Summer 6-15-2016

SYNTHESIZING AND INTEGRATING RESEARCH ON IT-BASED VALUE CO-CREATION: A META-ANALYSIS

Markus Mandrella
University of Göttingen, mmandre@uni-goettingen.de

Simon Trang
University of Göttingen, strang@uni-goettingen.de

Lutz M. Kolbe
University of Goettingen, lkolbe@uni-goettingen.de

SYNTHESIZING AND INTEGRATING RESEARCH ON IT-BASED VALUE CO-CREATION: A META-ANALYSIS

Complete Research

Mandrella, Markus, University of Göttingen, Germany, mmandre@uni-goettingen.de

Trang, Simon, University of Göttingen, Germany, strang@uni-goettingen.de

Kolbe, Lutz M., University of Göttingen, Germany, lkolbe@uni-goettingen.de

Abstract

Recently, competition has shifted from the firm to the network level. Following this path, a growing stream in IT value research has emerged, aiming to understand how multiple firms create value through joint IT resources and capabilities. Despite the efforts made thus far, there are inconsistencies regarding construct definitions and divergent empirical findings. In this paper, we synthesize and integrate the body of knowledge on IT-based value co-creation. Drawing on the relational view, we first synthesize the existing empirical findings. The results of a meta-analysis of 72 studies encompassing 33,732 observations underline the importance of four sources of IT value: IT-based inter-organizational assets, IT-based knowledge sharing, IT-based complementary capabilities, and IT-based governance. A further moderator meta-analysis integrates divergent empirical findings in the literature. We find that objective measures dampen the relationship between inter-organizational IT and business value, while process-level measures and IT capabilities strengthen it. Moreover, we find evidence for higher value impacts in developing countries and an influence of inter-organizational relationship types. This study contributes by clarifying the IT-business value relationship and offers insights into sources of inconsistencies in IT-based value co-creation studies. By doing so, this paper lays a foundation for future research and theory development.

Keywords: Value co-creation; Relational view; IT value; Inter-organizational IT; Meta-analysis; Review.

1 Introduction

With advancements in information technology, research and practice continues to investigate how value can be derived from IT. This is becoming an even greater challenge as contemporary organizations cooperate more regularly in interfirm relationships. Inter-organizational systems (IOS), e.g., eBusiness systems, electronic data interchange (EDI), and supply chain systems, improve interfirm coordination and communication, increase innovation, and facilitate knowledge sharing (Chi and Holsapple, 2005). By combining such IT resources and developing interfirm capabilities, firms can co-create superior benefits and synergies (Grover and Kohli, 2012). However, this also results in new issues for IT value generation due to heterogeneous strategies, information systems, and capabilities that must be integrated among firms (Rai et al., 2012). Furthermore, it is difficult to capture and manage the distribution of co-created value (Kohli and Grover, 2008).

Research on IT value evaluates the economic impact of IT (Kohli and Grover, 2008). It is a research field of contradictory findings, which has come to be known as the productivity paradox of IT (Brynjolfsson, 1993). To explain these inconsistencies in research findings, much effort has been recently placed into synthesizing IT value research through literature reviews and framework development (Kohli and Grover, 2008; Masli et al., 2011; Melville et al., 2004; Schryen, 2010; Yassaee and

Mettler, 2015) as well as meta-analyses (Kohli and Devaraj, 2003; Sabherwal and Jeyaraj, 2015). At this point, researchers generally agree that IT does create value and that the contradictory findings have been a result of time lag and measurement issues as well as contextual and intermediate factors. Research on IT-based value co-creation investigates how multiple firms can create value via joint IT resources and capabilities, resulting in challenges such as the level of analysis, new value-creation mechanisms, and methodological approaches (Grover and Kohli, 2012). To address these challenges, research on IT-based value co-creation has been garnering increased attention. The importance of this research area has been addressed, for example, by recent publications on IT value (Kohli and Grover, 2008; Masli et al., 2011; Sabherwal and Jeyaraj, 2015) and the 2012 MIS Quarterly special issue on co-creating IT value (Grover and Kohli, 2012).

Despite the great efforts made in furthering IT-based value co-creation research during recent years, we observe several inconsistencies in the literature: First, although research has explored a wide variety of interfirm IT factors that contribute to business value, there exist various definitions and concepts. For example, many studies refer to IS integration but are related to different concepts, such as infrastructural (Saraf et al., 2007), information (Barua et al., 2004), or IT-enabled process integration (Rai et al., 2015). Second, there are contradictory findings regarding the impact of inter-organizational IT on business value, such as those concerning the value of investments in EDI systems (e.g., Dröge and Germain, 2000; Truman, 2000). Third, studies investigate business value at different levels of analysis and dimensions, diminishing the comparability of results. Fourth, different methodological and value-measurement approaches as well as underlying contextual factors, such as the type of relationship, might affect the studies' results. Such inconsistencies limit our understanding of how value can be co-created through IT. Therefore, a systematic analysis is necessary to explain how the structural characteristics of IT-based value co-creation studies influence business value. This will help to critically review past studies in this research field as well as facilitate future research and theory development.

The aim of this study is therefore to synthesize and explain contradictory findings of the growing research on IT-based value co-creation. To do so, we aim to answer the following research questions: (1) Which inter-organizational IT factors lead to business value in what magnitude? (2) To which business value dimensions does inter-organizational IT lead? (3) How do the study's methodological and contextual attributes affect the relationship between inter-organizational IT and business value?

To answer these research questions, we conducted a meta-analysis of 66 quantitative publications, 72 studies and over 33,000 observations. We built on the relational view of the firm (Dyer and Singh, 1998) as well as the related IT-based value co-creation framework developed by Grover and Kohli (2012) and analyzed four sources of relational value: (1) IT-based inter-organizational assets, (2) IT-based knowledge sharing, (3) IT-based complementary capabilities, and (4) IT-based governance. We investigated the extent of business value resulting from these sources and how they differ among different value dimensions: (a) firm level vs. relational level and (b) process level vs. organizational level. Furthermore, we examined whether variation across studies depends on methodological and contextual factors. This resulted in a research model with hypotheses based on theory and previous findings. In addition, we conducted explorative analyses where no a priori expectation was given. Such data-driven research initiates future theory development (Hambrick, 2007) and is increasingly called for by IS researchers (e.g., Grover and Lyytinen, 2015).

The remainder of this paper is structured as follows. First, we define the constructs and moderators identified in IT-based value co-creation research and derive the study's research model. We then introduce the research design including the data collection, coding procedure, and statistical analysis. Afterwards, we discuss the results in light of the current body of IT-based value co-creation literature, address limitations, and offer an outlook for further research. The study closes with a conclusion.

2 Research on IT-Based Value Co-Creation

We follow the definition of IT value research by Kohli and Grover (2008), in which economic outcomes and/or IT-related factors are investigated at the inter-organizational level of analysis. Therefore, our focus lies on research that satisfies the following conditions: (1) IT-based variable or manifestation, (2) endogenous variable with an organizational IT economic impact, and (3) at least one of the first two conditions lies at an interfirm level of analysis.

Figure 1 summarizes the research model. In the following, we define the structural dimensions of the studies and develop hypotheses regarding the impact on business value.

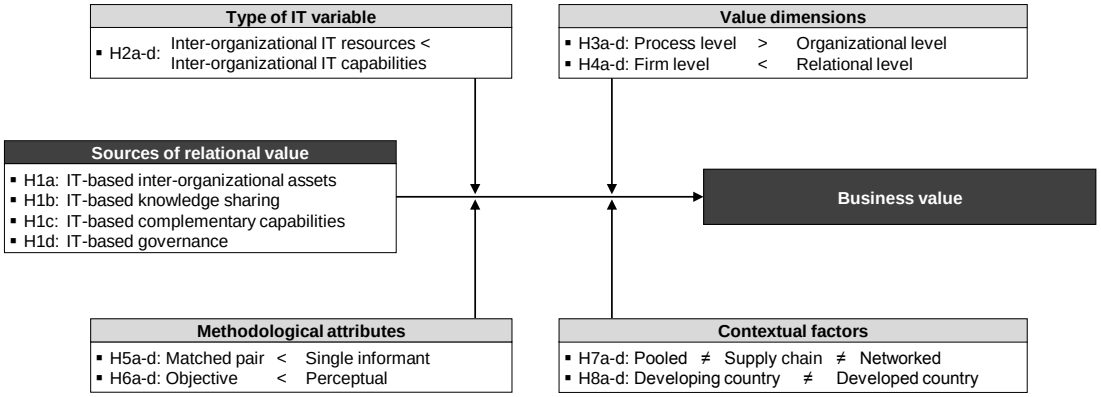

Figure 1. Research model of IT-based value co-creation.

