

ANTECEDENTS OF KNOWLEDGE TRANSFER FROM CONSULTANTS TO CLIENTS IN ENTERPRISE SYSTEM IMPLEMENTATIONS¹

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Abstract

Enterprise resource planning (ERP) systems and other complex information systems represent critical organizational resources. For such systems,

firms typically use consultants to aid in the implementation process. Client firms expect consultants to transfer their implementation knowledge to their employees so that they can contribute to successful implementations and learn to maintain the systems independent of the consultants. This study examines the antecedents of knowledge transfer in the context of such an interfirm complex information systems implementation environment. Drawing from the knowledge transfer, information systems, and communication literatures, an integrated theoretical model is developed that posits that knowledge transfer is influenced by knowledge-related, motivational, and communication-related factors. Data were collected from consultant-and-client matched-pair samples from 96 ERP implementation projects. Unlike most prior studies, a behavioral measure of knowledge transfer that incorporates the application of knowledge was used. The analysis suggests that all three groups of factors influence knowledge transfer, and provides support for 9 of the 13 hypotheses. The analysis also confirms two mediating relationships. These results (1) adapt prior research, primarily done in non-IS contexts, to the ERP implementation context, (2) enhance prior findings by confirming the significance of an antecedent that has previously shown mixed results, and (3) incorporate new IS-related constructs and measures in developing an integrated model that

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should be broadly applicable to the interfirm IS implementation context and other IS situations. Managerial and research implications are discussed.

Keywords: Knowledge transfer, enterprise systems, ERP, implementation, consultants, structural equation modeling, partial least squares

Introduction

More than 60 percent of firms in the United States had implemented, or planned to implement, enterprise resource planning (ERP) systems in 2000. Since then, the sales of ERP packaged software has increased by about 150 percent per year, reaching an annual sales level of more than \$30 billion in 2004. Total expenditures on ERP are certainly much more (Sheu et al. 2004). Moreover, firms that successfully implement ERPs have been shown to exhibit higher performance across a wide variety of financial metrics (Hitt et al. 2002).

However, the implementation of such complex information systems (IS) continues to challenge firms. Researchers have identified many reasons for less than successful implementations, including lack of in-house expertise (Smith et al. 1998), poor employee retention (McFarlan and Nolan 1995), and difficulties in keeping up with changing technologies (Lacity and Willcocks 1998).

Because of these issues, most organizations rely on external consultants for significant help in developing and implementing these systems (Lozinsky 1998). Since ERP systems are focused on providing a degree of functional interoperability that is "difficult and expensive to achieve with stand-alone custom-built systems" (Hitt et al. 2002, p. 72), this reliance on consultants is well-founded (DiRomualdo and Gurbaxani 1998; Quinn 1999). With the growing application of outsourcing to ever more sophisticated levels in development and integration projects, new opportunities are also rapidly opening for such vendor-client processes in the broader field of information systems.

In using consultants, organizations typically have goals that go beyond the successful implementation of a new system; they also have the less-tangible goal of acquiring new implementation, operational, maintenance, and training knowledge. The successful transfer of this knowledge from consultants to business clients is critical for meeting the perceived needs of the client organization (Bancroft et al. 1998; Soh et al. 2000).

Knowledge is usually defined as a justified belief that increases an individual's capacity to take effective action (Alavi and Leidner 2001). It exists in two primary forms: explicit, which is transmittable in formal, systematic language, and tacit, which "'indwells' in a comprehensive cognizance of the human mind and body" (Nonaka 1994, p. 16). *Commercial knowledge*, which may be explicit or tacit, or both, "is not truth, but effective performance: not 'what is right,' but 'what works' or even 'what works better'" (Demarest 1997, p. 375).

The knowledge domain of this study is a specific variety of commercial knowledge—complex information systems implementation knowledge—sets of rules, tools, and guidelines and ways to employ them that produce effective systems implementation. ERP implementation knowledge, which is both explicit and tacit, embodies those activities associated with configuring and testing ERP modules, installing software and hardware, and training client employees in preparation for on-going operation, maintenance, and support of a vendor-supplied system that is typically *customized* (Bancroft et al. 1998; Lozinsky 1998). Such knowledge includes, for example, guidelines for manipulating configuration tables so that they align with business processes and knowledge of how a sales-order transaction flowing through to another functional area might trigger a change in inventory stock levels or in the generation of invoices.

