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THE IMPACT OF HUMAN ASSET SPECIFICITY ON THE SOURCING OF APPLICATION SERVICES

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Abstract

The question concerning the circumstances under which it is advantageous for a company to outsource certain information systems functions has been a controversial issue for the last decade. While opponents emphasize the risks of outsourcing based on the loss of strategic potentials and increased transaction costs, proponents emphasize the strategic benefits of outsourcing and high potentials of cost-savings. This paper brings together both views by examining the conditions under which both the strategic potentials as well as savings in production and transaction costs of developing and maintaining software applications can better be achieved in-house as opposed to by an external vendor. We develop a theoretical framework from three complementary theories and test it empirically based on a mail survey of 139 German companies. The results show that insourcing is more cost efficient and advantageous in creating strategic benefits through IS if the provision of application services requires a high amount of firm specific human assets. These relationships, however, are partially moderated by differences in the trustworthiness and intrinsic motivation of internal versus external IS professionals. Moreover, capital shares with an external vendor can lower the risk of high transaction costs as well the risk of losing the strategic opportunities of an IS.

Keywords: Information systems, outsourcing, transaction cost theory, resource-based theory, property rights theory, incomplete contracts theory, Partial Least Squares (PLS), moderators

1 INTRODUCTION

Although market research companies propagate an ongoing growth of IS outsourcing (IDC, 1999), companies still behave very different regarding the sourcing (i.e., the insourcing versus outsourcing) of IS functions. Whereas some companies decide to outsource their entire IS department, others prefer to selectively outsource particular IS functions (e.g., data center operations) completely or partially to legally independent service providers (Dibbern & Heinzl, 2001; Lacity, Willcocks & Feeny, 1996). Still others studied the outsourcing option or actually experienced outsourcing, but decided to keep or bring back IS in-house (backsourcing) (Hirschheim & Lacity, 2000). Finally, various types of outsourcing ownership arrangements have been observed in the market, including joint ventures, where the client and the vendor share capital, or spin-offs, where the client has 100% share of the vendor's capital (Heinzl, 1993).

In recognizing the diversity in the IS sourcing behavior of organizations, it may be concluded that the sourcing decision is highly dependent on the specific situation of each organization. One promising way of explaining this diversity is to elaborate on the general factors that characterize the decision context of a company and to develop theoretical linkages between these factors and the actual sourcing behavior of organizations. Indeed, a review of previous literature on IS outsourcing reveals that this *situational approach* was pursued by numerous empirical and conceptual works (Dibbern, et al.,

2004). These studies may be characterized as studies on the determinants of IS outsourcing. From those with a theoretical grounding, the majority used transaction cost theory (TCT) (Dibbern, et al., 2004). This theory is based on the argument that the governance choice is based on economic criteria such as transaction costs and production costs. The core of the theory is about selecting the most efficient governance mode based on an analysis of the characteristics of the decision object (e.g. its asset specificity, the technological uncertainty, and site specificity).

Empirical examinations of the influence of these *contextual factors* on IS outsourcing have revealed the following results (Dibbern, et al., 2004): The influence of technological uncertainty tended to be very inconsistent. Site specificity has an impact for small and medium-sized firms at best (Dibbern, Heinzl & Leibbrandt, 2003). A connection between asset specificity and degree of outsourcing could be substantiated when the focus was specifically on human rather than physical assets (i.e., technical IS assets). Finally, it is widely documented that the desire to save costs is among the most, if not the most, important decision criteria. In this respect, the results from the study by Ang und Straub (1998) are particularly enlightening. They show that production costs play a more important role than transaction costs. What is missing, however, is a study, that systematically examines the reasons for cost differences between the in-house and outsourcing options. At the same time, there is scant research that tests whether the impact of asset specificity on the sourcing choice is, indeed, mediated by assessments of production and transaction cost differences between the firm and the market.

In addressing these research gaps, the objective of this study is to uncover and test the reasons and hidden assumptions for the influence of human asset specificity on the degree of outsourcing. This corresponds with a more recent claim for advancements in transaction cost theory (Burr, 2003). In order to recognize the common practice of selective outsourcing, this study focuses on the sourcing of application software services, including both development and maintenance. In the following chapters the theoretical framework will be introduced. In chapter 3, the framework will be operationalized and empirically tested. Finally the results of the study are discussed and their implications are unveiled.

2 THEORETICAL FRAMEWORK

The theoretical framework is presented in Figure 1. The arrows embody the individual hypotheses. The algebraic signs “+” and “-” indicate whether the linkages between the individual constructs are expected to be positive or negative. The following section elaborates on these relationships and explains the theoretical underpinning of these hypotheses.