2.1 IT-based sources of relational value

Based on the relational view of the firm (Dyer and Singh, 1998), Grover and Kohli (2012) propose four sources of business value from inter-organizational IT. The relational view states that a firm's resources and capabilities may span its boundaries. By combining resources and capabilities in a unique way and creating idiosyncratic interfirm linkages, firms can create relational value - supernormal profits they could not attain on their own. Dyer and Singh (1998) assume four main sources of relational value: (1) interfirm relation-specific assets, (2) knowledge-sharing routines, (3) complementary resources and capabilities, and (4) effective governance. All these sources can be created, expanded, or enabled by inter-organizational IT (Grover and Kohli, 2012). In the following, we analyze each of these IT-based sources and how they contribute to relational value. The construct definitions are provided in Table 1.

Construct	Definition	Examples
IT-based inter-org. assets	IT assets and IT personnel that are specialized to the relationship and enable digital connections in interfirm relationships.	IT integration, IOS adoption, eBusiness capabilities, use of operations support systems
IT-based knowledge sharing	Knowledge and information exchange based on IOS that enable information processing capabilities.	Data connectivity, electronic inf. sharing, online information capabilities, IOS visibility
IT-based complementary capabilities	IT functionalities that synergistically complement each other and enable the technical ability to identify, exploit, and leverage complementary capabilities and resources.	IT reconfiguration, analytic ability of IOS, IT-enabled intangibles, IT leverage competence
IT-based governance	The facilitation of coordination, planning, control, and decision making through IOS.	E-cooperation, IT-enabled collaborative decision making, IT-enabled planning and control

Table 1. Construct definitions of the IT-based sources of relational value.

First, we distinguish between inter-organizational IT resources and IT capabilities. IT resources refer to "commodity-like assets that are widely available and can be purchased from the factor market" (Wang et al., 2012, p. 328). They encompass IT-related technological assets and human resources (Bharadwaj, 2000; Ray et al., 2005). Inter-organizational IT resources can be related to a certain source of relational value, e.g., partner interface–directed information systems for knowledge sharing (Malhotra et al., 2005) and operations management systems as relation-specific assets (Bardhan et al.,

2007). Furthermore, they encompass general inter-organizational IT infrastructure. In IT-based value co-creation research, IT resources are assessed in terms of three concepts: (1) investments in IOS, (2) adoption of IOS, and (3) functionalities of IOS. On the other hand, IT capabilities are defined as the "ability to mobilize and deploy IT-based resources in combination or copresent with other resources and capabilities" (Bharadwaj, 2000, p. 171). In the context of value co-creation, inter-organizational IT resources are used in combination with the four sources of the relational view to perform interfirm business activities (Rai et al., 2006), e.g., the analytical ability of IOS to leverage complementary capabilities (Lee and Wang, 2013) and effective governance via electronic cooperation (Choi and Ko, 2012). In literature, this is assessed through IT-based factors that reflect (1) the actual use of IOS for relational sources and (2) the enabling role of IOS for relational sources.

Relation-specific IT resources describe IT assets and IT personnel that are specialized for the relationship (Grover and Kohli, 2012). Research has examined IT resources that relate to the interfirm IT infrastructure, such as integration (e.g., Bharadwaj et al., 2007; Rai et al., 2006; Saraf et al., 2007), interoperability (Zhao and Xia, 2014), and customization (Klein and Rai, 2009). Furthermore, several studies have investigated investments in IOS in general (e.g., Hadaya and Cassivi, 2012) as well as its adoption (da Silveira and Cagliano, 2006). As a capability, IT-based relation-specific assets enable digital connections in interfirm relationships in the form of interfirm process integration as well as new products and services (Grover and Kohli, 2012; Rai et al., 2015); eBusiness capabilities (Devaraj et al., 2007; Zhu et al., 2015) are such an example. We argue that IT-based inter-organizational assets lead to business value for the following reasons: First, as relation-specific resources and capabilities, they foster idiosyncratic linkages and make further value-creating initiatives economically viable (Hadaya and Cassivi, 2012; Saraf et al., 2007). Second, through the automation of interfirm business processes, they reduce transaction costs and uncertainties by, for example, reducing both paperwork as well as communication errors (Im and Rai, 2014; Rai et al., 2015). Third, new business opportunities, such as access to new markets and improved customer satisfaction, can arise (Barua et al., 2004; Zhu and Kraemer, 2005). Therefore, we propose a first hypothesis:

H1a: IT-based inter-organizational assets are positively related to business value.

Business value can also be co-created through knowledge sharing based on IOS, such as knowledge repositories or common databases (Grover and Kohli, 2012). At the resource level, this includes investments in and the adoption of specific IOS for both knowledge-sharing (Malhotra et al., 2005) and information-sharing functionalities of IOS, such as data connectivity and availability (Zhao and Xia, 2014). At the capability level, information-processing capabilities are embedded in interfirm processes to, for example, provide tactical information on demand (Barua et al., 2004). The relational view argues that firms can co-create value by developing the absorptive capacity to recognize, assimilate, and apply information to partner firms (Dyer and Singh, 1998). Inter-organizational systems allow one to deal with large amounts of data and thus provide the infrastructural basis for absorptive capacity (Barua et al., 2004; Wong et al., 2015). Furthermore, the reduction of technical barriers and seamless access to data initially leads to increased, more efficient, and more visible information flows among network partners (Barua et al., 2004; Roberts and Grover, 2012). Therefore, we propose that:

H1b: IT-based knowledge sharing is positively related to business value.

Complementary IT resources describe IT functionalities that synergistically complement each other, whereas IT capabilities in this context refer to the technical ability to identify, exploit, and leverage complementary capabilities and resources of partner firms (Grover and Kohli, 2012). Quantitative IS research has paid less attention to this source of value. However, existing studies (e.g., Jeong et al., 2009; Rai et al., 2012; Subramani, 2004) indicate that IT-based complementary capabilities lead to business value. Because of greater connectivity and communication through IOS, firms can leverage partner resources that are not available on the market (Hadaya and Cassivi, 2012; Zhu and Kraemer, 2002). For example, firms complement their IT capabilities to develop a platform that integrates knowledge about customers, leading to superior and synergetic value effects (Sarker et al., 2012). Therefore, we propose the following:

H1c: IT-based complementary capabilities are positively related to business value.

IT-based governance in interfirm relationships refers to the facilitation of coordination, planning, control, and decision making through IOS and leads to business value for the following reasons: First, the relational view argues that informal and self-enforcing governance mechanisms are more effective than formal arrangements (Dyer and Singh, 1998). IT-based governance resources and capabilities serve as safeguards, resulting in less opportunistic behavior and more intense collaborative management of relationships (Grover and Kohli, 2012; Lee et al., 2014; Wang et al., 2013). Second, due to more frequent interactions, IT-based governance leads to an improved decision-making and planning process in interfirm relationships (Wang et al., 2013). Therefore, we propose the following:

H1d: IT-based governance is positively related to business value.

Grounded in the resource-based view, it is argued that IT resources can be imitated by competitors because they are mobile in nature and widely available on the market (Mata et al., 1995; Wade and Hulland, 2004). Therefore, IT resources per se do not necessarily lead to business value. In contrast, IT capabilities are developed over time, embedded within an organization and its processes, and therefore difficult to transfer and to imitate (Barua et al., 2004; Rai et al., 2012). Under these conditions, researchers agree that IT does create business value. Although research has shown that inter-organizational IT resources are necessary conditions for value co-creation (e.g., Hadaya and Cassivi, 2012) and also have direct effects on business value (e.g., Dröge and Germain, 2000), we argue that inter-organizational IT capabilities have an even greater impact on business value. However, as interfirm relationships are rather complex – with multiple partners having heterogeneous strategies and cultures – they are more difficult to organize and manage (Barringer and Harrison, 2000). Hence, IT must meet the specific challenges that arise from the network context, which can be achieved by developing unique inter-organizational IT capabilities (Saraf et al., 2007; Subramani, 2004). Therefore, we propose our second hypothesis:

H2a-d: Inter-organizational IT capabilities have a greater impact on business value than inter-organizational IT resources do.

2.2 Business value dimensions

The business value of IT can manifest itself in several different dimensions. Traditionally, researchers distinguish between the impacts of IT on organizational or process business value (Kohli and Grover, 2008; Melville et al., 2004; Schryen, 2010). Organizational business-value measures encompass market, accounting, and relationship value. Process value measures assess the efficiency of specific business processes, such as ordering and customer processes. Researchers widely agree that IT first impacts business process performance, where improvements lead to overall organizational performance (Dehning and Richardson, 2002; Ray et al., 2005; Schryen, 2010). This especially applies to interfirm relationships because inter-organizational IT fosters the integration and synthesis of business processes (Melville et al., 2004; Rai et al., 2006). In contrast, performance measures at the firm or relationship-wide level are influenced by numerous other factors, possibly weakening the impact of IT resources and capabilities (Davamanirajan et al., 2006; Dehning and Richardson, 2002). Therefore, we propose for all IT-based sources of relational value (a-d) the following hypothesis:

H3a-d: IT-based sources have a greater impact on process value than on organizational value.