The ERP context is prototypical of Swanson's (1994) most demanding innovation domain (Type IIIc) since ERP focuses on the fulfillment of "the enterprise needs of an organization by tightly integrating the various functions of an organization using a process view" (Sadagopan 2003, p. 169).

Swanson notes that both users and consultants play important roles in the successful implementation of Type III innovations, and that the transfer of knowledge is important in the ERP context (Soh et al. 2000).

However, not much is known about knowledge transfer from consultants to business users (i.e., clients) in the context of Type III innovations—a setting that is knowledge intensive and in which the knowledge structure of the participants is asymmetric. Initially, the consultant primarily possesses *technical knowledge*, whereas the client primarily possesses *business knowledge* (Rus and Lindvall 2002). Such knowledge asymmetry can be problematic because it creates *knowledge barriers* that inhibit the adoption of complex technologies (Attewell 1992). Transferring knowledge from consultants to clients is one mechanism to lower such knowledge barriers. Hence, the knowledge initially possessed by the consultant must be integrated and embodied (Faraj and Sproull 2000) in the system and/or in the knowledge of the client (Soh et al. 2000).

In comparison to the implementation of internally developed IS applications, business clients play a larger and more significant role in ERP implementations (Markus and Tanis 2000; Soh et al. 2000). Indeed, business clients typically out-number IS specialists on ERP “mixed” project teams (Bancroft et al. 1998). Hence, understanding how knowledge transfer effectively occurs in such instances is important.

Many factors have been identified in non-IS contexts to be favorable to, or deleterious to, successful knowledge transfer. The first step of this study was to identify such factors from the general knowledge transfer literature. Unfortunately, empirical results regarding antecedents of knowledge transfer in non-IS contexts have not been consistently strong and robust, prompting a call for additional studies (Argote 1999). In the ERP context, developing these understandings is especially difficult because it is quite different from environments in which the theories usually have been developed and tested. Further, the ERP context is different from the traditional IS develop-

ment-implementation situations because of the greater importance and complexity of the systems, the crossing of firm boundaries, and the high degree of asymmetry of the knowledge of participants.

Therefore, the research questions for this study are: What are the antecedents of knowledge transfer from a consultant to a client, and to what extent do these antecedents explain knowledge transfer in the context of ERP implementations? The approach taken to address these questions involves the integration of the theory of information systems implementation with findings regarding knowledge transfer in other domains.

Knowledge Transfer

There are many extant definitions of knowledge transfer. In the past, some researchers equated knowledge sharing with knowledge transfer (e.g., Huber 1991). Recently, much knowledge transfer research has adopted a “source and recipient” generic model.

However, there are several views concerning when knowledge transfer can be said to have taken place. Some researchers have taken the simple exchange approach by defining knowledge transfer as “dyadic exchanges of organizational knowledge between a source and a recipient unit in which the identity of the recipient matters” (Szulanski 1996, p. 28). Others also focus on the resulting changes to the recipient. For example, knowledge transfer can be seen as “the process through which one unit (e.g., group, department, or division) is affected by the experience of another” (Argote and Ingram 2000, p. 151). Darr and Kurtzberg (2000) go further by arguing that knowledge transfer occurs “when a contributor shares knowledge that is *used* by an adopter” (p. 29).

Given the multiple objectives of knowledge transfer in ERP implementations, only a sophisticated operationalization of the concept will suffice here. Since the literature suggests that key aspects of knowledge transfer are knowledge *movement* and

the *application* of knowledge, this study captures both of these ideas by defining knowledge transfer as *the communication of knowledge from a source so that it is learned and applied by a recipient*.

Research Model and Hypotheses

Since most knowledge transfer research has been done in non-IS contexts and much has focused on unit-to-unit transfer within an organization, there is a distinct challenge to develop a research model that adopts the most appropriate constructs from prior research and integrates them with constructs that are most appropriate for the IS context.

