Comparing IT Supplier Selection Criteria in Single- Versus Multi-Sourcing Constellations: An Empirical Study

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ABSTRACT

Although information technology (IT) outsourcing is widely applied by companies and has been intensively researched, there has been little scientific research on the differences in single- versus multi-sourcing constellations. Furthermore, linear extension of single-sourcing to multi-sourcing is limited, despite the fact that companies utilize multi-sourcing more frequently in recent times. This empirical research aims to increase the understanding of differences in single- versus multi-sourcing constellations based on the relevance of IT supplier selection criteria for application development and maintenance as well as infrastructure services. Based on a literature review, an empirical survey of sourcing professionals was conducted. Combined inferential and descriptive statistical analysis indicates a significant difference of the relevance of various IT supplier selection criteria in single- versus multi-sourcing constellations. The study reveals that criteria related to supplier-risk are more relevant in single-sourcing, while criteria related to price are dominant in multi-sourcing constellations.

Keywords

IT supplier selection, IT selection criteria, IT outsourcing, multi-sourcing, single-sourcing

INTRODUCTION

Information technology (IT) outsourcing has been intensively applied by corporations, and over the last two decades it has been widely investigated and discussed by scientific scholars (Currie and Willcocks, 1998; Dibbern, Goles, Hirschheim and Jayatilaka, 2004; Lacity and Willcocks, 1998; Oshri, Kotlarsky and Willcocks, 2011; Willcocks and Lacity, 1998). Research has focused on dyadic relationships between one client and one supplier (Bapna, Barua, Mani and Mehra, 2010), despite the fact that many corporations have moved to a more selective IT outsourcing approach, combining best-of-breed IT services from multiple suppliers (Bapna et al., 2010; Cohen and Young, 2006; Hakkenberg, Himmelreich, Ketterer and Woelders, 2011; Levina and Su, 2008; Oshri, Kotlarsky, Rottman and Willcocks, 2009; Oshri et al., 2011; Su and Levina, 2011). Thus, it can be observed that companies frequently enter into multi-sourcing rather than single-sourcing (dyadic client supplier relationships) constellations (Bapna et al., 2010). Multi-sourcing is defined as the blending of services from multiple company-internal and company-external suppliers in the pursuit of business goals (Cohen and Young, 2006). The major benefits generally attributed to multi-sourcing are reducing the risk of outsourcing failure, improving agility and adaptability, accessing specialized expertise and capabilities, as well as reducing costs (Bapna et al., 2010; Levina and Su, 2008; Su and Levina, 2011). Regarding the extrapolation of research findings from single-sourcing to multi-sourcing, Bapna et al. (2010, p.749) emphasize that "linear extensions of dyadic client-supplier IT outsourcing relationships are insufficient to capture the nuances of the multisourced environment." Thus, the purpose of this study is to increase the understanding of differences in single- versus multi-sourcing constellations.

Dibbern et al. (2004) describe two major stages in IT outsourcing: the decision process stage, encompassing why, what, and which issues of IT outsourcing, and the implementation phase, covering how and outcome-related aspects. In regards to "how to implement the sourcing decision", the supplier selection is one important dimension (Dibbern et al., 2004, p.6) and leads to our overall research question [RQ]:

Are there any differences in selecting IT suppliers in single- versus multi-sourcing constellations and, if so, what are they?

To answer this question, the researchers conducted an empirical survey of IT supplier selection criteria in single- versus multi-sourcing constellations. According to Grover, Cheon and Teng (1996) and Dibbern and Heinzl (2009), different information systems (IS) functions can be outsourced. Grover et al. (1996) differentiate five IS functions: applications development and maintenance (ADM), systems operations, telecommunications, end-user support, and systems planning and management. While systems planning and management possesses a strategic character and is overall IS management, including IT architecture, IT governance, etc., the remaining IS functions can be distinguished by two major characteristics (Beulen, Fenema and Currie, 2005). The IS function ADM is mainly project-driven, in contrast to the IS functions systems operations, telecommunications, and end-user support, which are of operational character. Those three can be summarized under the term infrastructure operations. Thus, we limited our research to the IS functions ADM and infrastructure (referred to in the following as INFRA). This choice is justified because of the opposed characteristics of these particular IS functions (see inter alia Beulen et al. (2005)).

This article aims to contribute to research on IT outsourcing in general and on multi-sourcing in particular in three ways. First, it illustrates IT supplier selection criteria that are derived from the literature and evaluated with sourcing practitioners; second, it reveals significant differences in the relevance of IT supplier selection criteria in single- versus multi-sourcing constellations; and, third, it derives and discusses particular IT supplier selection criteria that are significantly more relevant in single- or multi-sourcing constellations. This research also aims to help practitioners who are attempting IT supplier selection by providing an overview of IT supplier selection criteria and the differences to be considered in single- versus multi-sourcing constellations. In particular, practitioners can learn from this research which IT supplier selection criteria should get a higher weighting when performing supplier selection.

The remainder of this paper consists of five sections. The next section provides an overview of fundamental terms. Section three outlines the research design. Sections four and five present our analysis before we discuss and conclude in the final section.

FOUNDATION AND RELATED RESEARCH

Zorn and Campbell (2006) emphasize that in any field of research it is important to have a common understanding of basic terms. Thus, we provide an overview on single- versus multi-sourcing, IT supplier selection criteria, and different IS functions, as well as relevant prior research.