2.1 Transaction cost theory

Impact of human asset specificity. From the view of TCT, the variations in production and transaction costs between insourcing and outsourcing represent two major criteria for the assessment of the sourcing decision (Williamson, 1981). Transaction costs comprise all costs, that arise when delegating an IS function to another party. The tasks of delegating include activities such as selecting the right exchange partner, specifying the required services of the exchange relationship, controlling the completeness and timelines of the service provision, as well as adjusting the terms of the contract or even terminating the relationship (Picot & Maier, 1992). These activities help reducing the risk that the other party behaves opportunistic (e.g., by consciously charging exorbitant prices or by providing inferior services).

The transaction costs increase when the principal has decreasing knowledge about the object and the manner of the service provision. This is especially the case if the process of the development and the maintenance of application software demand a high level of specific investments. Both the development and the maintenance of software applications can be characterized as labor intensive knowledge work. The focus, therefore, is on human rather than physical assets when determining the level of specificity of assets that are required to develop and maintain software applications. These

human assets may be characterized as knowledge assets. They comprise knowledge about the application context (respectively the business processes) and the knowledge of the software technical realization (Iivari, Hirschheim & Klein, 2001). These types of knowledge can be categorized as firm-specific if they include knowledge of unique business processes and application software that is specifically customized to a company. This then is closely related to the notion of tacit knowledge (Polanyi, 1966), which is developed through a process of social interaction (Nonaka, 1994) of those people that are involved in the process of developing and maintaining application software – including both collaboration between the group of IS specialists (i.e. system analysts, designers and programmers), and the collaboration between IS specialists and the end users. Hence, the human asset specificity consists of four components as illustrated in Figure 1.

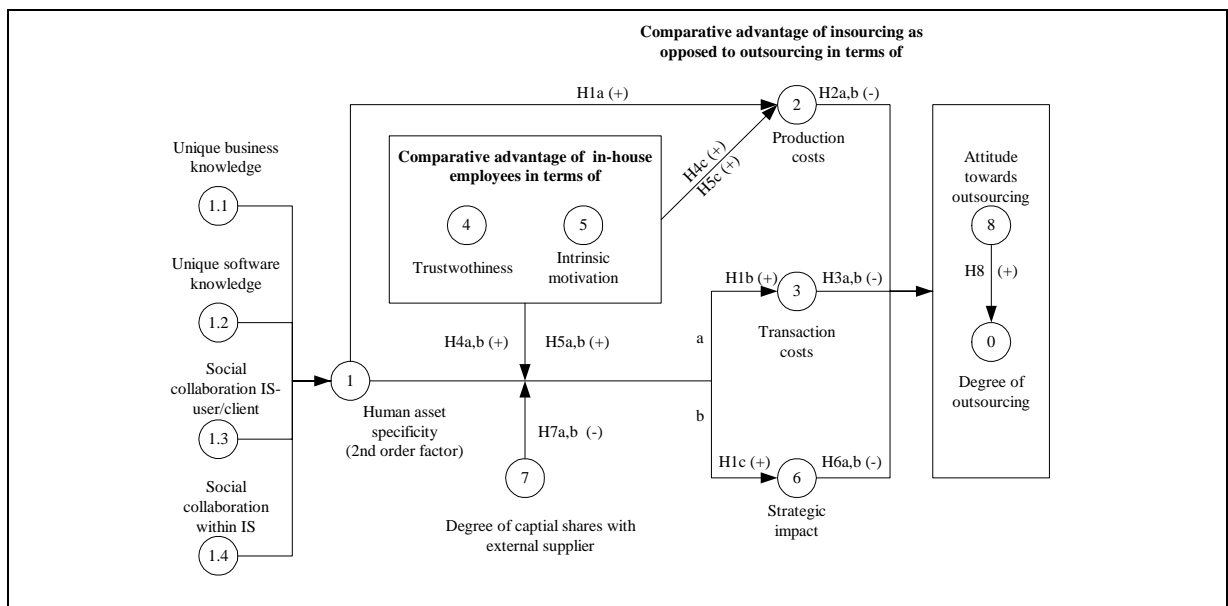


Figure 1 Theoretical Framework

According to TCT the risk of opportunistic behavior (which is especially high when firm specific IS functions are involved) can be prevented more efficiently using in-house internal authority thereby resulting in lower transaction costs.

At the same time, it can be expected that the production costs via insourcing also decrease with increasing human asset specificity. Production costs include all costs that arise for performing the actual activities necessary to complete the tasks associated with the provision of an IS function. For external service providers the provision of firm-specific application software requires a considerable amount of extra learning effort (Beath & Walker, 1998). This makes it difficult to realize economies of scale by using the same knowledge assets at different customer sites. In contrast, internal IS departments usually can draw on long-term experiences with the specific user requirements as well with the unique technical infrastructure and applications portfolio of their organization (Dibbern, Heinzl & Leibbrandt, 2003). This leads to the following hypotheses:

H 1a und b: The more specific the human assets required to perform an IS function are, the higher the comparative internal (a) production and (b) transaction cost advantages of insourcing as opposed to outsourcing an IS function.