Scholars have offered various frameworks for classifying the variables that influence knowledge transfer. However, most of these apply to domains and organizational levels that are quite different from that being studied here. For example, Argote (1999) depicts knowledge transfer between organizational units to be affected by factors in four categories: characteristics of the relationship among organizations, of the knowledge transferred, of the organizations, and of the transfer process. Szulanski (1996) identified two categories of factors that affect the transfer of best practices between units of the same firm, which he termed *knowledge barriers* and *motivational barriers*.

Szulanski's study is important because it identifies some classes of factors affecting knowledge transfer and because it offers empirical evidence about the relative strength of those factors. His results are partially reinforced by evidence from the IS implementation domain with regard to some knowledge factors. However, his somewhat surprising negative results concerning motivational factors are contradicted by IS studies (Bagchi et al. 2003; Bock and Kim 2002).

In the complex systems implementation situation in IS, knowledge is transferred *interfirm*, between

specific individuals in consulting firms to specific individuals in user firms in an ongoing process. In contrast to the objectives of this study, Szulanski's objective was to determine the origins of difficulties in "internal stickiness" in an *intra-firm* one-shot context. He studied groups of sources and recipients rather than specific pairs of individuals (consultant and client), which is the most relevant unit of analysis in ERP implementations.

In addition to knowledge-related and motivational factors, communication-related factors have been included in the model presented here. A particularly robust finding in the IS literature is that communication difficulties between parties can impede efforts to share knowledge and to understand differing world views, rendering the implementation of technology solutions problematic (Barki and Hartwick 2001; Markus and Benjamin 1997). Therefore, the research model, shown in Figure 1, proposes an integrated model in which knowledge transfer is influenced by three sets of factors: knowledge-related, communication-related, and motivational factors. Figure 1 shows the individual constructs as well as the hypotheses of this study, including two mediating relationships. These constructs have been identified because of their theoretical relevance and managerial importance, as subsequently described.

Knowledge Transfer: The Dependent Variable

The dependent variable in the research model is knowledge transfer. Knowledge is taken to be transferred when learning takes place and when the recipient understands the intricacies and implications associated with that knowledge so that he or she can apply it (Argote 1999; Darr and Kurtzberg 2000). For example, consultants may transfer knowledge about testing procedures to clients who learn and apply this knowledge, as evidenced by clients developing test scripts, conducting unit tests of individual modules, and running integration tests to ascertain whether data are correctly passed between two or more modules.

