** (0.005757)	0.047621 *** (0.005426)		0.115304 *** (0.005434)
log(Transaction Frequency)	0.399719 *** (0.013206)	0.439606 *** (0.012933)	0.337646 *** (0.010747)	0.444348 *** (0.012623)	
Nagelkerke's R2	0.1671814	0.1435973	0.163638	0.1608902	0.1160723
%-change of R2		14,1%	2,1%	3,8%	30,6%
Significance: *** = significant at the 0,1% level; **= significant at the 1% level; *= significant at the 5% level, †=significant at the 10% level					

Table 3. Results for constructed logistic regression models

The base model has a Nagelkerke's R2 of 16,7%. We find that all variables of the base model are highly significant.

For testing the first hypothesis, the project volume, which is a proxy for environmental uncertainty, has been excluded from the base model. We find that Nagelkerke's R2 drops by 14.1% to 14.4%. This is the second largest decrease and significantly higher than the third and fourth largest decrease. Therefore, hypothesis H1 is supported.

If customer familiarity, which is used as a proxy for behavioral uncertainty, is excluded, R2 only decreases by 2.1%, which is the smallest decrease of all constructs. As hypothesis H2 claims that behavioral uncertainty only has a low explanatory power, H2 is supported.

For testing hypothesis H3, we excluded asset specificity from the base model. We find that Nagelkerke's R2 only slightly drops by 3.8% from 16.7% to 16.1%. As this is the second smallest decrease and by far smaller than third smallest one, we can conclude that H3 is supported.

If transaction frequency is excluded from the base model, Nagelkerke's R2 decreases by 30.6% to 11.6%. This is the largest drop of all, but hypothesis H4 claimed that transaction frequency only has a low explanatory power, it is rejected.

DISCUSSION

Our results show that most of the explanatory power of TCE is based on only two constructs, namely environmental uncertainty and transaction frequency. The other two TCE constructs, behavioral uncertainty and asset specificity, do not seem to be that important. Therefore, environmental uncertainty and transaction frequency should be considered as possible new constructs for a new endogenous theory of ITO that should be developed after Lacity et al. (2011).

Before discussing the contribution of our results, limitations of our approach and data analysis are presented. First, the employed dataset comes from only one vendor, which is a threat to the generalizability of the results. On the other hand, data from the same vendor and multiple clients cancels out vendor specific effects and makes it possible to more thoroughly focus on the individual TCE constructs. Second, the chosen proxies for the TCE constructs might not be the perfect proxies. However, we employed proxies that have also been used by previous studies and have proven to be reliable. Furthermore, as we are dealing with data from an ITO service provider, we are limited to the available variables and cannot define our own variables.

We contribute to theory by showing that most of the explanatory power of TCE within the ITO domain is due to environmental uncertainty and transaction frequency. Therefore, these two constructs are candidates to be included in the newly developed endogenous theory of ITO after Lacity et al. (2011).

The high relevance of environmental uncertainty is opposed to Williamson (1985) who argues that behavioral uncertainty should be paramount to environmental uncertainty. Environmental uncertainty is the dominant type of uncertainty in the ITO domain. This could be mainly due to the fact that IT projects have in general a high degree of uncertainty (Nidumolu 1995; Schwartz and Zozaya-Gorostiza 2003). The higher the uncertainty of an ITO transaction, the higher the flexibility of the governance mechanism should be.

Furthermore, this is the first study that shows that transaction frequency has a high influence on the chosen governance mechanism. According to the literature reviews of Karimi-Alaghehband et al. (2011) and Lacity et al. (2011) no other study has found a significant influence of this TCE construct.

Our results suggest that behavioral uncertainty and asset specificity should not be part of a newly developed endogenous theory. The ITO market is characterized with a high degree of competition (Manning et al. 2011). Acting opportunistically always has the danger that it comes out. This would destroy the reputation of the vendor and might even be fatal (Dibbern et al. 2008; Dongus et al. 2014). Therefore, it is quite unrealistic that there is a high danger of opportunistic behavior by the vendor.

The conducted analyses suggest that asset specificity has hardly any influence in the ITO domain. This is opposed to Riordan and Williamson (1985) who argue that it has the hugest influence of all TCE constructs. From the perspective of an ITO vendor, most of the asset specificity is related to human asset specificity. Human assets are quite mobile and can be used easily work for other customers. This is different in manufacturing where a vendor might have invested in specific tools for being able to fulfill the requirements of the customer. Another explanation could be that due to the high demand of ITO during the last years, it is easily possible to find a second best use for an IT asset.

We contribute to practice by examining factors that determine the contract choice. We find that behavioral uncertainty and the danger of opportunistic behavior does not explain the choice of governance mechanism, which is opposed to findings by Gefen et al. (2008) and Gopal et al. (2003). Therefore, clients do not have to focus on trust issues in the ITO domain. Furthermore, we show the influence of client specific characteristics that should be considered while choosing the appropriate type of contract.

This is only a first step towards an endogenous theory of ITO. Other possible constructs and their influence on the choice of governance mechanism should be analyzed.

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