H2a, 3a: The higher the comparative (2a) production and (3a) transaction cost advantages of insourcing as opposed to outsourcing an IS function, the less it will be outsourced.

Antipodes of opportunistic behavior as moderators. The assumption that certain actors behave opportunistically and that such behavior can be prevented more efficiently through the use of the

firm's internal authority system has been critiqued more recently (cf. Burr, 2003). One may argue that besides exercising authority, there are other mechanisms to reduce the risk of opportunistic behavior without leading to higher transaction costs. A number of researchers have argued that the inclusion of the construct of trust may increase the explanatory power of TCT (e.g. Chiles & McMackin, 1996; Ghoshal & Moran, 1996). Establishing trust-based relationships may reduce the risk of opportunistic behavior – both in-house as well as with interorganizational relationships (Sabherwal, 1999). Accordingly, it is important to assess and compare the trustworthiness of in-house and outsourced personnel. If an organization successfully establishes a trust-based relationship with an external service provider, it is possible to outsource specific tasks without suffering transaction cost disadvantages. If, on the other hand, the trustworthiness of the internal personnel is assessed higher, the internal transaction cost advantages are reinforced with an increasing specificity of application software services. This leads to the following hypothesis:

H 4a: The higher the trustworthiness of in-house as opposed to outsourced IS workers, the higher is the impact of human asset specificity (H1b) on in-house transaction cost advantages in performing an IS function.

Another factor that counteracts opportunistic behavior without leading to increased transaction costs is the intrinsic motivation of employees. Employees are intrinsically motivated if they commit certain activities for their own sake (Frey & Osterloh, 1997, S. 308). By contrast, employees are extrinsically motivated if they are solely motivated by external incentives such as monetary incentives. Opportunistic behavior aims to increase one's own benefits knowing that this may occur at the cost of the other party. Insofar as opportunistic behavior is primarily extrinsically motivated (Osterloh & Frey, 2000, S. 539), we argue that the more the employees are intrinsically motivated, the less they are affected from external incentives and the less they will behave opportunistically. The social environment of the work process in applications development and maintenance has strong influences on the extent of intrinsic motivation (Couger & Colter, 1985). When changing from insourcing to outsourcing (or the other way around), the social environment usually is severely affected. This means that the intrinsic motivation of IS professionals may be positively or negatively affected by the sourcing choice. Taking this issue into account leads to the following hypothesis:

H 5a: The higher the intrinsic motivation of the internal workers opposed to the external personnel, the stronger the connection between the degree of human asset specificity and internal transaction cost advantages.

In addition, it can be stated that employees with a higher level of intrinsic motivation are more productive than those whose output is solely stimulated by extrinsic motivation. This general notion has been argued to apply to the development and the maintenance of application software (Couger & Colter, 1985). Accordingly, we might conclude that differences in the intrinsic motivation between internal and external workers directly result in differences in the production costs. Trustworthiness, likewise, may have a similar effect. Employees that are trusted are able to concentrate solely on getting their work done. As a result, they will not lose time on other matters such as constantly reporting to their supervisor, justifying resources and documenting work procedures. This, in turn, leads to increased productivity and lower production costs. Therefore, differences in the trustworthiness between internal and external workers directly result in differences in the production costs. Taken together, the following hypotheses are generated:

H 4c, 5c: The higher the (4c) trustworthiness and (5c) intrinsic motivation of internal as opposed to external IS workers, the higher the internal production cost advantages.

2.2 Resource-Based Theory

Companies that solely focus on minimizing costs when making sourcing decisions of application services run the risk of neglecting the strategic contribution of IS. In managing IS, it is not only about minimizing costs but also about ensuring that the output of the IS work matches with the strategic

objectives of an organization. A pure cost comparison of alternative sourcing options implies that an IS function can be provided in the same manner and of the same quality, no matter whether it is performed in-house or externally. It is assumed that the firm and the market have access to the same input factors and can create the same outputs (Demsetz, 1988, p. 147). In contrast, resource-based theory holds that organizations generally differ in their resources and capabilities (Penrose, 1959) and that these differences serve as a basis for the achievement of competitive advantages against competitors (Barney, 1991).

According to RBT, an IS can be classed as strategic if it (1) contributes to business benefit and if the necessary resources and capabilities (2) are non-imitable, (3) non-substitutable (4) and non-tradable (Mata, Fuerst & Barney, 1995).

The contribution of an IS to achieve higher business benefits usually takes place indirectly (Clemons & Row, 1991). IS resources are complementary strategic assets (Clemons & Row, 1991, S. 280ff.). They can contribute to achieve cost savings and/or to differentiate the products/services of an organization by enabling a higher level of automation and improved information supply in the primary business processes and operational functions. This also applies to partial IS functions (e.g. the development and maintenance of software applications). In particular the applications portfolio of organizations is said to play an important role in strategic planning of IS (McFarlan & McKenney, 1983; Raghunathan, Raghunathan & Tu, 1999).