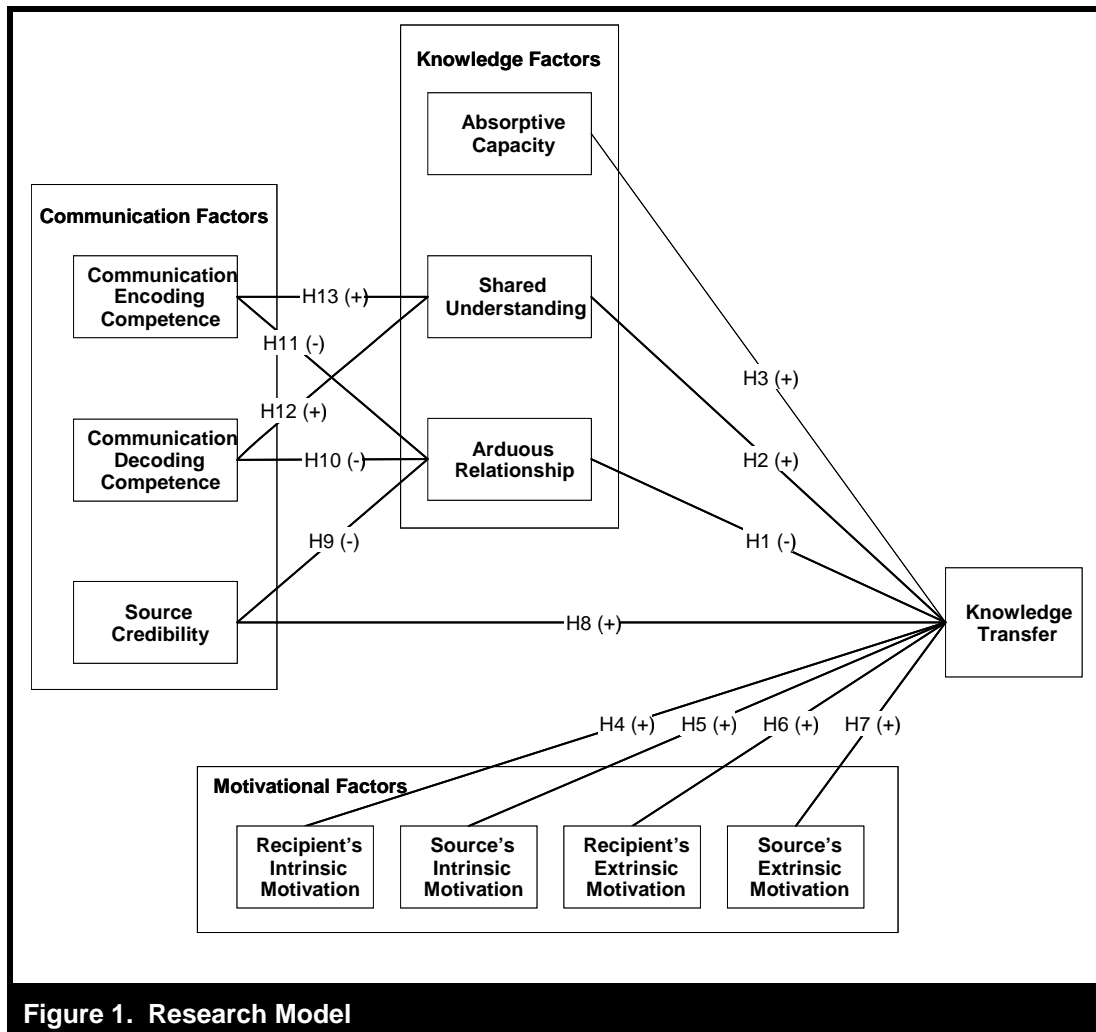


Figure 1. Research Model

Knowledge-Related Antecedents

Szulanski identified three knowledge factors—an arduous relationship between source and recipient, causal ambiguity, and absorptive capacity—that influence the transfer of knowledge. In the model for this study, arduous relationship and absorptive capacity are included as both have also been found to be important in the IS context (Aladwani 2002; Faraj and Sproull 2000). However, Szulanski's operationalization of causal ambiguity was not found to be a major factor in the context of enterprise information systems (Timbrell et al. 2001) and was dropped. Instead, *shared understanding* (Nelson and Coopriider 1996),

which is posited to influence knowledge transfer in the ERP context, has been incorporated into the model.

Arduous Relationship

Various studies have suggested that one important factor affecting the transfer of knowledge is the relationship between a source and a recipient (Argote 1999). Transferring knowledge can require frequent and numerous interactions between the parties (Nonaka 1994). A successful interaction depends on the quality of the relationship. An arduous relationship, which is defined as an

emotionally laborious and distant relationship between a source and a recipient (Szulanski 1996), affects the ability for the source to transfer the needed knowledge and of the recipient to learn and apply the knowledge. Hence, an arduous relationship between a source and a recipient is likely to adversely affect knowledge transfer (Baum and Ingram 1998).