Since *multi-sourcing* (or multisourcing) is increasingly adopted by practitioners, scholarly researchers are focusing more and more on this phenomenon (Bapna et al., 2010). Recently, multi-sourcing received a lot of attention based on a book by Gartner Research (Charles, 2006). For this study, we apply the definition of Cohen and Young (2006, p.1), as suggested by other authors, including Levina and Su (2008), which describes multi-sourcing as "the disciplined provisioning and blending of business and IT services from the optimal set of internal and external suppliers in the pursuit of business goals." Multi-sourcing covers an optimal set of multiple suppliers that are frequently referred to as geographically disperse (Bapna et al., 2010). In contrast to multi-sourcing, *single-sourcing* has been investigated more thoroughly and describes a dyadic client-supplier relationship (Bapna et al., 2010; Dibbern et al., 2004; Treleven and Schweikhart, 1988).

When it comes to the implementation of sourcing decisions, Dibbern et al. (2004) describe three main activities: (1) selecting one (or more) supplier(s), (2) building and structuring the outsourcing relationship, and (3) managing the resulting relationship. For this research, we focus our efforts on the first activity and aim to investigate differences in supplier selection for single- versus multi-sourcing constellations. According to Dibbern et al. (2004), literature has been relatively sparse when considering the issue of how organizations actually choose IT suppliers. Although some researchers (please refer for example to (McFarlan and Nolan, 1995)) offer guidance on IT outsourcing selection criteria, the authors restrict their research mainly to dyadic client-supplier relationships and do not propose precise criteria. Further, they do not differentiate between supplier selection in single- versus multi-sourcing constellations nor between different IS functions.

In regards to IS functions, Grover et al. (1996, p.106) describe ADM as "systems analysis, design, and construction of application software and the accompanying software maintenance." In addition, ADM is mainly project-driven and requires a high degree of interaction (Beulen et al., 2005; Faraj and Sproull, 2000). In contrast, infrastructure operations—which include systems operations, telecommunications, and end-user support—can be described as a continuous service (Beulen et al., 2005; Grover et al., 1996). Beulen et al. (2005, p.135) define infrastructure operations as "preventative and remedial services that physically repair or optimize computing and communications hardware."

RESEARCH DESIGN

We have chosen a two-step research approach. First, we conducted an extensive literature review in order to identify the body of knowledge on supplier selection in general and to ascertain supplier selection criteria for IS functions in particular. Second, we performed an empirical survey of IT supplier selection criteria applied in single- versus multi-sourcing constellations. The IT supplier selection criteria derived in the first step built the basis for the survey in the second step.

Identification of supplier selection criteria

As a first step, we carried out a literature review according to vom Brocke et al. (2009) and identified the body of knowledge on IT supplier selection criteria. In our literature review we aimed to identify IT supplier selection criteria in the literature and therefore focused on research outcomes of previous research studies (Cooper, 1988). Therefore our perspective was neutral and our coverage representative (Cooper, 1988). As suggested by vom Brocke et al. (2009), our literature search process encompassed four phases: journal search, database search, keyword search, and backward/forward search. Each phase is composed of a search task and an evaluation task (Levy and Ellis, 2006). In this context, evaluation describes the process of limiting the number of articles to those relevant to the topic (vom Brocke et al., 2009). During the *journal search* phase, leading IS journals (please refer to Willcocks, Whitley and Avgerou (2008)) were identified and formed the basis for the *database search*, since Webster and Watson (2002) recommend querying scholarly databases in order to ensure that all top-tier journals are included in the literature search. Accordingly, the following databases were selected: EBSCOhost, Proquest, Emerald, Science Direct, and Web of Science. Those databases were queried by the following keywords during the *keyword search*: IT/IS supplier selection, IT/IS vendor selection, IT/IS outsourcing criteria, IT/IS sourcing criteria. All articles were evaluated and the relevant ones selected. As a last search step, we extended our literature search in order to identify articles that cite or have been cited in relevant ones (*forward and backward search*).

While analyzing the identified articles, we extracted all supplier selection criteria, removed redundancies, adjusted the wording, and derived a list of 32 IT supplier selection criteria. This literature-driven list was evaluated and condensed with sourcing practitioners in two steps. First, we compared our list with actually applied, real-life examples of IT supplier selection criteria lists. These were provided by representatives of four independent client organizations currently selecting IT suppliers for both ADM and infrastructure services. In a second step, we conducted expert interviews with sourcing practitioners in order to derive a relevant set of IT supplier selection criteria. Hence, we came up with a list of 15 IT supplier selection criteria along five dimensions as described in Table 1, which formed the basis for our survey questionnaire.