The requirements for strategic IS resources – being non-imitable and non-substitutable – are fulfilled in particular if they are firm-specific (Dierickx, Cool & Barney, 1989, p. 1505). Hence, there is a direct link between asset specificity from TCT and the concept of specific resources from RBT (Dibbern, Güttler & Heinzl, 2001; Foss, Knudsen & Montgomery, 1995; Poppo & Zenger, 1998).

However the question is raised if an external service provider is willing to make such specific investments. An external service provider naturally pursues its own strategic objectives. The provider's profits, in particular, can be increased if economies of scale are achieved by providing the same or similar application services for several customers. However, whenever the development and maintenance of application software requires firm specific investments, such economies of scale would not be realized. As it is, the risk of opportunistic behavior of the external service provider is equally present in this context as in TCT. This also implies that it is again important to assess the trustworthiness and the intrinsic motivation levels of the personnel for both the external service provider and the firm's internal workers. Should in-house advantages in trustworthiness and intrinsic motivation exist, the better the firm's ability to minimize strategic risks and exploit strategic opportunities. On the other hand, behavioral advantages at the vendor side may promote the building of strategic outsourcing alliances with an external vendor (McLellan, Marcolin & Beamish, 1995). This may be summarized as follows:

- H 1c: The more specific the human assets required to perform an IS function are, the higher is the advantage of insourcing as opposed to outsourcing in providing a strategically significant IS function.
- H 4b, 5b: The higher the (4b) trustworthiness and (5b) intrinsic motivation of in-house as opposed to outsourced IS workers in providing an IS function, the higher is the impact of human asset specificity on in-house advantages in providing a strategically significant IS function.
- H 6a: The higher the advantage of insourcing as opposed to outsourcing in providing a strategically significant IS function, the less it will be outsourced.

2.3 Incomplete Contracts Theory

An interesting difference between TCT and RBT consists in the role of incomplete contracts. According to TCT only incomplete contracts can be established when the provision of an IS function requires a high amount of firm specific knowledge and social collaboration. This increases the risk of

opportunistic behavior and leads to higher transaction costs. By contrast, the RBT postulates that situations in which contracts can only be settled incompletely are the basis for reaching a sustained competitive advantage. Thus, the challenge is to maintain the positive (i.e., strategic) effects of specific investments without suffering higher transaction costs. Two possible behavioral safeguards against opportunism have already been introduced, namely trust and non-monetary incentives (that lead to a higher level of intrinsic motivation). As mentioned earlier, according to TCT, a third possibility is the exercise of authority. It is assumed that internal authority (i.e. the hierarchical system) is more effective in safeguarding against opportunism than any arm's length relationship with external suppliers (Williamson, 1981).

This last assumption has been heavily criticized by proponents of the property rights theory. From their point of view, there is no reason why the authority over in-house IS workers should be higher than the authority over an external service provider (Alchian & Demsetz, 1972, S. 777). Both are simply different types of contractual agreements. These opposing arguments have motivated proponents of incomplete contracts theory to answer two fundamental questions:

- (1) What backs up authority and
- (2) how can authority solve the holdup problem?

According to Grossmann, Hart and Moore (1986), ownership over non-human assets provides the ultimate source of authority. It gives the owner residual control rights over the use of the assets (Hart & Moore, 1990, p. 1120) and provides bargaining power to decide upon the distribution of the ex post surplus resulting from specific investments in human assets (Grossmann & Hart, 1986, p. 696, 716; Hart & Moore, 1990, p. 1122). The residual control rights, resulting from ownership, are in the hands of a firm's top management. They decide on the allocation of parts of the profits and thus decide on the employment. If IS workers behave opportunistically there is the possibility for the management to dismiss them on the basis of property rights. In the context of the development and maintenance of application software, this means that a company is able to reduce the risk of opportunistic behavior if it is the property owner of the legal institution that employs the IS workers. Of course, the contract with an external service provider can also be dissolved. However, this does not automatically mean that its employees will lose their jobs. In contractual outsourcing relationships a company has no direct right to take drastic measures against the individual employees of the external service provider. This is different if the company is a shareholder of the external service provider. Property rights are transferred through equity shares, which leads to the following two hypotheses:

H 7a und b: The higher the degree of ownership over (i.e. capital of shares with) the external vendor, the less a higher level of human asset specificity leads to (a) internal transaction cost advantages and (b) advantages in the strategic contribution of an IS function.