Research on IT-based value co-creation can be further referred to on different levels of analysis, i.e., the firm or relational level (Straub et al., 2004). At the firm level, organizational outcomes are analyzed independently from the interfirm relationship. In contrast, relational value aggregates firm-level outcomes to relation-specific outcomes, such as network returns on interest. Furthermore, relation-specific value can be assessed at the firm level, but as a result of the interfirm relationship and vice versa (Provan and Kenis, 2007). Similar to H3, we argue that the impact of the four IT-based sources on business value will be greater if it is assessed at the specific domain of investigation (Davamanirajan et al., 2006; Zhu, 2004). In the context of value co-creation, the four IT-based sources

first impact relational value, which in turn leads to value for the individual firms (Chang and Shaw, 2009). In contrast, business value at the firm level is also affected by intra-organizational IT resources and capabilities, along with other factors. Furthermore, value can be shared unequally among firms (Grover and Kohli, 2012). Therefore, we propose a fourth hypothesis:

H4a-d: IT-based sources have a greater impact on relational value than on firm-level value.

2.3 Methodological moderators

The means of measurement is a major issue in IT value research (Chan, 2000). We first analyze the type of respondents: data can be collected from a single informant or by matching responses from two individuals in different firms but with the same relationship. Because single informants may not have adequate knowledge about the relationship as a whole and over- or underestimate the variables – especially in asymmetric relationships – matched pair surveys tend to be more reliable (John and Reve, 1982; Ryoo and Kim, 2015) and can also reduce common method bias (Tallon and Pinsonneault, 2011b). However, matched pairs compromise the anonymity of the survey (Kearns and Sabherwal, 2007) and are especially difficult to conduct in different firms (Duffy, 2008), leading to measurement errors (Gerow et al., 2014). Because of the bias of single respondents and in accordance with other IS topics (e.g., Gerow et al., 2014), we argue that using single respondent types will result in larger estimates of business value:

H5a-d: IT-based sources have a greater impact on business value in studies that use single respondent types.

Second, measurement of IT value can be classified into two types: objective and perceptual (Chau et al., 2007). Although objective measures tend to be more reliable, perceptual measures are better suited to the study's context and variables of interest (Chau et al., 2007; Sabherwal and Jeyaraj, 2015). Because of methodological challenges and a lack of information on the companies surveyed, it is even more difficult to find or develop appropriate measures at an inter-organizational level of analysis (Straub et al., 2004). Therefore, we propose the following:

H6a-d: IT-based sources have a greater impact on business value in studies that use perceptual measures.

2.4 Contextual variables

The importance of relationship attributes in the context of IT-based value co-creation has been highlighted by various studies (e.g., Grover and Saeed, 2007; Rajaguru and Matanda, 2013). Therefore, we analyze the type of relationship as a contextual variable. Kumar and van Dissel (1996) distinguish three types of interdependencies among firms: First, in a pooled interdependency, multiple firms use and share common resources. Second, in supply chain interdependencies, the output from one firm becomes the input for another firm; this is the most investigated type of relationship in IS research, e.g., buyer–supplier relationships. Third, firms collaborate in mutual exchange and interactively in networked interdependencies, such as in collaborative alliances. Researchers argue that the impact of certain IOS differs among these relationship types (Chi and Holsapple, 2005; Kumar and van Dissel, 1996). Hence, we expect variations in the magnitude of the relationship between the four IT-based sources and business value. However, there are no theoretical foundations regarding the impact of IT resources and capabilities derived from the relational view. Therefore, we have no a priori hypotheses and propose non-directional hypotheses for this contextual variable:

H7a-d: The relationship between IT-based sources and business value differs among studies with pooled, supply chain, and networked relationship types.

Lastly, we investigate the role of the economic region in terms of developing and developed countries. It is argued that firms in developing countries have less access to the resources, skilled labor, and technological infrastructure required to develop IT capabilities (Shih et al., 2008). In contrast, regula-

tory support and minimal competitive pressure (Zhu and Kraemer, 2005) as well as the high potential of IT capabilities for improvement (Piatkowski, 2006) might foster IT-based value co-creation in developing countries. Previous studies on IT value have revealed contradictory findings regarding the role of the economic region (e.g., Patrakosol and Lee, 2009; Sabherwal and Jeyaraj, 2015). Therefore, we propose another non-directional hypothesis:

H8a-d: The relationship between IT-based sources and business value differs among studies conducted in developing and developed countries.

3 Meta-Analysis

This study employs a meta-analysis to test the main effect of IT-based sources on business value. A meta-analysis partition test is then used to assess the moderating effects of the types of IT variables, different value dimensions, methodological attributes, and further contextual factors.

Meta-analysis is a statistical method that systematically aggregates the quantitative results of primary studies and, in doing so, allows for a higher statistical power for the measures of interest (King and He, 2005; Rosenthal, 1991). This methodology is particularly suitable for this analysis because it not only enables us to integrate findings of previous studies in a rigorous and quantitative fashion but also allows us to analyze the effects of context-dependent factors. Through this, we can explain the differences among studies and consolidate contradictory findings on the IT-business value relation.

The research design comprises three basic steps. First, we collected quantitative papers on IT value in inter-organizational settings that cover the relation between IT and value variables. In the second step, we used these papers to extract a database of studies and calculated a quantitative measure ("effect size") for the IT-business value relations. The studies were then coded for the variables of interest, i.e., the type of the IT variable (resource or capability), different value dimensions, methodological attributes, and further contextual factors. This database constitutes the basis for the following statistical analysis for detecting and assessing the moderators.

3.1 Data-collection procedure

The meta-analysis starts with the identification of prior studies that report sufficient data on the association between IT and business value in interfirm relationships. Our procedure for data collection includes searches through scientific databases as well as for studies from prior meta-analyses, which is consistent with the recommendations of Hunter and Schmidt (2004) and other IS meta-studies (Gerow et al., 2014; Kohli and Devaraj, 2003; Sabherwal and Jeyaraj, 2015; Wu and Lederer, 2009).

Publications were collected between August and October 2015. We began our search for such studies in Business Source Complete (EBSCOhost), ScienceDirect (ELSEVIER), and the Association for Information Systems Electronic Library (AISeL). The papers included in the analysis were identified using keywords such as "value co-creation", "relational value", and "IT value" in conjunction with terms such as "inter-organizational", "inter-firm", "collaborative network", "corporate network", "cluster", and "alliance." The search results were first screened to determine whether they contained a quantitative empirical study with an IT value focus. We used prior meta-analyses on IT value as an additional source of studies, screening the studies used in Kohli and Devaraj (2003), Sabherwal et al. (2006), and Sabherwal and Jeyaraj (2015) for those that study interfirm relationships. We explicitly included conference publications and studies that had no double-blind reviews in our search results to counteract the file drawer effect (Rosenthal, 1979), which refers to the tendency of journals to preferentially publish significant results, thereby biasing the results if only journals are considered for the analysis (Dickersin, 1990).

We only sought out studies that provide sufficient information for the subsequent statistical analysis, particularly the information necessary to derive an effect size for the IT-business value relation, sam-

ple size, and a precise description of the study's context. This data was essential for the following coding procedure. When publications reported several studies based on independent data sets, they were treated as different studies. When studies included several IT or business value variables, and thus important relationships, they were coded in one of two ways: If the difference between the variables was relevant for the subsequent coding procedure, they were added to the database as separate relationships.[1] However, if the difference between the variables was determined to be important, they were arithmetically averaged (Hunter and Schmidt, 2004).

The final sample comprises 66 publications, including 72 studies and 126 IT-business value correlations, all of which were published between 1999 and 2015. Together, there was a total of 33,732 different observations. The full list of studies can be found in the Appendix.

3.2 Coding of studies and measurement of variables

The coding procedure began with gathering data for the IT value relation. To measure the effect size of this relationship, we coded for the correlation between IT and business value. If a study did not directly report this information, we applied the method described in Hunter and Schmidt (2004) for correcting study artifacts (see Appendix E in Wu and Lederer, 2009). The coding procedure for each study also included capturing information for the following variables. (1) *Source of relational value*: The IT variable of each correlation entry was categorized according to the four IT-based sources of relational value (see Table 1): IT-based inter-organizational assets, IT-based knowledge sharing, IT-based complementary capabilities, and IT-based governance. (2) *Type of IT variable*: A correlation for the variable "resource / capability" was coded as a resource if the IT variable is measured by investments in, adoption of, and functionalities of IOS. In contrast, if the IT variable is assessed by the actual use of IOS for relational sources or the enabling role of IOS for relational sources, the correlation entry was coded as inter-organizational IT capability. (3) *Value dimensions*: A correlation was coded for the variable "process level / organizational level" according to the business variable of each study. The variable captures process outcomes (e.g., operational excellence) or organizational outcomes (e.g., improved financial performance). The variable "firm level / relational level" was coded according to where the business value is measured, whether at the firm level (e.g., return on assets) or at the relationship level (e.g., supplies chain performance). (4) *Methodological attributes*: The variable "matched pair / single informant" captures whether the data for both the IT and the business value is collected from a single respondent, while "objective / perceptual" was coded for the information on how the business variables are measured, either as objective indicators (e.g., return on investments) or perceptual statements (e.g., perceived alliance performance). (5) *Contextual factors*: The variable "pooled / supply chain / networked" was coded according to the inter-organizational business relation under study. This categorization follows Kumar and van Dissel's (1996) understanding of different types of interdependencies. The variable "developing country / developed country" was coded according to the sample of each study (International Monetary Fund, 2015).