Dimension	ID	Criterion	Relevant literature
Supplier perception	01	Market reputation and reference clients	Gottschalk and Solli-Sæther, 2005; Grover, Cheon and Teng, 1994; Kern and Willcocks, 2000; Klepper, 1995; Michell and Fitzgerald, 1997; Willcocks, Lacity and Kern, 1999
	02	Financial stability and cash flow	Gottschalk and Solli-Sæther, 2005; Grover et al., 1994; Kern, 1997; McFarlan and Nolan, 1995; Willcocks et al., 1999
	03	Strategic alliances and partner relationships (network of potential supplier(s))	Currie and Willcocks, 1998; McFarlan and Nolan, 1995; Millar, 1994; Quinn, 1999
	04	Ease of cooperation (based on past experience and throughout selection process with potential supplier(s))	Choi and Kelemen, 1994; Dibbern, Winkler and Heinzl, 2008; Gulla and Gupta, 2009; Lacity and Willcocks, 1995; Oliver, 1990
Capability and offering	05	Industry expertise	Hirschheim and Lacity, 2000; Lee and Kim, 1999; Willcocks and Kern, 1998
	06	Business process specific expertise	Clark, Zmud and McCray, 1995; Hirschheim and Lacity, 2000; Michell and Fitzgerald, 1997; Willcocks and Kern, 1998

	07	Technological competence	Aubert, Dussault, Patry and Rivard, 1999; Grover et al., 1996; Karamouzis, 2008; McFarlan and Nolan, 1995; Michell and Fitzgerald, 1997; Quinn, 1999
	08	Methodological competence	Karamouzis, 2008; Willcocks et al., 1999
	09	Innovation potential (ability of potential supplier(s) to provide added value in regards to innovation)	Aubert et al., 1999; Grover et al., 1996; Kern, 1997; McLellan, Marcolin and Beamish, 1995
Organizational and strategic aspects	10	Global presence	Apte, Sobol, Hanaoka, Shimada, Saarinen, Salmela and Vepsalainen, 1997; Grover et al., 1996; Kern, 1997; Lacity and Willcocks, 1995; Michell and Fitzgerald, 1997; Millar, 1994; Quinn, 1999
	11	Fit (strategic, organizational and cultural)	Aubert et al., 1999; Kern, 1997; Millar, 1994; Quinn, 1999; Suhaimi, Hussin and Mustaffa, 2007
	12	Qualified and well trained staff	Aubert et al., 1999; Grover et al., 1996; Millar, 1994; Quinn, 1999; Suhaimi et al., 2007
	13	Employee attrition	Aubert et al., 1999; Grover et al., 1996; Millar, 1994; Willcocks and Kern, 1998
Legal concerns	14	Acceptance of legal guidelines (willingness of potential supplier(s) to accept, for example, a frame contract, benchmarking rules or audit rights)	Dibbern et al., 2004; Kern and Willcocks, 2000; Willcocks et al., 1999
Financial aspects	15	Competitive pricing	Gottschalk and Solli-Sæther, 2005; Grover et al., 1994; Grover et al., 1996; Lacity and Willcocks, 1995; Michell and Fitzgerald, 1997; Millar, 1994; Pinnington and Woolcock, 1997; Suhaimi et al., 2007

Table 1: Overview of IT supplier selection criteria

Empirical survey

Based on the above identified IT supplier selection criteria, we conducted an empirical survey of sourcing practitioners as a second step. We set up a questionnaire encompassing the 15 IT supplier selection criteria along the two dimensions single- versus multi-sourcing and the two IS functions ADM and INFRA. The questionnaire was complemented by characteristics of the survey respondents such as industry, number of employees, revenues, sourcing behavior, etc. In order to gauge the relevance of each IT supplier selection criterion, we applied, as suggested for example by Matell and Jacoby (1972), a Likert-scale from one to seven, with one representing "not important at all" and seven representing "very important".

This questionnaire was handed out to 144 IT sourcing professionals at the fifth "IT Operations Day" in Frankfurt (Germany)—a leading congress of IT professionals in the German-speaking region. The topic of the chosen congress was "professional IT sourcing" with a special focus on single- and multi-sourcing strategies. By selecting this congress, the researchers were able to ensure that a relevant set of subject matter experts (Lawshe, 1975) were queried. The return rate of fully exploitable questionnaires was 28.5 percent.

For software support, we utilized SPSS version 19. Our statistical analysis was twofold. On the one hand, we applied a Wilcoxon signed-rank test for inferential statistical analysis (Bühl, 2009), and on the other hand, we conducted a box plot analysis. In regards to descriptive statistical analysis, box plots are utilized to describe and compare robust, nominal data with the help of the following values: median, inter-quartile range, range, minimum, and maximum (Frigge, Hoaglin and Iglewicz, 1989). Robust statistics means that the specific instruments are more resistant (robust) to the presence of outliers than the

classical statistics based on the normal distribution (Massart, Smeyers-Verbeke, Capron and Schlesier, 2005). Box plots generally help to visualize and structure numerical data in order to show tendencies and indicate outliers within defined groups. According to McGill, Tukey and Larsen (1978), such plots are widely used in exploratory data analysis and help in preparing visual summaries for statisticians and non-statisticians alike.

In order to ensure overall reliability of the survey, we applied Cronbach's alpha (α) test (Cronbach, 1951; Reynaldo and Santos, 1999). Cronbach's alpha test served to indicate the internal consistency and the reliability of the Likert-scale-based survey and helped to validate the psychometric score of the sample. Overall, nine Cronbach's alpha tests were conducted to indicate the reliability of the whole set of questions based on the following equation:

$$\alpha = \frac{k\left(\overline{\mathrm{cov}} / \overline{\mathrm{var}}\right)}{1 + (k-1)\left(\overline{\mathrm{cov}} / \overline{\mathrm{var}}\right)}$$

In this context, reliability can be defined mathematically as the fraction of the variability in the responses to the survey that is the result of differences in the respondents; that means that answers to a reliable questionnaire will differ because the respondents have different opinions and not because the survey is confusing or has multiple interpretations (Bühl, 2009). The computation of Cronbach's alpha values in SPSS is based on the number of question items on the survey (k) and the ratio of the average inter-item covariance to the average item variance (Bühl, 2009). Table 2 illustrates the Cronbach's alpha values for our survey. Since we identified 15 IT supplier selection criteria, the items per IS function make a sum of 15, and 30 for both IS functions. This adds up to 60 items in total for the survey.