2.4 Attitudes versus Current Behavior

The considerations so far assume that the perceived differences between insourcing and outsourcing in the production costs, the transaction costs and the strategic contributions of an IS function are directly reflected by the degree of outsourcing. In decision theory, this presumes that every change in the perception of the management concerning those objectives involves an instant adjustment of the sourcing behavior. However, in reality, this adjustment process may occur with some delay. Moreover, institutional factors as well as other general conditions or influences could hinder a strictly rational behavior of management (Lacity & Hirschheim, 1993). Thus, it seems useful to examine the extent to which the attitudes of an organization's CIO are reflected by the current degree of outsourcing, and to examine if the three sourcing objectives are equally reflected by the current degree of outsourcing as by the overall attitude towards outsourcing:

H 5b-7b: Perceived differences between insourcing and outsourcing in (5b) the production costs, (6b) the transaction costs and (7b) the strategic contribution strongly influence the attitude of the management towards outsourcing an IS function.

H8: The more positive the attitude towards outsourcing an IS function, the higher the degree of outsourcing of the particular function.

3 EMPIRICAL STUDY

In order to examine the validity of the theoretical framework, data was collected through a mailed questionnaire survey and analyzed by using Partial Least Squares (PLS), a structural equation modeling (SEM) procedure. This procedure fits with the confirmatory character of this study, since it allows the simultaneous test of the proposed hypotheses and the underlying measurement instrument.

3.1 Operationalization of Constructs and Data Collection

The constructs of the framework were operationalized as measurable variables. Herby, the special requirements of the SEM procedure were considered. Each construct was measured by at least two reflective indicators (i.e., survey questions) (Chin, 1998; Fornell, 1989). Whenever possible, validated indicators from previous studies were adapted. Table 1 shows one sample indicator per construct as well as the source of reference from which the measures were drawn. Most of the variables are measured on a (positive-to-negative) five-point Likert-scale ranging from “strongly agree” to “strongly disagree”, with “neither agree nor disagree” as a mid-point. The use of other scales (e.g., percentages) is indicated in Table 1. Moreover, respondents had to provide their ratings for each item for both the development and the maintenance of application software.

The questionnaire was reviewed by practitioners in order to ensure readability and comprehensibility. It was then sent out to 916 companies in Germany (516 in the Machinery Industry and 400 Financial Institutions). The questionnaires were personally addressed to the chief information officers (CIOs). Only companies with more than 500 employees were considered. Overall, 139 usable questionnaires were returned, which equals a response rate of 15.2%. Since data was collected for both the development and the maintenance, 278 (139 x 2) cases were available for model testing.

No.	Construct	Source	Sample Measures [total number of items]
0	Degree of Outsourcing	Based on (Dibbern & Heinzl, 2001; Teng, Cheon & Grover, 1995)	For each of the two IS functions, please estimate the average percentage currently allocated to external service providers in terms of . . . the function’s total budget (from 0 to 100%) [3]
1.1	Specificity of Business Knowledge	Based on (Ang & Cummings, 1997; Poppo & Zenger, 1998)	In doing the actual work for each of the IS functions in your organization, it requires . . . good understanding of business processes that are unique to your organization. [2]
1.2	Specificity of Software Knowledge	(Ang & Cummings, 1997; Poppo & Zenger, 1998)	. . . detailed knowledge of software systems developed specifically for your organization. [2]
1.3	Social Collaboration between IS Workers and Users/Client	Newly developed based on (Pinto, Pinto & Prescott, 1993)	In doing the actual work for each of the IS functions . . . it is important to have strong social / interpersonal working relationships between IS workers and user/clients of the system. [2]
1.4	(Intra) Social Collaboration between IS Workers	See 1.3	. . . it is important to have strong collegial / collaborative relationships within the group of IS workers. [2]
2	Comparative production cost advantage	Based on (Ang & Straub, 1998)	In doing the actual work required for each of the IS functions . . . our internal staff works more cost efficient than an external service provider [5]
3	Comparative transaction cost advantage	Based on (Ang & Straub, 1998)	When delegating i.e. transferring tasks of the particular IS function . . . the costs incurred in negotiating, managing and coordinating are lower within the firm than in case of contracting with an external service provider. [4]

4	Comparative advantages in trustworthiness	Based on (Zaheer & Venkatraman, 1994)	In doing the actual work required for each of the IS functions how much more or less you in general feel and believe personnel of an external service provider compared to your own employees will . . . do the job right even when the opportunity to behave opportunistically is present [3]
5	Comparative advantages in intrinsic motivation	Newly developed based on (Calder & Staw, 1975)	Factoring out performance incentives that result in direct monetary benefits (e.g. extra payments), our firm's employees compared to the personnel of external service providers are . . .much more motivated to do quality work in the particular IS function. [3]
6	Comparative advantages in strategic impact	Newly developed based on (Barney, 1991)	The contribution of this IS function to achieve a competitive advantage is weakened if it is . . . carried out by an external service provider as opposed to our organization. [3]
7	Degree of capital shares with external supplier	Based on (Heinzl, 1993)	For that portion of the work within each of the IS functions that is done by one or more external service providers: . . . What share of capital does your organization have with the service providers on average? [1]
8	Attitude towards outsourcing	Based on (Ajzen & Fishbein, 1980)	Overall, having an external service provider perform this IS function is . . . bad-good (from -3 to + 3) [6]

Table 1. Construct Measurement

In order to ensure that the usable questionnaires represent a homogeneous subset of the population, the companies that replied to a first mailing round were compared with those that replied to a follow up mailing round by using the following characteristics: company sales, total number of employees, and degree of outsourcing for both IS functions. No significant differences could be detected between both groups, which increases the confidence in the data (t-Test, $p < 0,05$).