3.3 Data analysis and results

This study follows the widely applied Hedges and colleagues' method for conducting fixed effects meta-analyses (Hedges and Olkin, 1985; Hedges and Vevea, 1998). We first converted the effect sizes into a standard normal metric using Fisher's z-transformation and then weighted these scores with each study's sample size, allowing us to account for differences in measurement errors.

[1] Please note that for the later calculations, the sample sizes for these entries have been corrected. However, what we refer to as "observation" is still the sum of individual observations across the studies.

The results of the meta-analysis are displayed in Table 2 and give support for the direct effects of all four sources of relational value (H1a–d). All sources are significantly different from zero. Considering the confidence intervals, the data suggest that IT-based governance has the strongest influence, followed by IT-based knowledge sharing, IT-based complementary capabilities, and IT-based inter-organizational assets. To check the robustness of these findings, we computed Orwin's fail-safe N statistics (Orwin, 1983), which display the number of non-significant publications that would be required to reduce the estimated effect size to a trivial level. For hypotheses H1a–d, the fail-safe N clearly exceeds the number of studies, indicating that unpublished and non-significant studies are not a threat for our analysis. Moreover, one study has a sample size of 14,065, which clearly exceeds the others. We checked if this single study might have biased the results. A re-estimation without this study did not change the significant positive influence as well as the order of the hypotheses.

Hypothesis	# corr.	# observations	Est. correlation	Std. err.	Z-value	Confidence interval (.95)	Orwin's fail-safe N	Variance	Credibility interval (.80)
H1a: IT-based inter-org. assets	72	25,713	.146	.006	23.636 **	.134 – .158	139	.032	-.084 – .377
H1b: IT-based knowledge sharing	24	3,593	.308	.017	19.072 **	.278 – .337	124	.179	.079 – .537
H1c: IT-based compl. capabilities	16	4,654	.235	.015	16.351 **	.208 – .262	59	.040	-.020 – .490
H1d: IT-based governance	14	1,589	.423	.025	17.991 **	.382 – .463	104	.025	.220 – .626

Notes: # corr. = number of correlations; Std. err. = the standard error of the point estimators; Confidence interval = computed at an 95% level, Orwin's fail-safe N = assumption of a criterion correlation of .05, calculated as #studies * (est. correlation - criterion correlation) / criterion correlation; Variance = the variance in the distribution of the effect sizes; Credibility interval = computed at an 80% level; indications for significance: ** $p < .01$, * $p < .05$, and $^{n.s.}$ $p > .05$.

Table 2. Results of the meta-analysis.

We computed credibility intervals for the search of moderators (Hunter and Schmidt, 2004). It is a measure for the posterior distribution of the effect sizes before correcting for measurement errors. A wide interval or an interval that includes zero indicates that effect sizes originate in different subpopulations. The effect sizes of all four sources were revealed to have large credibility intervals (>.40) or include zero correlations. Accordingly, moderating effects should be suspected.

The moderating hypotheses were tested using a partition test (King and He, 2005). The studies were split into subgroups relating to the moderator variable being examined. As a next step, a meta-analysis was calculated separately for the subgroups. The resulting weighted average Z-values were then compared using a Z-test (Hedges and Olkin, 1985). The results are depicted in Table 3.

We find empirical support across all four sources of IT-based relational value for the type of IT variable (H2) and the objective vs. perceptual measurement of the value variable (H6). The data also gives evidence for the hypothesis that developed countries differ from undeveloped ones for three value dimensions (H8). The data suggest that developing countries profit even more from IT. However, due to insufficient data, the hypothesis for IT-based complementary capabilities could not be evaluated (H8c). We found partial support for the value dimensions (H3 and H4) and the network type (H7) but no support for differences between matched pair and single informant measurements (H5).

4 Discussion

4.1 Summary of findings

Our results support the strong theoretical foundation of the relational view and its use in IS research. All four IT-based sources contribute significantly to business value. Furthermore, the capability approach founded on the resource-based view also holds true for interfirm relationships, as inter-organizational IT capabilities have a stronger relationship with business value than IT resources do. Our analysis also indicates that IT-based knowledge sharing and governance are more tightly associated with business value than IT-based inter-organizational assets and complementary capabilities are.

Hypothesis	a. IT-based inter-org. assets				b. IT-based knowledge sharing				c. IT-based compl. capabilities				d. IT-based governance			
	# corr.	# obs.	est. corr.	Z-value (support)	# corr.	# obs.	est. corr.	Z-value (support)	# corr.	# obs.	est. corr.	Z-value (support)	# corr.	# obs.	est. corr.	Z-value (support)
H2: Inter-organizational IT resources < Inter-organizational IT capabilities																
Inter-org. IT resources	45	14,995	.097	9.584 **	12	1866	.213	6.333 **	9	3,635	.158	10.408 **	3	425	.235	5.094 **
Inter-org. IT capabilities	27	10,718	.215	(Yes)	12	1727	.404	(Yes)	7	1,019	.484	(Yes)	11	1,164	.484	(Yes)
H3: Process level > Organizational level																
Process level	35	11,896	.158	1.595	10	1,176	.484	8.783 **	7	940	.468	9.184 **	8	902	.474	2.913 **
Organizational level	37	13,817	.138	(No)	14	2,417	.213	(Yes)	9	3,714	.170	(Yes)	6	687	.352	(Yes)
H4: Firm level < Relational level																
Firm level	35	16,790	.102	9.986 **	8	803	.385	- 2.833 **	7	2,095	.311	- 5.051 **	5	676	.382	1.666 n.s.
Relational level	37	8,923	.229	(Yes)	16	2789	.285	(No)	9	2,559	.171	(No)	9	913	.452	(No)
H5: Matched pair < Single informant																
Matched pair	12	799	.214	- 1.216 n.s.	2	90	.391	- .425 n.s	4	684	.464	- 2.310 *	2	151	.364	.905 n.s.
Single informant	54	20,583	.172	(No)	21	3,222	.336	(No)	10	1,682	.378	(No)	12	1,438	.429	(No)
H6: Objective measurement < Perceptual measurement																
Objective	14	5,124	.034	9.102 **	2	449	.025	6.648 **	4	2,692	.059	14.442 **	1	123	.003	5.177 **
Perceptual	58	20,589	.174	(Yes)	22	3,144	.345	(Yes)	12	1,962	.452	(Yes)	13	1466	.453	(Yes)
H7: Pooled ≠ Supply chain ≠ Networked																
Pooled	6	321	.260	.349 n.s,	1	166	.616	4.784 **,	4	1,947	.088	9.629 **,	8	818	.406	
Supply chain	51	7,229	.241	2.830 **,	19	2,840	.324	6.852 **,	8	1,140	.420	5.584 **,	0	0	n.a.	n.a.
Networked	15	18,164	.106	10.027 ** (Partly)	4	567	.587	4.860 ** (Yes)	4	1,567	.271	4.358 ** (Partly)	0	0	n.a.	
H8: Developing country ≠ Developed country																
Developing country	6	516	.453	8.056 **	4	637	.378	2.183 *	0	0	n.a.	n.a.	2	246	.496	1.575 n.s.
Developed country	60	23,497	.129	(Yes)	19	2,862	.294	(Yes)	15	4,560	.234		12	1,343	.409	(Yes)

Note: # corr. = number of correlations; # obs. = number of observations; est. corr. = estimated correlations; indications for significance: ** $p < .01$, * $p < .05$, and n.s. $p > .05$; for H7 each group of Z-values displays pairwise comparisons, i.e., the first Z-value refers to pooled vs. supply chain, the second refers to supply chain vs. networked, and the third pooled vs. networked.

Table 3. Results of the moderator meta-analysis.

An explanation for this might be that – although the value of IT-based knowledge sharing and governance per se is widely known (Grover and Kohli, 2012) – these sources develop their full potential when used in combination with digitally enabled interfirm business capabilities (Roberts and Grover, 2012; Subramani, 2004). Hence, there might be both a direct and an indirect effect of IT-based inter-organizational assets and complementary capabilities on business value. Further research is necessary to understand the interdependencies of these four IT-based sources and their co-creation mechanisms.

Regarding the value dimensions, we found evidence that inter-organizational IT first impacts the process level (H3b–d). However, we did not observe IT-based assets to have a higher value on the process level than on the organizational level. This is surprising because the support and integration of interfirm processes is an essential outcome of this IT-based source (Rai et al., 2015). Future theory development is necessary to understand the impact of IT-based inter-organizational assets on different value dimensions. However, there are reverse effects regarding IT-based knowledge sharing and complementary capabilities (H4b–c). A possible explanation for this might be that these IT-based sources have high spillover effects because firms can also use knowledge and complementary capabilities outside the relationship. Knowledge absorbed from other firms is a particularly important source for innovation and firm performance (Dyer and Singh, 1998). In contrast, relation-specific assets have less value outside the relationship (Saraf et al., 2007). Future research should therefore investigate spillover effects resulting from IT-based sources of relational value more extensively.