As Nunnally (1978) suggests, Cronbach's alpha values indicate an acceptable level of internal consistency if $\alpha > 0.7$. Accordingly, the internal consistency of the conducted survey is acceptable in all nine cases. As the internal consistency of the survey is given, the collected data can be analyzed in the next step.

Cronbach's alpha (α)	**Single-sourcing**	**Multi-sourcing**	**Overall**
ADM	0.769 (15 items)	0.791 (15 items)	0.834 (30 items)
INFRA	0.851 (15 items)	0.858 (15 items)	0.906 (30 items)
Overall	0.839 (30 items)	0.897 (30 items)	0.921 (60 items)

Table 2: Cronbach's alpha values

INFERENTIAL STATISTICAL ANALYSIS

As the dataset was collected using a seven-point Likert-scale, it needs to be treated as ordinal data (Bühl, 2009). Therefore, a non-parametric statistical hypothesis test was used to evaluate the related samples and to shed light on the compared, central tendencies. The Wilcoxon two-sided signed-rank test (matched pairs) was chosen due to the fact that the data are on an ordinal scale and the sample cannot be assumed to be normally distributed. We consider a difference between the two samples as significant if the corresponding p-value is smaller than 0.05 (95%).

Based on our prior research on single- and multi-sourcing and, in particular, on the statement of Bapna et al. (2010) that linear extension of single-sourcing fails to capture the nuances of multi-sourcing, we derived our null and alternative hypotheses. The following null hypothesis (H_0) was defined (H_0: θ = Median (X1−X2) = 0):

*H_0: The median in regards to relevance of a single-sourcing criterion **does not** differ significantly from the median of its counterpart in multi-sourcing.*

Consequently, the corresponding alternative hypothesis (H_A) was defined as (H_A: $\theta < 0$ or $\theta > 0$):

*H_A: The median in regards to relevance of a single-sourcing criterion **does** differ significantly from the median of its counterpart in multi-sourcing.*

For each observed pair (supplier selection criteria in a single- versus multi-sourcing context), the difference ($d_i = x_{i1} - x_{i2}$) and the absolute values were computed. All nonzero absolute differences were then sorted into ranks (ascending order). In the case of ties (equal values for the median), the average rank of the observations was used.

Two Wilcoxon signed-rank tests were conducted. Each IT supplier selection criterion was compared within single- and multi-sourcing environments. Furthermore, the characteristics of the selected criteria were analyzed along the two different IS functions ADM and INFRA to be more precise with the survey and analysis.

Case #	ADM 01	ADM 02	ADM 03	ADM 04	ADM 05	ADM 06	ADM 07	ADM 08	ADM 09	ADM 10	ADM 11	ADM 12	ADM 13	ADM 14	ADM 15
Matched pairs	Multi-sourcing ADM market reputation and reference clients Single-sourcing ADM market reputation and reference clients	Multi-sourcing ADM financial stability & cash flow Single-sourcing ADM financial stability & cash flow	Multi-sourcing ADM strategic alliances and partner relationships Single-sourcing ADM strategic alliances and partner relationships	Multi-sourcing ADM ease of cooperation Single-sourcing ADM ease of cooperation	Multi-sourcing ADM industry expertise Single-sourcing ADM industry expertise	Multi-sourcing ADM business process specific expertise Single-sourcing ADM business process specific expertise	Multi-sourcing ADM technological competence Single-sourcing ADM technological competence	Multi-sourcing ADM methodological competence Single-sourcing ADM methodological competence	Multi-sourcing ADM innovation potential Single-sourcing ADM innovation potential	Multi-sourcing ADM global presence Single-sourcing ADM global presence	Multi-sourcing ADM fit Single-sourcing ADM fit	Multi-sourcing ADM qualified and well trained staff Single-sourcing ADM qualified and well trained staff	Multi-sourcing ADM employee attrition Single-sourcing ADM employee attrition	Multi-sourcing ADM acceptance of legal guidelines Single-sourcing ADM acceptance of legal guidelines	Multi-sourcing ADM competitive pricing Single-sourcing ADM competitive pricing
Z	-2.599[a]	-3.613[a]	-1.987[a]	-1.121[a]	-3.375[a]	-3.290[a]	-.339[b]	-.407[a]	-1.038[a]	-2.007[a]	-4.003[a]	-1.498[a]	-3.268[b]	-3.588[a]	-2.658[b]
Asymp. Sig. (2-tailed)	.009**	.000***	.047*	.262	.001***	.001***	.735	.684	.299	.045*	.000***	.134	.001***	.000***	.008**

Legend: *** significant at 99.9%; **significant at 99%; *significant at 95% [a] Based on positive ranks; [b] Based on negative ranks

Table 3: Test statistics of Wilcoxon signed-rank test for ADM

As Table 3 indicates, a Wilcoxon test was conducted to evaluate if respondents rated single-sourcing criteria significantly differently than multi-sourcing criteria within ADM. The results indicate a significant difference for the ADM cases #01, #02, #03, #05, #06, #10, #11, #13, #14, and #15, as $p < 0.05$. In these cases, H_0 needs to be rejected.