3.2 Data Analysis Methods

As indicated, PLS was used for model testing. This component-based procedure has fewer requirements on sample size and data distribution than covariance-based SEM procedures (Chin, 1998) and, therefore, was deemed appropriate for this study. Furthermore, it allows for the specification of second order molar factors, which follows the same logic as formative indicators (Chin & Gopal, 1995). This form of modeling was applied to the construct of human asset specificity. The model testing included validity tests of the measurement model, a test of the explanatory power of the overall model by assessing its explained variance, and the testing of the individual hypotheses (structural model). Significance tests were conducted with the use of 500 “bootstrap resamples” (Chin, 1998). The moderator effects were tested with a “two-way-interaction” procedure (Chin, Marcolin & Newsted, 2003) where all possible “interaction terms” were created by first standardizing the values of the moderating variables (e.g. trust) as well as the independent variable (human asset specificity) and then building the product of the respective standardized items. Subsequently, the impacts of the three sets of variables (interaction terms, moderators and human asset specificity) on the respective dependent variable (e.g. transaction cost advantages) were analyzed. The existence of a moderator effect was supported when the impact of a moderator term showed up to be statistically significant (Chin, Marcolin & Newsted, 2003).

3.3 Model Findings

Descriptive Findings. The descriptive results provide a general contextual summary of the sample. Table 2 gives an overview of the averages of selected contextual variables – differentiated by industries and, if available, by IS function.

The evaluations reveal that the CIOs that answered the questionnaire had more than 10 years working experience with their company and therefore can be classed as relatively experienced. There are some differences between the Machinery and the Finance Industry. For example, it is instructive to note that the IS expenditures in the Finance Industry are approximately three times higher than in the Machinery Industry. Moreover, the Finance Industry shows higher average degrees of outsourcing and

capital shares with an external vendors than the Machinery Industry. Finally, the combined average degree of outsourcing in both industries is surprisingly high for Germany. It makes up 41.6% for the development of application software and 38.7% for the maintenance. This shows that the outsourcing of application services has substantially increased over the last few years in Germany.

Variable		Machinery		Finance		Both	
		n	Mean	n	Mean	n	Mean
CIO Company Membership (in Years)		61	13.6	74	17.8	135	15.9
Number of Employees in	Entire Organization	58	3474.6	67	1951.7	125	2648.0
	Entire IS Function	61	51.9	73	118.0	134	88.0
	Applications Development	59	16.4	73	38.5	132	28.6
	Applications Maintenance	59	13.1	72	39.2	131	27.5
IS Budget as Percentage from Total Sales (Machinery), i.e. Assets (Finance)		56	2.1%	48	6.6%	104	4.2%
Total Sales, i.e. Assets of Organization (in Mio. EUR)		55	483.5	56	6417.3	111	3477.1
Current Budget Spent on Outsourcing	Development	62	30.4%	77	50.6%	139	41.6%
	Maintenance	62	28.9%	77	46.6%	139	38.7%
Capital Share with External Vendor	Development	50	6.8%	59	14.0%	109	10.7%
	Maintenance	50	6.9%	59	14.3%	109	10.9%

Table 2. Descriptive Findings

The evaluations reveal that the CIOs that answered the questionnaire had more than 10 years working experience with their company and therefore can be classed as relatively experienced. There are some differences between the Machinery and the Finance Industry. For example, it is instructive to note that the IS expenditures in the Finance Industry are approximately three times higher than in the Machinery Industry. Moreover, the Finance Industry shows higher average degrees of outsourcing and capital shares with an external vendors than the Machinery Industry. Finally, the combined average degree of outsourcing in both industries is surprisingly high for Germany. It makes up 41.6% for the development of application software and 38.7% for the maintenance. This shows that the outsourcing of application services has substantially increased over the last few years in Germany.

Measurement validity. The measures for the latent variables were found to be quite strong. The reliabilities for both the individual indicators and the constructs exceeded the recommended threshold values for nearly all cases. All factor loadings were significant at the 0.001 level and exceeded the recommended value of 0.7 except for one indicator of the trust construct. It showed a value of 0.61 and was excluded from the analysis. Moreover, one indicator for the construct production costs yielded a value of 0.67. It was kept for reasons of consistency, since all other indicators of that construct loaded satisfactorily high. In terms of construct validity, the “composite reliability” of the constructs reached values above 0.8 (recommended > 0.7) in all cases, and the “average variance extracted” exceeded the value of 0.6 in all instances (recommended > 0.5).