Contrary to our expectations, we did not find any significant effects of the respondent type (H5a–d). Due to the small sample size for studies using matched pairs, these results should be interpreted with caution. Nonetheless, future studies using matched pair surveys may provide additional insight into their usefulness. Consistent with our argumentation, studies find a higher impact on business value when using perceptual measures; this finding is in line with previous research on IT value (e.g., Chau et al., 2007; Sabherwal and Jeyaraj, 2015).

Regarding the type of relationship, we found mixed results. IT-based inter-organizational assets and knowledge sharing have a higher value in pooled and supply chain relationships than in networked relationships. It might be that the former relationships are characterized as more structured, making the coordination of IOS less complex than in networked relationships (Kumar and van Dissel, 1996). In contrast, IT-based complementary capabilities have the lowest value in pooled interdependencies. Future research should develop theoretical foundations to understand the role of relationship types. Furthermore, we found that three IT-based sources have a stronger relationship with business value in developing countries than developed ones. Besides possible methodological issues, other explanations for this could include the presence of regulatory support, reduced competitive pressure, or the greater potential of IT capabilities in developing countries, even though companies in these countries have fewer resources to invest in IOS and develop IT capabilities (Patrakosol and Lee, 2009).

4.2 Implications for Research and Practice

Regarding theoretical contributions, we made a first step in integrating and synthesizing the literature on IT-based value co-creation, which can be a starting point for conducting future studies. Second, our study further confirms the strong theoretical support of the relational view in IS research. Third, the results provide possible explanations for contradictory findings from previous studies. Our results reveal that across all studies inter-organizational IT significantly contributes to business value, indicating that the productivity paradox might not be an issue in IT-based value co-creation research. Fourth, our study provides insights into how future studies might be designed. Researchers should be careful when using objective measures of business value, as they might deepen the impact of inter-organizational IT. Furthermore, researchers should also be aware that the type of relationship and the economic region could influence the study's results.

This study also provides important insights into how managers can achieve superior value through IT-based value co-creation. IT executives should not focus on IT investments alone but rather develop unique inter-organizational IT capabilities to derive superior value. Furthermore, the results indicate

that managers should first focus on IOS that foster knowledge sharing and governance, as these systems lead directly to value and provide a starting point for further integration with business partners. They should pay special attention to knowledge absorbed from partner firms, which can lead to superior benefits for the whole company. Lastly, IT executives should not only consider profitability-based and objective outcomes but also evaluate IOS investments based on their impacts on strategic and soft measures.

4.3 Limitations and future research

First, across all four IT-based sources of relational value, the effect sizes reveal to have a generally high degree of heterogeneity. While we were able to explain some of the variance among the studies, more analysis would be beneficial in order to both increase the methodological rigor and gain further theoretical insights. An avenue could be to assume random effects in contrast to fixed effects among the studies. Moreover, more advanced methods against a possible publication bias, e.g. using funnel plots, should be considered in further analysis. Second, due to some missing study information in our database, we decided to use a partition test and to test each hypothesis separately. More advanced meta-analysis techniques such as meta-regression in combination with data imputation techniques might be an avenue in order to account for correlations among the independent variables. Finally, to avoid a biased picture due to a "sampling bias toward empirical studies," further research should integrate our findings with other non-quantitative empirical research methods (King and He, 2006).

Despite these limitations, our study provides promising directions for future research. First, interdependencies and synergies between IT-based sources of relational value should be examined. This will provide deeper insights into the success factors for IT-based value co-creation. Second, dimensions of business value should also be analyzed separately, especially regarding the spillover effects of interfirm and intrafirm value as well as the distribution of value. This will help in understanding the extent to which individual firms in interfirm relationships can benefit from IT-based value co-creation. Third, research must further develop methodological approaches to improve the reliability of research results. Besides a more frequent use of matched pair surveys, it will also be necessary to develop measures that capture the value of whole networks (Straub et al., 2004). Lastly, theoretical development is needed to understand the contextual factors that influence IT-based value co-creation.

5 Conclusion

This study set out to synthesize and explain the contradictory findings of research on IT-based value co-creation. By conducting a meta-analysis of 66 publications including over 33,000 observations, we identified valuable insights for this growing research field. To some extent, there are similar results for IT value research in general. Objective measures dampen the relationship between inter-organizational IT and business value, whereas process level measures and IT capabilities strengthen it. However, we find special IT-based co-creation mechanisms based on the relational view, indications for spillover effects, higher value impacts in developing countries, and an influence of relationship types, indicating that the interfirm context requires special attention in IT value research. Our study provides contributions to both theory and practice and can guide future research and theory development.

Acknowledgements. This research was supported by the German Research Foundation (DFG), grant GRK 1703/1 for the Research Training Group "Resource Efficiency in Interorganizational Networks - Planning Methods to Utilize Renewable Resources."

Appendix

	Sample size	IT-based inter-org. aseets	IT-based knowledge sharing	IT-based compl. capabilities	IT-based governance
(Al-Duwailah et al., 2015)	307	.420, .620			
(Bardhan et al., 2006)	287	.013			
	266	.200			
(Bardhan et al., 2007)	708	-.043, .099			
(Barua et al., 2004)	1.076	.528	.095, .238		
(Bharadwaj et al., 2007)	126	.090	.090		.003
(Chen et al., 2009)	491				.550
(Chen et al., 2013)	117	.361			
(Cheng et al., 2014)	260			.590	
(Choi and Ko, 2012)	119		.460		.550
(Devaraj et al., 2007)	120	.001			
(Dobrzykowski, 2012)	711	.189, .043			
(Dröge and Germain, 2000)	200	.018, .152			
(Gang et al., 2008)	284		.411		
(Hadaya and Cassivi, 2012)	51	.526, .123			
(Hyvönen, 2007)	51	.356			
(Im and Rai, 2014)	238	.365			.395
	76	.160			.255
(Jean et al., 2010)	240	.321, .325			
(Jeong et al., 2009)	121			.530	
(Jiang and Zhao, 2014)	128	.300, .582			
(Kaefer and Bendoly, 2004)	186			.081, .165	
(Klein and Rai, 2009)	91	.120			
	132	.210			
(Ko et al., 2009)	169		.616	.578	.515
(Kyu Kim et al., 2011)	51		.252		
	51		.514		
(Lai et al., 2008)	227	.625, .621	.639, .604		
(Lee and Wang, 2013)	147	.340		.257	
(Lee et al., 2014)	124		.350		
(Liu et al., 2013)	252		.380, .490		.460, .530
(Liu and Ravichandran, 2011)	329		.000		
(Loukis and Charalabidis, 2012)	14,065	.122, .099, .176, .082, .076, .088			
(Lu and Wang, 2012)	121	.177			
(Nicolaou et al., 2011)	116	.170			.260
(Patrakosol and Lee, 2009)	68	.400			
	107	.350			
(Paulraj et al., 2008)	212	.200, .210			
(Prasad et al., 2013)	192				.361
(Rai et al., 2006)	110	.230, .130, .140	.290, .170, .150		
(Rai et al., 2012)	1,659			.023	
(Rai et al., 2015)	342	.082			
(Rai and Tang, 2010)	318	.338		.383	
(Rajaguru and Matanda, 2013)	302			.506	.626
(Ramamurthy et al., 1999)	83	.250			
(Roberts and Grover, 2012)	108	.140		.290	
(Rosenzweig, 2009)	170				.470, .480
(Ryoo and Kim, 2015)	70	.420, .280			
(Saeed et al., 2005)	38	-.080, .380			
(Saldanha et al., 2013)	3.023	-.011			
(Sanders, 2007)	245	.296			
(Saraf et al., 2007)	63	.251			
(da Silveira and Cagliano, 2006)	201	.154			
(Sriram and Stump, 2004)	318	-.143			
(Subramani, 2004)	131	.086, .219		.005, .348	
(Tafti et al., 2013)	635			.103	
(Tallon and Pinsonneault, 2011a)	241	.090			
(Tanriverdi, 2006)	356			.113	
(Truman, 2000)	48	.066			
(Vaccaro et al., 2010)	113		.142		
(Vickery et al., 2003)	57	.052, .200			
(Wang et al., 2013)	144				.300
(Wang et al., 2015)	150	.460	.510		
(Wong et al., 2012)	188		.450, .500		
(Wong et al., 2015)	188	.520	.469		.557
(Xu et al., 2014)	176	.340			
(Xue et al., 2013)	421	.146, .118			
(Yao et al., 2009)	215		.270		
(Zhao and Xia, 2014)	194	.290, .335	.253	.290	
(Zhu et al., 2004)	612	.480			
(Zhu et al., 2015)	196	.600, .501			

Table 4. List of Studies used for the Meta-Analysis.