Likewise, a Wilcoxen test was conducted for the IS function infrastructure (Table 4).

Case #	INFRA 01	INFRA 02	INFRA 03	INFRA 04	INFRA 05	INFRA 06	INFRA 07	INFRA 08	INFRA 09	INFRA 10	INFRA 11	INFRA 12	INFRA 13	INFRA 14	INFRA 15
Matched pairs	Multi-sourcing INFRA market reputation and reference clients Single-sourcing INFRA market reputation and reference clients	Multi-sourcing INFRA financial stability & cash flow Single-sourcing INFRA financial stability & cash flow	Multi-sourcing INFRA strategic alliances and partner relationships Single-sourcing INFRA strategic alliances and partner relationships	Multi-sourcing INFRA ease of cooperation Single-sourcing INFRA ease of cooperation	Multi-sourcing INFRA industry expertise Single-sourcing INFRA industry expertise	Multi-sourcing INFRA business process specific expertise Single-sourcing INFRA business process specific expertise	Multi-sourcing INFRA technological competence Single-sourcing INFRA technological competence	Multi-sourcing INFRA methodological competence Single-sourcing INFRA methodological competence	Multi-sourcing INFRA innovation potential Single-sourcing INFRA innovation potential	Multi-sourcing INFRA global presence Single-sourcing INFRA global presence	Multi-sourcing INFRA fit Single-sourcing INFRA fit	Multi-sourcing INFRA qualified and well trained staff Single-sourcing INFRA qualified and well trained staff	Multi-sourcing INFRA employee attrition Single-sourcing INFRA employee attrition	Multi-sourcing INFRA acceptance of legal guidelines Single-sourcing INFRA acceptance of legal guidelines	Multi-sourcing INFRA competitive pricing Single-sourcing INFRA competitive pricing
Z	-3.668[a]	-4.538[a]	-1.332[a]	-2.351[a]	-2.170[a]	-1.652[a]	-.293[a]	-1.410[b]	-.706[a]	-.770[a]	-1.669[a]	-.992[b]	-.925[a]	-.222[a]	-2.932[b]
Asymp. Sig. (2-tailed)	.000***	.000***	.183	.019*	.030*	.099	.769	.159	.480	.441	.095	.321	.355	.824	.003**
Legend: *** significant at 99.9%; **significant at 99%; *significant at 95% [a] Based on positive ranks; [b] Based on negative ranks															

Table 4: Test statistics of Wilcoxon signed-rank test for INFRA

The results indicate a significant difference for the INFRA cases #01, #02, #04, #05, and #15, as $p < 0.05$. In these cases, H_0 needs to be rejected.

Three cases and their corresponding IT supplier selection criteria are highly significant (at least at 99%) in both IS functions (ADM and INFRA). Therefore, they are subject to further analysis in the next section. The cases/ IT supplier selection criteria are:

- Case #01: market reputation and reference clients
- Case #02: financial stability and cash flow
- Case #15: competitive pricing

DESCRIPTIVE STATISTICAL ANALYSIS

Under the assumption of the internal consistency of the conducted survey (Cronbach's alpha) and based on significant differences within the described matched pairs (Wilcoxon signed-rank test), a box plot analysis was conducted to visualize the findings. To illustrate and compare the findings with robust parameters, box plots were generated for the cases #01, #02, and #15. The following figures (1, 2, and 3) illustrate those box plots.

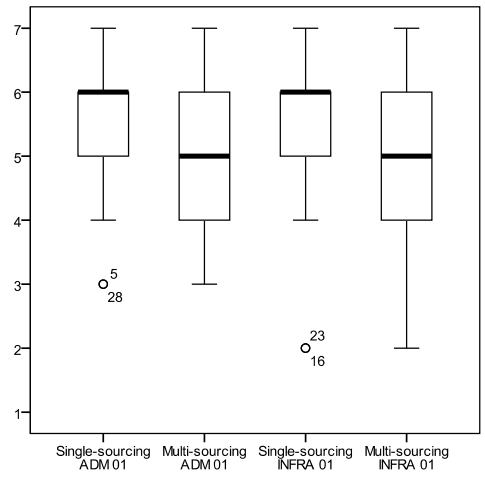

Figure 1: Box plots for case #01 – market reputation and reference clients

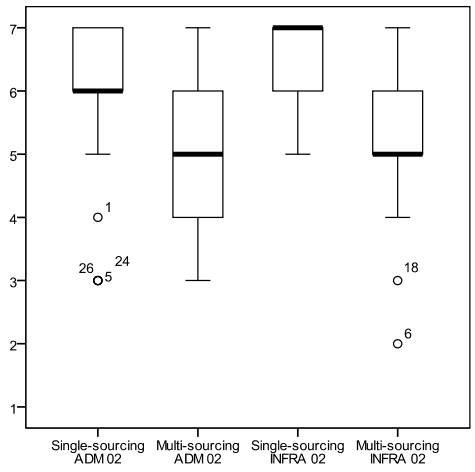

Figure 2: Box plots for case #02 – financial stability and cash flow

Figure 1 gives an overview of the IT supplier selection criterion "market reputation and reference clients" (case #01 ADM and INFRA). While the median within both single-sourcing constellations (ADM and INFRA) lies on the number 6, the criterion seems to be less important in multi-sourcing environments. This finding indicates that supplier-risk related criteria—under which we subsume criteria that indicate towards potential outsourcing failure (such as "market reputation and reference clients")—play a more important role in single-sourcing constellations than in multi-sourcing constellations. This is supported by Figure 2, which illustrates the box plots for the criterion "financial stability and cash flow" (case #02 ADM and INFRA), another supplier-risk related selection criterion. This in turn relates to the opportunity for multi-sourcing to reduce the exposure to supply-side risks, as stated by Bapna et al. (2010).