Explained variance (R^2). The sourcing model provides two main dependent variables: (1) the current degree of outsourcing and (2) the attitude towards outsourcing. Although the main objective of this study was not to explain the variance of these two factors comprehensively, but rather to elaborate on the moderated and mediated impact of human asset specificity, the R-squares are reasonably high for the degree of outsourcing and the attitude construct (0.26 and 0.35 respectively). This is also true for the three mediators (production costs, transaction costs and strategic contribution). Their explained variance ranges from 14 to 20 per cent.

Structural Model. The results of the hypotheses are discussed below. We partition the discussion beginning with the direct (unidirectional) effects, followed by the moderator effects.

- Direct Impacts

Second-order factor: Confirmed: The impacts of all four factors of human asset specificity (second-order factor) are positive and significant. Unique software knowledge (0.21, $t=19.7$) contributes a little less to the determination of the human asset specificity than unique process knowledge (0.36, $t=21.1$), social collaboration among IS professionals (0.42, $t=27.8$), and social collaboration between IS professionals and users/clients (0.35, $t=25.6$).

Hypotheses 1a-c: Confirmed: The path coefficients between the human asset specificity and the three comparative advantages of insourcing in (a) production costs (0.21, $t=3.46$), (b) transaction costs (0.09, $t=1.34$) and (c) strategic contribution (0.14, $t=2.24$) reveal positive values and are significant. The influence on in-house production cost advantages turns out to be the strongest.

Hypotheses 2a and b: Confirmed: The path coefficients between the extent of in-house production cost advantages and the attitude towards the outsourcing of IS functions (-0.36, $t=5.00$) as well as the degree of outsourcing (-0.11, $t=1.32$) each reveal a negative value and are significant. The influence on the attitudes is much stronger.

Hypotheses 3a and b: Confirmed: The path coefficients between the extent of in-house transaction cost advantages and the attitude towards the outsourcing of an IS function (-0.13, $t=1.91$) and the degree of outsourcing (-0.12, $t=1.61$) each reveal a negative value and are significant.

Hypotheses 6a and b: Confirmed: The path coefficients between the extent of in-house advantages in the strategic contribution and the attitude towards outsourcing (-0.21, $t=3.83$) as well as the degree of outsourcing (-0.12, $t=1.84$) both reveal a negative value and are significant. The influence on attitude is stronger.

Hypothesis 4c: Confirmed: The path coefficient between comparative advantages in the trustworthiness of in-house IS workers and comparative in-house production cost advantages (0.18, $t=2.72$) reveals a positive value and is significant.

Hypothesis 5c: Confirmed: The path coefficient between comparative advantages in the intrinsic motivation of in-house IS workers and comparative in-house production cost advantages (0.26, $t=3.35$) reveals a positive value and is significant.

Hypothesis 8: Confirmed: The path coefficient between the attitude towards the outsourcing of an IS function and the degree of outsourcing is positive and significant (0.28, $t=3.85$).

- Moderator Effects

Hypothesis 4a: Rejected: Other than expected, the path coefficient between the interaction term *human asset specificity x trustworthiness* and the extent of internal transaction cost advantages showed a negative rather than positive sign, but was found to be non significant (-0.06, $t=0.73$).

Hypothesis 4b: Confirmed: The path coefficient between the interaction term *human asset specificity x trustworthiness* and comparative in-house advantages in the generation of a strategic impact is positive and significant (0.12, $t=1.90$).

Hypothesis 5a: Confirmed: The path coefficient between the interaction term *human asset specificity x intrinsic motivation* on the extent of internal transaction cost advantages is positive and significant (0.18, $t=1.75$).

Hypothesis 5b: Rejected: Other than expected, the path coefficient between the interaction term *human asset specificity x intrinsic motivation* and comparative in-house advantages in the generation of a strategic impact is negligible small and non significant (0.03, $t=0.47$).

Hypotheses 7a und b: Confirmed: The coefficient between the interaction term *human asset specificity x capital shares with the external vendor* and comparative in-house transaction cost advantages (-0.10, t=1.53) as well as comparative in-house advantages in the generation of a strategic impact (-0.14, t=2.7) are both negative and significant.

4 DISCUSSION OF THE RESULTS AND IMPLICATIONS

In summary, the theoretical framework, by and large, was substantiated by our empirical data. Only two of the moderator effects did not stand the test and there are a number of substantial differences in the strength with which certain relationships are supported. In the following the findings will be discussed in more detail.