References

Al-Duwailah, F., Ali, M. and Al-Debei, M.M. (2015), "The Impact of CRM Infrastructural and Cultural Resources and Capabilities on Business Performance: An Apllication of the Resource-Based View in the Mobile Telecommunications Industry", *Proceedings of the 23rd European Conference on Information Systems (ECIS 2015)*, pp. 1–16.

Bardhan, I., Mithas, S. and Lin, S. (2007), "Performance Impacts of Strategy, Information Technology Applications, and Business Process Outsourcing in U.S. Manufacturing Plants", *Production and Operations Management*, Vol. 16 No. 6, pp. 747–762.

Bardhan, I., Whitaker, J. and Mithas, S. (2006), "Information Technology, Production Process Outsourcing, and Manufacturing Plant Performance", *Journal of Management Information Systems*, Vol. 23 No. 2, pp. 13–40.

Barringer, B.B. and Harrison, J.S. (2000), "Walking a Tightrope: Creating Value Through Interorganizational Relationships", *Journal of Management*, Vol. 26 No. 3, pp. 367–403.

Barua, A., Konana, P., Whinston, A. and Yin, F. (2004), "An Empirical Investigation of Net-Enabled Business Value", *Management Information Systems Quarterly*, Vol. 28 No. 4, pp. 585–620.

Bharadwaj, A. (2000), "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation.", *Management Information Systems Quarterly*, Vol. 24 No. 1, pp. 169–196.

Bharadwaj, S., Bharadwaj, A. and Bendoly, E. (2007), "The Performance Effects of Complementarities Between Information Systems, Marketing, Manufacturing, and Supply Chain Processes", *Information Systems Research*, Vol. 18 No. 4, pp. 437–453.

Brynjolfsson, E. (1993), "The Productivity Paradox of Information Technology", *Communications of the ACM*, Vol. 36 No. 12, pp. 67–77.

Chan, Y.E. (2000), "IT Value : The Great Divide Between Quantitative and Qualitative and Organizational Individual Measures", *Journal of Management Information Systems*, Vol. 16 No. 4, pp. 225–261.

Chang, H.-L. and Shaw, M.J. (2009), "The Business Value of Process Sharing in Supply Chains: A Study of RosettaNet", *International Journal of Electronic Commerce*, Vol. 14 No. 1, pp. 115–146.

Chau, P.Y.K., Kuan, K.K.Y. and Liang, T.-P. (2007), "Research on IT Value: What We Have Done in Asia and Europe", *European Journal of Information Systems*, Vol. 16 No. 3, pp. 196–201.

Chen, D.Q., Preston, D.S. and Xia, W. (2013), "Enhancing Hospital Supply Chain Performance: A Relational View and Empirical Test", *Journal of Operations Management*, Vol. 31 No. 6, pp. 391–408.

Chen, J.-S., Tsou, H.T. and Huang, A.Y.-H. (2009), "Service Delivery Innovation - Antecedents and Impact on Firm Performance", *Journal of Service Research*, Vol. 12 No. 1, pp. 36–55.

Cheng, J.-H., Chen, M.-C. and Huang, C.-M. (2014), "Assessing Inter-Organizational Innovation Performance through Relational Governance and Dynamic Capabilities in Supply Chains", *Supply Chain Management: An International Journal*, Vol. 19 No. 2, pp. 173–186.

Chi, L. and Holsapple, C.W. (2005), "Understanding Computer-Mediated Interorganizational Collaboration: A Model and Framework", *Journal of Knowledge Management*, Vol. 9 No. 1, pp. 53–75.

Choi, S. and Ko, I. (2012), "Leveraging Electronic Collaboration to Promote Interorganizational

Learning", *International Journal of Information Management*, Vol. 32 No. 6, pp. 550–559.

Davamanirajan, P., Kauffman, R., Kriebel, C. and Mukhopadhyay, T. (2006), "Systems Design, Process Performance, and Economic Outcomes in International Banking", *Journal of Management Information Systems*, Vol. 23 No. 2, pp. 65–90.

Dehning, B. and Richardson, V.J. (2002), "Returns on Investments in Information Technology: A Research Synthesis", *Journal of Information Systems*, Vol. 16 No. 1, pp. 7–30.

Devaraj, S., Krajewski, L. and Wei, J. (2007), "Impact of eBusiness Technologies on Operational Performance: The Role of Production Information Integration in the Supply Chain", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1199–1216.

Dickersin, K. (1990), "The Existence of Publication Bias and Risk Factors for its Occurrence", *The Journal of the American Medical Association*, Vol. 10 No. 263, pp. 1385–1359.

Dobrzykowski, D.D. (2012), "Building Procurement Capability for Firm Performance: A Service-Dominant Logic View", *Benchmarking: An International Journal*, Vol. 19 No. 4, pp. 567–584.

Dröge, C. and Germain, R. (2000), "The Relationship of Electronic Data Interchange with Inventory and Financial Performance", *Journal of Business Logistics*, Vol. 21 No. 2, pp. 209–230.

Duffy, R.S. (2008), "Towards a Better Understanding of Partnership Attributes: An Exploratory Analysis of Relationship Type Classification", *Industrial Marketing Management*, Vol. 37 No. 2, pp. 228–244.

Dyer, J. and Singh, H. (1998), "The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage", *Academy of Management Review*, Vol. 23 No. 4, pp. 660–679.

Gang, Q.U., Shaobo, J.I. and Qingfei, M.I.N. (2008), "Inter-Organizational Coordination, IT Support, and Environment", *Tsingua Science and Technology*, Vol. 13 No. 3, pp. 374–382.

Gerow, J.E., Grover, V., Thatcher, J. and Roth, P.L. (2014), "Looking Toward the Future of IT-Business Strategic Alignment through the Past: A Meta-Analysis", *Management Information Systems Quarterly*, Vol. 38 No. 4, pp. 1159–1185.

Grover, V. and Kohli, R. (2012), "Cocreating IT Value: New Capabilities and Metrics for Multifirm Environments", *Management Information Systems Quarterly*, Vol. 36 No. 1, pp. 225–232.

Grover, V. and Lyytinen, K. (2015), "New State of Play in IS Research: The Push to the Edges", *Management Information Systems Quarterly*, Vol. 39 No. 2, pp. 271–296.

Grover, V. and Saeed, K. (2007), "The Impact of Product, Market, and Relationship Characteristics on Interorganizational System Integration in Manufacturer-Supplier Dyads", *Journal of Management Information Systems*, Vol. 23 No. 4, pp. 185–216.

Hadaya, P. and Cassivi, L. (2012), "Joint Collaborative Planning as a Governance Mechanism to Strengthen the Chain of IT Value Co-Creation", *Journal of Strategic Information Systems*, Elsevier B.V., Vol. 21 No. 3, pp. 182–200.

Hambrick, D.C. (2007), "The Field of Management's Devotion to Theory : Too Much of a Good Thing?", *Academy of Management Journal*, Vol. 50 No. 6, pp. 1346–1352.

Hedges, L.V. and Olkin, I. (1985), *Statistical Methods for Meta-Analysis*, FL: Academic Press, Orlando.

Hedges, L.V. and Vevea, J.L. (1998), "Fixed- and Random-Effects Models in Meta-Analysis", *Psychological Methods1*, Vol. 3 No. 4, pp. 486–504.

Hunter, J.E. and Schmidt, F.L. (2004), *Methods of Meta-Analysis: Correcting Error and Bias in*

Research Findings, Sage: Thousand Oaks, Newbury Park.

Hyvönen, J. (2007), "Strategy, Performance Measurement Techniques and Information Technology of the Firm and their Links to Organizational Performance", *Management Accounting Research*, Vol. 18 No. 3, pp. 343–366.

Im, G. and Rai, A. (2014), "IT-Enabled Coordination for Ambidextrous Interorganizational Relationships", *Information Systems Research*, Vol. 25 No. 1, pp. 72–92.

International Monetary Fund. (2015), *World Economic Outlook: Uneven Growth Short- and Long-Term Factors*.

Jean, R., Sinkovics, R.R. and Cavusgil, S.T. (2010), "Enhancing International Customer–Supplier Relationships Through IT Resources: A Study of Taiwanese Electronics Suppliers", *Journal of International Business Studies*, Vol. 41 No. 7, pp. 1218–1239.

Jeong, C., Ko, I., Jang, H. and Lee, C. (2009), "The Effects of IT Leveraging Competence on Firm Performance in Cross-firm Relationships: Focusing on Social Capital and Collaboration", *Proceedings of the 42nd Hawaii International Conference on System Sciences*, pp. 1–10.

Jiang, Y. and Zhao, J. (2014), "Co-Creating Business Value of Information Technology", *Industrial Management & Data Systems*, Vol. 114 No. 1, pp. 53–69.

John, G. and Reve, T. (1982), "The Reliability and Validity of Key Informant Data from Dyadic Relationships in Marketing Channels", *Journal of Marketing Research*, Vol. 19 No. 4, pp. 517–524.