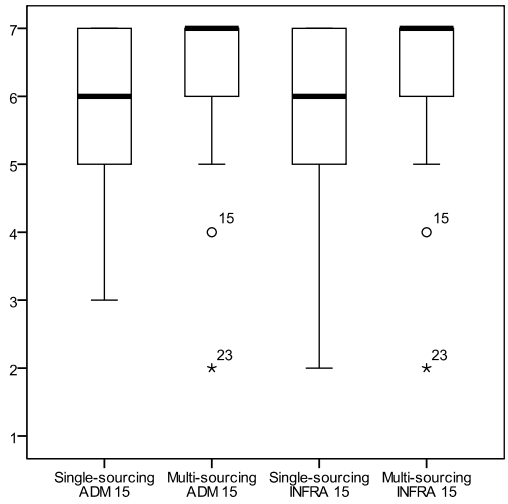

Figure 3: Box plots for case #15 – competitive pricing

In regards to the IT supplier selection criterion "competitive prices" (case #15 ADM and INFRA), the responses of the experts draw a clear picture. Figure 3 compares the criterion for ADM and INFRA in both single- and multi-sourcing constellations. While "competitive prices" still play a very important role in single-sourcing, the median of the answers concerning multi-sourcing lies on the maximum of the scale (i.e. 7). This means that more than 50% of the survey respondents assigned the highest relevance to "competitive prices" in a multi-sourcing context. This finding indicates that one major driver for applying multi-sourcing is that practitioners strive for "competitive prices" by generating competition

between multiple suppliers with regard to prices. This supports, for example, Porter (1985, p.106) who claimed, in regards to improving the cost position, that companies should keep "the number of sources sufficient to ensure competition".

DISCUSSION AND CONCLUSION

This article presents findings from an empirical research study conducted with sourcing practitioners and aims to contribute to the body of knowledge in the area of IT outsourcing in general and the differences of single- versus multi-sourcing in particular. It is in response to the fact that companies have moved towards multi-sourcing and that current literature lacks depth in this regard. The basis for an empirical survey builds a thorough literature review of IT supplier selection criteria. By employing sourcing practitioners to evaluate the literature-driven set of criteria, a final list of 15 relevant IT supplier selection criteria along five dimensions was derived and utilized for the empirical survey. This empirical survey exemplifies that for IS function ADM, the relevance of 10 out of 15 IT supplier selection criteria is significantly different in single- versus multi-sourcing constellations. This is also true for 5 out of 15 IT supplier selection criteria for the IS function INFRA. Yet, we see differences between the ADM and INFRA results. For example, case #13 (employee attrition) is in ADM significant at 99.9%; however, it is not at all significant in INFRA. This applies also for case #14 (acceptance of legal guidelines) and others. This indicates that in ADM the surveyed practitioners assign a significant difference to the respective IT supplier selection criteria between single- and multi-sourcing constellations, which they do not in INFRA. Only in three cases (#01, #02, and #15) do we observe a highly significant (at least 99%) difference of the relevance between single- and multi-sourcing constellations across both ADM and INFRA. For cases #01 and #02, this is related to mitigation of supply-side risks and seems to be more important in single-sourcing, while for case #15 this is related to prices and is more important in multi-sourcing.

Hence, the theoretical contribution of this article is threefold. First, the article illustrates IT supplier selection criteria based on an extensive literature review and evaluation with practitioners; second, it reveals empirical significant differences between single- and multi-sourcing IT supplier selection criteria; and, third, it exemplifies that criteria in regards to supply-side risks are more relevant in single-sourcing and cost-driven criteria are more relevant in multi-sourcing environments. Therefore, the article targets the following research question:

> *Are there any differences in selecting IT suppliers in single- versus multi-sourcing constellations and, if so, what are they?*

Furthermore, this research also aims to help practitioners who are asked to select IT suppliers either in a single- or multi-sourcing context by providing a comprehensive list of IT supplier selection criteria and corresponding literature support as well as recommendations in regards to relevance. While we identified numerous IT supplier selection criteria in the literature, the evaluation performed by sourcing experts gives other practitioners a list of really relevant criteria. Further, depending on the sourcing context (single- versus multi-sourcing), this research provides practitioners with help in regards to the weighting of individual supplier selection criteria. In the case of selecting one single supplier, we would recommend emphasizing supply-risk related selection criteria and therefore allocating a higher weight to these criteria. Consequently, in regards to multi-sourcing we would recommend allocating more weight to price-related selection criteria.

Certainly, this research is also beset with limitations. One limitation, for example, is the focus on the German-speaking congress when conducting the empirical survey. However, those attending the congress can be characterized as being knowledgeable about IT outsourcing in general and single- as well as multi-sourcing in particular. In this regards, further research might build upon the presented research design and apply it to other regions. Another limitation might be the focus on ADM and INFRA. Yet, the researchers have good arguments to separate these two IS functions. Future research might broaden this and, for example, include the sourcing of business processes or knowledge processes. Finally, further research on the difference between single- and multi-sourcing could investigate why those differences in relevance occur.