ERP implementation projects last an average of 23 months but can take as long as 5 years (Stein 1999), highlighting a need for ongoing and cooperative relationships between consultants and clients. Empirical work in the IS project context demonstrates the importance of cooperative relationships among stakeholders; such relationships facilitate the flow and interpretation of knowledge, ultimately contributing to project success (Faraj and Sproull 2000; Kraut and Streeter 1995). Therefore,

H1: *The more arduous the relationship between a consultant and a client, the less the knowledge transfer.*

Shared Understanding

Shared understanding represents the extent to which the work values, norms, philosophy, problem-solving approaches, and prior work experience of a dyad are similar (Gerwin and Moffat 1997; Nelson and Coopriider 1996). Research suggests that similar heuristics and shared experiences between a source and a recipient are important antecedents of knowledge transfer (Hansen 1999), that they remove barriers to understanding and acceptance between a source and a recipient (Krauss and Fussell 1990), and that both participants thereby enhance their ability to work toward a common goal (Nelson and Coopriider 1996). Without shared understanding, there is a tendency for the parties to disagree about what they should be doing and why, which leads to poor outcomes (Bennett 1996; Gerwin and Moffat 1997).

In an IS context, Nelson and Coopriider (1996) found that shared understanding between IS and line managers improves the performance of IS

organizations and facilitates the sharing of knowledge. During ERP implementations, consultants bring to the engagement their prior work experience, work values, norms, philosophy, and problem-solving approaches. To the extent that these are similar to those of the client, there is a greater likelihood that the two are able to work effectively toward transferring knowledge. Therefore,

H2: *The greater the shared understanding between a consultant and a client, the greater the knowledge transfer.*

Absorptive Capacity

Absorptive capacity is the ability of a recipient to recognize the importance and value of externally sourced knowledge, assimilate it, and apply it (Cohen and Levinthal 1990). It is largely a function of the recipient's existing stock of knowledge prior to the transfer. Studies suggest that absorptive capacity is positively related to knowledge transfer (Galbraith 1990; Hamel 1991).

IS researchers have found that functional users who lacked absorptive capacity about the development process typically experienced difficulties assimilating and applying transferred knowledge (Nelson and Coopriider 1996). In fact, absorptive capacity was found to be an important determinant of positive IS project outcomes (Aladwani 2002). Thus, the extent to which clients possess ERP implementation knowledge should influence their ability to value, assimilate, and apply the knowledge transferred by the consultants. Therefore,

H3: *The greater the absorptive capacity of a client, the greater the knowledge transfer.*

Motivational Antecedents

A second set of factors identified by Szulanski as potentially influencing knowledge transfer is motivational factors. Although he identifies a number of factors as motivational—including lack of incentives, lack of confidence, turf protection, and the “not invented here” syndrome—Szulanski empirically examined only the generic “lack of motiva-

tion” on the part of the source and recipient. He found neither the motivation of the recipient nor the motivation of the source particularly influential in explaining knowledge transfer. Others have theorized and found a positive relationship between motivation and knowledge transfer (Argote 1999). For example, in one study, knowledge-acquiring firms were found to be motivated to accelerate the speed of knowledge transfer when competitors were perceived to be developing similar products (Zander and Kogut 1995). Some researchers argue that these mixed findings may be a result of failing to consider the differential effects of intrinsic and extrinsic motivation (Osterloh and Frey 2000). This distinction, for both the consultant and client, is incorporated into this study.

Intrinsic Motivation

Employees are intrinsically motivated when their needs are directly satisfied (e.g., self-defined goals), or when their satisfaction lies in the content of the activity itself. Intrinsic motivation occurs when an activity “is valued for its own sake and appears to be self sustained” (Calder and Staw 1975, p. 599).

Osterloh and Frey (2000) conclude that intrinsic motivation should enable the transfer of tacit knowledge. They argue that because managers cannot easily observe knowledge and whether it has transferred, they need to rely on intrinsically motivated employees to transfer such knowledge. O’Dell and Grayson (1998) found intrinsic motivation important to transferring best practices. Project management, business reengineering, database administration, and systems integration are illustrative of types of ERP implementation knowledge that is primarily tacit and, therefore, difficult to codify (Markus and Tanis 2000; Soh et al. 2000). Thus, knowledge should transfer when the recipient and source are intrinsically motivated.

H4: *The more intrinsically motivated the client, the greater the knowledge transfer.*

H5: *The more intrinsically motivated the consultant, the greater the knowledge transfer.*

Extrinsic Motivation

In contrast to intrinsic motivation, employees are extrinsically motivated when satisfaction does not lie in the content of the activity itself. For example, compensation is a primary vehicle for indirectly motivating employees in that money is a “goal which provides satisfaction independent of the activity itself” (Calder and Staw 1975, p. 599).