Kaefer, F. and Bendoly, E. (2004), "Measuring the Impact of Organizational Constraints on the Success of Business-to-Business E-Commerce Efforts: A Transactional Focus", *Information and Management*, Vol. 41 No. 5, pp. 529–541.

Kearns, G.S. and Sabherwal, R. (2007), "Strategic Alignment Between Business and Information Technology: A Knowledge-Based View of Behaviors, Outcome, and Consequences", *Journal of Management Information Systems*, Vol. 23 No. 3, pp. 129–162.

King, W.R. and He, J. (2005), "Understanding the Role and Methods of Meta- Analysis in IS Research", *Communications of the Association of Information Systems*, Vol. 16, p. 654.

King, W.R. and He, J. (2006), "A Meta-Analysis of the Technology Acceptance Model", *Information & Management*, Vol. 43 No. 6, pp. 740–755.

Klein, R. and Rai, A. (2009), "Interfirm Strategic Information Flows in Logistics Supply Chain Relationships", *Management Information Systems Quarterly*, Vol. 33 No. 4, pp. 735–762.

Ko, I., Olfman, L. and Choi, S. (2009), "The Impacts of Electronic Collaboration and Information Exploitation Capability on Firm Performance", *International Journal of e-Collaboration*, Vol. 5 No. 2, pp. 1–17.

Kohli, R. and Devaraj, S. (2003), "Measuring Information Technology Pay Off: A Meta-Analysis of Structural Variables in Firm-Level Empirical Research", *Information Systems Research*, Vol. 14 No. 2, pp. 127–145.

Kohli, R. and Grover, V. (2008), "Business Value of IT: An Essay on Expanding Research Directions to Keep up with the Times", *Journal of the Association for Information Systems*, Vol. 9 No. 1, pp. 23–39.

Kumar, K. and van Dissel, H. (1996), "Sustainable Collaboration: Managing Conflict and Cooperation in Interorganizational Systems", *Management Information Systems Quarterly*, Vol. 20 No. 3, pp. 279–300.

Kyu Kim, K., Yul Ryoo, S. and Dug Jung, M. (2011), "Inter-organizational Information Systems Visibility in Buyer-Supplier Relationships: The Case of Telecommunication Equipment Component Manufacturing Industry", *Omega*, Vol. 39 No. 6, pp. 667–676.

Lai, K.H., Wong, C.W.Y. and Cheng, T.C.E. (2008), "A Coordination-Theoretic Investigation of the Impact of Electronic Integration on Logistics Performance", *Information & Management*, Vol. 45 No. 1, pp. 10–20.

Lee, H., Kim, M.S. and Kim, K.K. (2014), "Interorganizational Information Systems Visibility and Supply Chain Performance", *International Journal of Information Management*, Vol. 34 No. 2, pp. 285–295.

Lee, N.C. a and Wang, E.T.G. (2013), "Enabling Supply Chain Agility through IOS Integration and Supply Chain Flexibility", *Proceedings of the 18th Pacific Asia Conference on Information Systems (PACIS 2013)*, p. Paper 246.

Liu, H., Ke, W., Wei, K.K. and Hua, Z. (2013), "The Impact of IT Capabilities on Firm Performance: The Mediating Roles of Absorptive Capacity and Supply Chain Agility", *Decision Support Systems*, Vol. 54 No. 3, pp. 1452–1462.

Liu, Y. and Ravichandran, T. (2011), "A Dedicated Alliance Function, Information Technology, and the Integration of Alliance Experience", *Proceedings of the 32nd International Conference on Information Systems (ICIS 2011)*, pp. 1–15.

Loukis, E. and Charalabidis, Y. (2012), "Business Value of Information Systems Interoperability? A Balanced Scorecard Approach", *Proceedings of the 20th European Conference on Information Systems (ECIS 2012)*, pp. 1–12.

Lu, Y. and Wang, E. (2012), "Inter-Firm Cooperatoin and Ios Deployments in Buyer-Supplier Relationships: A Relational View", *Proceedings of the 20th European Conference on Information Systems (ECIS 2012)*, p. Paper 45.

Malhotra, A., Gosain, S. and Sawy, O. (2005), "Absorptive Capacity Configurations in Supply Chains: Gearing for Partner-Enabled Market Knowledge Creation", *Management Information Systems Quarterly*, Vol. 29 No. 1, pp. 145–187.

Masli, A., Richardson, V.J., Sanchez, J.M. and Smith, R.E. (2011), "The Business Value of IT: A Synthesis and Framework of Archival Research", *Journal of Information Systems*, Vol. 25 No. 2, pp. 81–116.

Mata, F., Fuerst, W. and Barney, J. (1995), "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis", *Management Information Systems Quarterly*, Vol. 19 No. 4, pp. 487–505.

Melville, N., Kraemer, K. and Gurbaxani, V. (2004), "Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value", *Management Information Systems Quarterly*, Vol. 28 No. 2, pp. 283–322.

Nicolaou, A.I., Sedatole, K.L. and Lankton, N.K. (2011), "Integrated Information Systems and Alliance Partner Trust", *Contemporary Accounting Research*, Vol. 28 No. 3, pp. 1018–1045.

Orwin, R.G. (1983), "A Fail-Safe N for Effect Size in Meta-Analysis", *Journal of Educational Statistics*, Vol. 8 No. 2, pp. 157–159.

Patrakosol, B. and Lee, S.M. (2009), "IT Capabilities, Interfirm Performance, and the State of Economic Development", *Industrial Management & Data Systems*, Vol. 109 No. 9, pp. 1231–1247.

Paulraj, A., Lado, A.A. and Chen, I.J. (2008), "Inter-Organizational Communication as a Relational Competency: Antecedents and Performance Outcomes in Collaborative Buyer–Supplier Relationships", *Journal of Operations Management*, Vol. 26 No. 1, pp. 45–64.

Piatkowski, M. (2006), "Can Information and Communication Technologies Make a Difference in the Development of Transition Economies?", *Information Technologies and International Development*, Vol. 3 No. 1, pp. 39–53.

Prasad, A., Green, P. and Heales, J. (2013), "On Governing Collaborative Information Technology (IT): A Relational Perspective", *Journal of Information Systems*, Vol. 27 No. 1, pp. 237–259.

Provan, K.G. and Kenis, P. (2007), "Modes of Network Governance: Structure, Management, and Effectiveness", *Journal of Public Administration Research and Theory*, Vol. 18 No. 2, pp. 229–252.

Rai, A., Arikan, I., Pye, J. and Tiwina, A. (2015), "Fit and Misfit of Plural Sourcing Strategies and IT-Enabled Process Integration Capabilities: Consequences of Firm Performance in the U.S. Electric Utility Industry", *Management Information Systems Quarterly*, Vol. 39 No. 4, pp. 1–XX.

Rai, A., Patnayakuni, R. and Seth, N. (2006), "Firm Performance Impacts of Digitally Enabled Supply Chain Integration Capabilities", *Management Information Systems Quarterly*, Vol. 30 No. 2, pp. 225–246.

Rai, A., Pavlou, P., Im, G. and Du, S. (2012), "Interfirm IT Capability Profiles and Communications for Cocreating Relational Value: Evidence from the Logistics Industry", *Management Information Systems Quarterly*, Vol. 36 No. 1, pp. 233–262.

Rai, A. and Tang, X. (2010), "Leveraging IT Capabilities and Competitive Process Capabilities for the Management of Interorganizational Relationship Portfolios", *Information Systems Research*, Vol. 21 No. 3, pp. 516–542.

Rajaguru, R. and Matanda, M.J. (2013), "Effects of Inter-Organizational Compatibility on Supply Chain Capabilities: Exploring the Mediating Role of Inter-Organizational Information Systems (IOIS) Integration", *Industrial Marketing Management*, Vol. 42 No. 4, pp. 620–632.

Ramamurthy, K., Premkumar, G. and Crum, M. (1999), "Organizational and Interorganizational Determinants of EDI Diffusion and Organizational Performance: A Causal Model", *Journal of Organizational Computing and Electronic Commerce*, Vol. 9 No. 4, pp. 37–41.

Ray, G., Muhanna, W. and Barney, J. (2005), "Information Technology and the Performance of the Customer Service Process: A Resource-Based Analysis", *Management Information Systems Quarterly*, Vol. 29 No. 4, pp. 625–652.

Roberts, N. and Grover, V. (2012), "Leveraging Information Technology Infrastructure to Facilitate a Firm's Customer Agility and Competitive Activity: An Empirical Investigation", *Journal of Management Information Systems*, Vol. 28 No. 4, pp. 231–270.

Rosenthal, R. (1979), "The File Drawer Problem and Tolerance for Null Results", *Psychological Bulletin*, Vol. 86, pp. 638–641.

Rosenthal, R. (1991), *Metaanalytic Procedures for Social Research*, Sage, California, 2nd ed.

Rosenzweig, E.D. (2009), "A Contingent View of E-Collaboration and Performance in Manufacturing", *Journal of Operations Management*, Vol. 27 No. 6, pp. 462–478.