REFERENCES

1. Apte, U.M., Sobol, M.G., Hanaoka, S., Shimada, T., Saarinen, T., Salmela, T. and Vepsalainen, A.P.J. (1997) IS outsourcing practices in the USA, Japan and Finland: a comparative study, *Journal of Information Technology*, 12, 289–304.
2. Aubert, B.A., Dussault, S., Patry, M. and Rivard, S. (1999) Managing the risk of IT outsourcing, *Proceedings of the 32nd Annual Hawaii International Conference on System Sciences*.

3. Bapna, R., Barua, A., Mani, D. and Mehra, A. (2010) Cooperation, coordination, and governance in multisourcing: an agenda for analytical and empirical research, *Information Systems Research*, 21, 4, 785–795.
4. Beulen, E., Fenema, P.V. and Currie, W. (2005) From application outsourcing to infrastructure management: extending the offshore outsourcing service portfolio, *European Management Journal*, 23, 2, 133–144.
5. Bühl, A. (2009) PASW 18. Einführung in die moderne Datenanalyse, Pearson Studium, München.
6. Charles, R.N. (2006) Multisourcing: moving beyond outsourcing to achieve growth and agility by Linda Cohen & Allie Young, *Journal of Applied Management and Entrepreneurship*, 11, 4, 101.
7. Choi, C.J. and Kelemen, M. (1994) Generic cultural competencies: managing cooperatively across cultures, Dartmouth Publishers, London.
8. Clark, T.D., Zmud, R.W. and McCray, G.E. (1995) The outsourcing of information services: transforming the nature of business in the information industry, *Journal of Information Technology*, 10, 4, 221–237.
9. Cohen, L.R. and Young, A. (2006) Multisourcing: moving beyond outsourcing to achieve growth and agility, Harvard Business School Press, Boston, MA.
10. Cooper, H.M. (1988) Organizing knowledge syntheses: a taxonomy of literature reviews, *Knowledge in Society*, 1, 104–126.
11. Cronbach, L.J. (1951) Coeffiecient alpha and the internal structure of tests, *Psychometrika*, 16, 297–334.
12. Currie, W.L. and Willcocks, L.P. (1998) Analysing four types of IT sourcing decisions in the context of scale, client/supplier interdependency and risk mitigation, *Information Systems Journal*, 8, 2, 119–143.
13. Dibbern, J., Goles, T., Hirschheim, R. and Jayatilaka, B. (2004) Information systems outsourcing: a survey and analysis of the literature, *SIGMIS Database*, 35, 4, 6–102.
14. Dibbern, J. and Heinzl, A. (2009) Outsourcing of information systems functions in small and medium sized enterprises: a test of a multi-theoretical model, *Business & Information Systems Engineering*, 1, 101–110.
15. Dibbern, J., Winkler, J. and Heinzl, A. (2008) Explaining variations in client extra costs between software projects offshored to India, *MIS Quarterly*, 32, 2, 333–366.
16. Faraj, S. and Sproull, L. (2000) Coordinating expertise in software development teams, *Management Science*, 46, 12, 1154–1568.
17. Frigge, M., Hoaglin, D.C. and Iglewicz, B. (1989) Some implementations of the boxplot, *American Statistician*, 43, 1, 50–54.
18. Gottschalk, P. and Solli-Sæther, H. (2005) Critical success factors from IT outsourcing theories: an empirical study, *Industrial Management & Data Systems*, 105, 6, 685–702.
19. Grover, V., Cheon, M.J. and Teng, J.T.C. (1994) A descriptive study on the outsourcing of information systems functions, *Information & Management*, 27, 1, 33–44.
20. Grover, V., Cheon, M.J. and Teng, J.T.C. (1996) The effect of service quality and partnership on the outsourcing of information systems functions, *Journal of Management Information Systems*, 12, 4, 89–116.
21. Gulla, U. and Gupta, M. (2009) Deciding information systems (IS) outsourcing: a multi-criteria hierarchical approach, *VIKALPA*, 34, 2, 25–40.
22. Hakkenberg, M., Himmelreich, H., Ketterer, H. and Woelders, F. (2011) Shared KPIs in multivendor IT outsourcing, *IT Advantage,* February, 16–19.
23. Hirschheim, R.A. and Lacity, M.C. (2000) The myths and realities of information technology insourcing, *Communications of the ACM*, 43, 2, 99–107.
24. Karamouzis, F. (2008) How to use a vendor evaluation model to standardize IT services provider selections, Gartner Research, Stamford, CT.
25. Kern, T. (1997) The gestalt of an information technology outsourcing relationship: an exploratory analysis, *Proceedings of the 18th International Conference on Information Systems*, Atlanta, Georgia.
26. Kern, T. and Willcocks, L.P. (2000) Contract, control and presentation in IT outsourcing: research in 13 UK organizations, *Journal of Global Information Management*, 8, 4, 15–29.
27. Klepper, R. (1995) The management of partnering development in I/S outsourcing, *Journal of Information Technology*, 10, 4, 249–258.
28. Lacity, M.C. and Willcocks, L.P. (1995) Interpreting information technology sourcing decisions from a transaction cost perspective: findings and critique, *Accounting, Management and Information Technologies*, 5, 3, 203–244.
29. Lacity, M.C. and Willcocks, L.P. (1998) An empirical investigation of information technology sourcing practices: lessons from experience, *MIS Quarterly*, 22, 3, 363–408.
30. Lawshe, C.H. (1975) A quantitative approach to content validity, *Personnel Psychology*, 28, 4, 563–575.
31. Lee, J.-N. and Kim, Y.-G. (1999) Effect of partnership quality on IS outsourcing success: conceptual framework and empirical validation, *Journal of Management Information Systems*, 15, 4, 29–61.