First of all, the overall attitude of the CIOs towards the outsourcing of application services is most strongly affected by perceived differences in the production costs between insourcing and outsourcing. This indicates that production cost savings represent one of the most important criteria in the sourcing decision (Dibbern, Heinzl & Leibbrandt, 2003; Lacity & Willcocks, 1998; McLellan, Marcolin & Beamish, 1995). Consistent with previous empirical studies, transaction costs play a much smaller role than production costs (Ang & Straub, 1998; Dibbern, Heinzl & Leibbrandt, 2003). This may be explained by the fact that the measurement and forecast of transaction costs is much more difficult than quantifying production costs (Barthélemy, 2001). Moreover, it is remarkable that strategic considerations play quite a significant role in the sourcing decision. This reaffirms both the results of case study research that discovered that some companies outsource IS functions for strategic intents (DiRomualdo & Gurbaxani, 1998; McLellan, Marcolin & Beamish, 1995) and works that emphasize strategic risks of outsourcing (Duncan, 1998; Earl, 1996).

Another interesting point shows up when comparing the impact of the three comparative factors (i.e., production, transaction, and strategic) on the current attitude towards the outsourcing of IS functions and the actual degree of outsourcing. Perceived differences in the production costs and the strategic contribution between insourcing and outsourcing affect the overall attitude much stronger than the current degree of outsourcing. This indicates a certain level of discrepancy between the actual sourcing behavior and the current overall assessment by the IS management. It further implies that the economic and strategic objectives associated with the sourcing decision may not always be achieved. This view is substantiated by the fact the relationship between attitudes and current degree of outsourcing came out to be significant and in the hypothesized direction. But the strength of that link might have been expected to be even higher if one believes that a CIOs evaluative appraisal of IS outsourcing should be reflected by the current sourcing practices of her/his organization. Instead, we might conclude that the exertion of influence of the CIO on the actual sourcing behavior is more limited.

Also informative are the circumstances under which the insourcing of the development and maintenance of application software produces lower production costs, transaction costs and a higher strategic contribution in comparison to outsourcing. The results show that insourcing reveals advantages in all three objectives if application software services require a high degree of specific investments into the human assets. The development and the maintenance of applications is viewed as more specific if it requires a higher degree of knowledge of firm-specific business processes and a higher level of social collaboration among the workers involved in the work process. Less important is the knowledge of firm-specific application software.

The importance of user participation and social interaction in IS development has already been emphasized in other works (e.g., Hirschheim, Klein & Lyytinen, 1996). The actual economic impact of these “soft factors”, however, has rarely been substantiated. In this respect, the presented results can also be considered as a contribution to the understanding of the production and cost function of the development and maintenance of application software.

This impression is reinforced by our findings of the influence of two other “soft factors” on differences of production costs. It is shown that internal advantages in the intrinsic motivation and trustworthiness of the employees contribute to the cost advantages of insourcing. Furthermore, it is instructive to note that the outsourcing of specific application services does not necessarily lead to increased transaction costs or the loss of strategic potentials. The risk of increased transaction costs is especially high if in-house IS workers possess a higher level of intrinsic motivation. The perceived strategic risks increase if in-house IS workers are assessed more trustworthy. However, if the personnel of external vendors is seen as having advantages in both intrinsic motivation and trustworthiness, the risks associated with outsourcing application services that require firm specific human assets are significantly lower and hence outsourcing becomes more attractive. Furthermore, outsourcing risk may also be reduced by capital shares in the external vendor. This confirms the thesis that property rights may reduce the risk of opportunistic behavior.

Consequently, outsourcing of application software services may not always imply increased standardization. Shared ownership arrangement as well as strong social competencies of the vendor personnel may partially offset the disadvantages in transaction costs and strategic impact when outsourcing custom tailored application services.

Overall, it can be stated that the question regarding the sourcing of application software services is a multidimensional decision problem. Companies facing this decision should consider a cost calculation including production and transaction costs as well as the strategic implications of the sourcing decision. It is recommended that firms perform appropriate analyses concerning the level of uniqueness of requirements for the development and maintenance of application software as well as the related business processes. It seems especially important to learn more about the kinds of knowledge which are necessary and how this knowledge is generated. Moreover, it is important to analyze the behavioral characteristics of the internal and external task owners in order to put the company’s economic and strategic IS objectives into practice.

Finally, it should be noted that although the findings of this study emerged from a well grounded statistical analysis, it is not necessarily a complete causal analysis. Rather, it is a snapshot of the sourcing behavior of German companies reflecting certain patterns. Also the generalizability of the results is limited. For example, this research has not addressed potential industry or functional differences. This provides avenues for future research on the determinants of IS outsourcing. In closing, it seems promising for future researchers to further elaborate on the integration of different theoretical lenses. This research has shown that integrating different theoretical lenses in a complementary manner can lead to a more informed picture of the IS sourcing behavior of organizations.

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