Ryoo, S.Y. and Kim, K.K. (2015), "The Impact of Knowledge Complementarities on Supply Chain Performance through Knowledge Exchange", *Expert Systems with Applications*, Vol. 42 No. 6, pp. 3029–3040.

Sabherwal, R. and Jeyaraj, A. (2015), "Information Technology Impacts on Firm Performance: An Extension of Kohli and Devaraj (2003)", *Management Information Systems Quarterly*, Vol. 39 No. 4, pp. 809–836.

Sabherwal, R., Jeyaraj, A. and Chowa, C. (2006), "Information System Success: Individual and Organizational Determinants", *Management Science*, Vol. 52 No. 12, pp. 1849–1864.

Saeed, K. a, Malhotra, M.K. and Grover, V. (2005), "Examining the Impact of Interorganizational Systems on Process Efficiency and Sourcing Leverage in Buyer-Supplier Dyads", *Decision Sciences*, Vol. 36 No. 3, pp. 365–397.

Saldanha, T.J. V, Melville, N.P., Ramirez, R. and Richardson, V.J. (2013), "Information Systems for Collaborating versus Transacting: Impact on Manufacturing Plant Performance in the Presence of Demand Volatility", *Journal of Operations Management*, Vol. 31 No. 6, pp. 313–329.

Sanders, N.R. (2007), "An Empirical Study of the Impact of E-Business Technologies on Organizational Collaboration and Performance", *Journal of Operations Management*, Vol. 25 No. 6, pp. 1332–1347.

Saraf, N., Langdon, C.S. and Gosain, S. (2007), "IS Application Capabilities and Relational Value in Interfirm Partnerships", *Information Systems Research*, Vol. 18 No. 3, pp. 320–339.

Sarker, S., Sarker, S., Sahaym, A. and Bjørn-andersen, N. (2012), "Exploring Value Cocreation in Relationship Between an ERP Vendor and its Partners: A Revelatory Case Study", *Management Information Systems Quarterly*, Vol. 36 No. 1, pp. 317–338.

Schryen, G. (2010), "Preserving Knowledge on IS Business Value", *Business & Information Systems Engineering*, Vol. 2 No. 4, pp. 233–244.

Shih, E., Kraemer, K.L. and Dedrick, J. (2008), "IT Diffusion in Developing Countries", *Communications of the ACM*, Vol. 51 No. 2, pp. 43–48.

da Silveira, G.J.C. and Cagliano, R. (2006), "The Relationship between Interorganizational Information Systems and Operations Performance", *International Journal of Operations & Production Management*, Vol. 26 No. 3, pp. 232–253.

Sriram, V. and Stump, R. (2004), "Information Technology Investments in Purchasing: An Empirical Investigation of Communications, Relationship and Performance Outcomes", *Omega*, Vol. 32 No. 1, pp. 41–55.

Straub, D., Rai, A. and Klein, R. (2004), "Measuring Firm Performance at the Network Level: A Nomology of the Business Impact of Digital Supply Networks", *Journal of Management Information Systems*, Vol. 21 No. 1, pp. 83–114.

Subramani, M. (2004), "How Do Suppliers Benefit From Information Technology Use in Supply Chain Relationships?", *Management Information Systems Quarterly*, Vol. 28 No. 1, pp. 45–73.

Tafti, A., Mithas, S. and Krishnan, M. (2013), "The Effect of Information Technology–Enabled Flexibility on Formation and Market Value of Alliances", *Management Science*, Vol. 59 No. 1, pp. 207–225.

Tallon, P. and Pinsonneault, A. (2011a), "Competing Perspectives on the Link Between Strategic Information Technology Alignment and Organizational Agility: Insights from a Mediation Model", *Management Information Systems Quarterly*, Vol. 35 No. 2, pp. 463–486.

Tallon, P.P. and Pinsonneault, A. (2011b), "Competing Perspectives on the Link Between Strategic Information Technology Alignment and Organizational Agility: Insights from a Mediation Model", *Management Information Systems Quarterly*, Vol. 35 No. 2, pp. 463–486.

Tanriverdi, H. (2006), "Performance Effects of Information Technology Synergies in Multibusiness Firms", *Management Information Systems Quarterly*, Vol. 30 No. 1, pp. 57–77.

Truman, G. (2000), "Integration in Electronic Exchange Environments", *Journal of Management Information Systems*, Vol. 17 No. 1, pp. 209–244.

Vaccaro, A., Parente, R. and Veloso, F.M. (2010), "Knowledge Management Tools, Inter-Organizational Relationships, Innovation and Firm Performance", *Technological Forecasting and Social Change*, Vol. 77 No. 7, pp. 1076–1089.

Vickery, S.K., Jayaram, J., Droge, C. and Calantone, R. (2003), "The Effects of an Integrative Supply Chain Strategy on Customer Service and Financial Performance: An Analysis of Direct versus Indirect Relationships", *Journal of Operations Management*, Vol. 21 No. 5, pp. 523–539.

Wade, M. and Hulland, J. (2004), "Review: The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research", *Management Information Systems Quarterly*, Vol. 28 No. 1, pp. 107–142.

Wang, E.T.G., Tai, J.C.F. and Grover, V. (2013), "Examining the Relational Benefits of Improved Interfirm Information Processing Capability in Buyer-Supplier Dyads", *Management Information Systems Quarterly*, Vol. 37 No. 1, pp. 149–173.

Wang, N., Liang, H., Zhong, W., Xue, Y. and Xiao, J. (2012), "Resource Structuring or Capability Building? An Empirical Study of the Business Value of Information Technology", *Journal of Management Information Systems*, Vol. 29 No. 2, pp. 325–367.

Wang, Y., Chen, Y. and Benitez-amado, J. (2015), "How Information Technology Influences Environmental Performance: Empirical Evidence from China", *International Journal of Information Management*, Vol. 35 No. 2, pp. 160–170.

Wong, C.W.Y., Lai, K. and Cheng, T.C.E. (2012), "Value of Information Integration to Supply Chain Management: Roles of Internal and External Contingencies", *Journal of Management Information Systems*, Vol. 28 No. 3, pp. 161–200.

Wong, C.W.Y., Lai, K.H., Cheng, T.C.E. and Lun, Y.H.V. (2015), "The Role of IT-Enabled Collaborative Decision Making in Inter-Organizational Information Integration to Improve Customer Service Performance", *International Journal of Production Economics*, Vol. 159 No. 1, pp. 56–65.

Wu, J. and Lederer, A. (2009), "A Meta-Analysis of the Role of Environment Based Voluntariness in Information Technology Acceptance", *Management Information Systems Quarterly*, Vol. 33 No. 2, pp. 419–432.

Xu, D., Huo, B. and Sun, L. (2014), "Relationships between Intra-Organizational Resources, Supply Chain Integration and Business Performance", *Industrial Management & Data Systems*, Vol. 114 No. 8, pp. 1186–1206.

Xue, L., Ray, G. and Sambamurthy, V. (2013), "The Impact of Supply-Side Electronic Integration on Customer Service Performance", *Journal of Operations Management*, Vol. 31 No. 6, pp. 363–375.

Yao, Y., Dresner, M. and Palmer, J.W. (2009), "Impact of Boundary-Spanning Information Technology and Position in Chain on Firm Performance", *Journal of Supply Chain Management*, Vol. 45 No. 4, pp. 3–16.

Yassaee, M. and Mettler, T. (2015), "The Current State of and Possible Future Avenues for IT Value Research: A Review of the Past 10 Years", *Proceedings of the European Conference on Information Systems*, pp. 1–17.

Zhao, K. and Xia, M. (2014), "Forming Interoperability through Interorganizational Systems Standards", *Journal of Management Information Systems*, Vol. 30 No. 4, pp. 269–298.

Zhu, K. (2004), "The Complementarity of Information Technology Infrastructure and E-Commerce Capability: A Resource-Based Assessment of Their Business Value", *Journal of Management Information Systems*, Vol. 21 No. 1, pp. 167–202.

Zhu, K. and Kraemer, K.L. (2002), "E-Commerce Metrics for Net-Enhanced Organizations: Assessing the Value of E-Commerce to Firm Performance in the Manufacturing Sector", *Information Systems Research*, Vol. 13 No. 3, pp. 275–295.

Zhu, K. and Kraemer, K.L. (2005), "Post-Adoption Variations in Usage and Value of E-Business by Organizations: Cross-Country Evidence from the Retail Industry", *Information Systems Research*, Vol. 16 No. 1, pp. 61–84.

Zhu, K., Kraemer, K.L., Xu, S. and Dedrick, J. (2004), "Information Technology Payoff in E-Business Environments: An International Perspective on Value Creation of E-Business in the Financial Services Industry", *Journal of Management Information Systems*, Vol. 21 No. 1, pp. 17–54.

Zhu, Z., Zhao, J., Tang, X. and Zhang, Y. (2015), "Leveraging E-Business Process for Business Value: A Layered Structure Perspective", *Information & Management*, Vol. 52 No. 6, pp. 679–691.