32. Levina, N. and Su, N. (2008) Global multisourcing strategy: the emergence of a supplier portfolio in services offshoring, *Decision Sciences*, 39, 3, 541–570.
33. Levy, Y. and Ellis, T.J. (2006) A systems approach to conduct an effective literature review in support of information systems research, *Informing Science*, 9, 181–212.
34. Massart, D.L., Smeyers-Verbeke, J., Capron, X. and Schlesier, K. (2005) Visual presentation of data by means of box plots, *LC-GC Europe*, 18, 2, 84–89.
35. Matell, M.S. and Jacoby, J. (1972) Is there an optimal number of alternatives for Likert-scale items? Effects of testing time and scale properties, *Journal of Applied Psychology*, 56, 6, 506–509.
36. McFarlan, F.W. and Nolan, R.L. (1995) How to manage an IT outsourcing alliance, *Sloan Management Review*, 36, 2, 9–23.
37. McGill, R., Tukey, J.W. and Larsen, W.A. (1978) Variations of box plots, *American Statistician*, 32, 1, 12–16.
38. McLellan, K.L., Marcolin, B.L. and Beamish, P.W. (1995) Financial and strategic motivations behind IS outsourcing, *Journal of Information Technology*, 10, 299–321.
39. Michell, V. and Fitzgerald, G. (1997) The IT outsourcing market-place: vendors and their selection, *Journal of Information Technology*, 12, 3, 223–237.
40. Millar, V. (1994) Outsourcing trends, *Proceedings of the Outsourcing, Cosourcing and Insourcing Conference*, University of California, Berkeley.
41. Nunnally, J.C. (1978) Psychometric theory, McGraw-Hill, New York, NY.
42. Oliver, C. (1990) Determinants of interorganizational relationships: integration and future directions, *Academy of management review*, 15, 2, 241–265.
43. Oshri, I., Kotlarsky, J., Rottman, J.W. and Willcocks, L.P. (2009) Global sourcing: recent trends and issues, *Information Technology & People*, 22, 3, 192–200.
44. Oshri, I., Kotlarsky, J. and Willcocks, L.P. (2011) The handbook of global outsourcing and offshoring, Palgrave Macmillan, Basingstoke.
45. Pinnington, A. and Woolcock, P. (1997) The role of vendor companies in IS/IT outsourcing, *International Journal of Information Management*, 17, 3, 199–210.
46. Porter, M.E. (1985) Competitive advantage, Free Press, New York, NY.
47. Quinn, J.B. (1999) Strategic outsourcing: leveraging knowledge capabilities, *Sloan Management Review*, 40, 4, 9–21.
48. Reynaldo, J. and Santos, A. (1999) Cronbach's alpha: a tool for assessing the reliability of scales, *Journal of Extension*, 37, 2, 2–5.
49. Su, N. and Levina, N. (2011) Global multisourcing strategy: integrating learning from manufacturing into IT service outsourcing, *IEEE Transactions on Engineering Management,* 58, 4, 717–729.
50. Suhaimi, M.A., Hussin, H. and Mustaffa, M. (2007) Information systems outsourcing: motivations and the implementation strategy in a Malaysian bank, *Business Process Management Journal*, 13, 5, 644–661.
51. Treleven, M. and Schweikhart, S.B. (1988) A risk/benefit analysis of sourcing strategies: single vs. multiple sourcing, *Journal of Operations Management*, 7, 4, 93–114.
52. vom Brocke, J., Simons, A., Niehaves, B., Riemer, K., Plattfaut, R. and Cleven, A. (2009) Reconstructing the giant: on the importance of rigour in documenting the literature search process, *Proceedings of the 17th European Conference on Information Systems (ECIS)*.
53. Webster, J. and Watson, R.T. (2002) Analyzing the past to prepare for the future: writing a literature review, *MIS Quarterly*, 26, 2, xiii–xxiii.
54. Willcocks, L., Whitley, E.A. and Avgerou, C. (2008) The ranking of top IS journals: a perspective from the London School of Economics, *European Journal of Information Systems*, 17, 2, 163–168.
55. Willcocks, L.P. and Kern, T. (1998) IT outsourcing as strategic partnering: the case of the UK Inland Revenue, *European Journal of Information Systems*, 7, 1, 29–45.
56. Willcocks, L.P. and Lacity, M.C. (1998) Strategic sourcing of information systems, Wiley, Chichester.
57. Willcocks, L.P., Lacity, M.C. and Kern, T. (1999) Risk mitigation in IT outsourcing strategy revisited, *The Journal of Strategic Information Systems*, 8, 3, 285–314.
58. Zorn, T. and Campbell, N. (2006) Improving the writing of literature reviews through a literature integration exercise, *Business Communication Quarterly*, 69, 2, 172–183.