Although intrinsic motivation is thought to be important for transferring knowledge, extrinsic motivation also seems to play a role. O’Dell and Grayson (1998) argue that an important leadership role for senior management is to reinforce and reward behaviors for sharing knowledge, especially in initial knowledge transfer initiatives. Bennett (1996) agrees that successful transfer of technology requires that individuals be recognized for good work. In IS, the results of Bock and Kim’s (2002) field survey indicate that extrinsic rewards are a trigger for knowledge sharing. This suggests that extrinsically motivated consultants and clients facilitate knowledge transfer.

H6: *The more extrinsically motivated the client, the greater the knowledge transfer.*

H7: *The more extrinsically motivated the consultant, the greater the knowledge transfer.*

Communication-Related Antecedents

The IS literature has consistently identified communication difficulties between stakeholders as major impediments to the successful deployment of systems (Hartwick and Barki 2001; Marakas and Elam 1998). The ERP literature has also identified communication as one of the critical success factors for implementation (Holland and Light 1999). For example, Soh et al. (2000) found that key users, IS personnel, and vendors involved in ERP implementations had different knowledge bases, which they found difficult to transfer to each other because of their varied backgrounds and interests.

The model used in this study incorporates three communication-related factors: source credibility and communication encoding and decoding competence. These factors have been found to be important in the context of complex systems implementations (Holland and Light 1999; Robey et al. 2002; Soh et al. 2000; Swaab et al. 2002).

Source Credibility

Source credibility is the extent to which a recipient perceives a source to be trustworthy and an expert (Dholakia and Sternthal 1977; Grewal et al. 1994). When source credibility is high, the knowledge presented by the source is perceived to be useful (Mizerski et al. 1979), thereby facilitating the transfer of knowledge. Attribution theory (Kelley 1973) suggests that recipients of knowledge attempt to assess whether the knowledge provides an accurate representation and/or whether the source of the knowledge lacks credibility. When source credibility is low, a recipient will perceive a source's knowledge to be less persuasive and will discount that knowledge (Eagley et al. 1978). When source credibility is high, the persuasive impact of the knowledge is typically strengthened (Mizerski et al. 1979) and the knowledge is perceived to be useful.

Szulanski found that an unreliable source was not a significant factor in his study of transfer of best practices between units; the perception of source unreliability neither facilitated nor impeded knowledge transfer. However, in IS, the transfer of knowledge between a quality assurance department and the IS department, as well as the transfer of knowledge between IS departments, has been found to be influenced by the credibility of the source (Slaughter and Kirsch 2000); when the source lacked credibility in the eyes of the recipient, the knowledge transfer was less effective. Therefore,

H8: *The more credible the consultant, the greater the knowledge transfer.*

In addition to the direct relationship between source credibility and knowledge transfer, source credibility is posited to influence knowledge transfer indirectly through *arduous relationship*. Source credibility is an attitude that a recipient has about a source (Dholakia and Sternthal 1977; Grewal et al. 1994) and is related to a recipient's willingness to communicate and collaborate with a source (Anderson and McLean 1974). Difficulty in communication and collaboration indicates a distant, and possibly laborious, relationship. This suggests that when source credibility is high, a recipient is likely to increase communication and collaboration with a source, thereby lessening the possibility of an arduous relationship. In one study, when the source credibility of IS specialists was low, businesspeople did not engage them in the organization's strategic initiatives in which IT was a critical part (Bashein and Markus 1997). Therefore,

H9: *The more credible the consultant, the less arduous the relationship between consultant and client.*

Communication Competence

Communication competence is the ability to demonstrate knowledge of the appropriate communication behavior to effectively achieve one's goals (Monge et al. 1982). Communication between individuals requires both the decoding and encoding of messages. Communication *decoding* competence refers to a recipient's ability to listen, be attentive and respond quickly; communication *encoding* competence refers to a source's ability to express one's ideas clearly, have a good command of the language, and be easily understood (Monge et al. 1982). Studies suggest that increased communication competence increases the likelihood for individuals to engage in activities with each other (Berman and Heilweg 1989), which affects their relationship (Monge et al. 1982) and shared understanding (Swaab et al. 2002).

Communication Competence and Arduous Relationship:

An empirical study examining communication encoding competence suggests that subordinates form either positive or negative perceptions about their supervisor based on his/her encoding competence (Berman and Heilweg 1989); positive perceptions of a supervisor improved the quality of their relationship while negative perceptions led to an arduous relationship. Other research suggests that when a client lacks the ability to listen, be attentive, and respond, an opportunity to improve his relationship with a consultant is missed (e.g., Robey et al. 2002).

Findings by IS researchers also suggest that communication competence is important for managing conflicts (Barki and Hartwick 2001) and improving team relationships (Guinan et al. 1998). Moreover, in their examination of ERP implementations, Soh et al. (2000) suggest that communication competence allows opportunities for stakeholders to improve the quality of their relationship. Thus, we posit an inverse relationship between communication competence (decoding and encoding) and the arduousness of the consultant-client relationship.

H10: *The greater a client's communication decoding competence, the less arduous the relationship between a consultant and a client.*

H11: *The greater a consultant's communication encoding competence, the less arduous the relationship between a consultant and a client.*

Communication Competence and Shared Understanding:

Communication difficulties may arise from a failure to recognize and accommodate differing values and views among individuals. For example, when transferring technologies, it is important to build a common understanding among stakeholders, and developing that shared understanding depends, in part, on the communication competence of the sender and receiver (Bennett 1996). Swaab et al. (2002) characterize communication competence as a process of structuring, evaluating, interpreting, and transforming

information into knowledge producing a common cognition of a problem or solution, and in shared understanding. This suggests that when consultants and business clients successfully progress through these steps, they are exhibiting encoding and decoding competence.

In their illustration of Daimler and Chrysler's merger, Malhotra et al. (2001) suggest that virtual teams had difficulty communicating with one another, making it hard to create shared understanding among members. In an experimental study, Kahai and Cooper (2003) found communication clarity facilitated the development of a shared understanding, which had a positive impact on decision quality. We expect a similar relationship between communication encoding and decoding competence and shared understanding.

H12: *The greater a client's communication decoding competence, the greater the shared understanding between a consultant and a client.*

H13: *The greater a consultant's communication encoding competence, the greater the shared understanding between a consultant and a client.*

Research Methodology ██████████

To test the model and hypotheses shown in Figure 1, matched-pair survey instruments were developed. These were administered via the World Wide Web. Consultants (sources) provided information about absorptive capacity and communication decoding competence. Clients (recipients) were asked about knowledge transfer, source credibility, and communication encoding competence. Both consultants and clients responded to items about intrinsic and extrinsic motivation, arduous relationship, and shared understanding; in the latter two instances, their responses were combined to produce one measure of each. The use of two questionnaires reduces potential problems arising from single informant and common method bias.

Data Collection: Projects and Respondents

To identify appropriate projects and research participants, consultants, project managers, consulting-firm partners, and senior IS executives were contacted. We identified ERP projects and respondents that satisfied three criteria. First, to ensure that significant activities would have recently occurred, ERP projects that were deployed or satisfied at least one milestone within the last 12 months were selected for inclusion. Second, each project consisted of the implementation of *one* specific ERP module such as Purchasing or General Ledger. Third, both the consultant and business client members of a dyad must have operated in his or her role for at least two months. This ensured adequate time for their relationship to evolve. These individuals represented leaders from their respective organizations—consultant leads and “power users”—who were the most knowledgeable members of the project team. Completed survey instruments from both a consultant and business client matching-pair for each project were required. Dynamic web pages were utilized to capture the consultant, client, and ERP module name. Both the individuals’ names and the ERP module name were displayed in the appropriate survey items to improve the specificity of the question and the quality of the data.

Over a six-month time period, the researchers collected data from a total of 96 projects from 80 client organizations and 38 consulting firms. As seen in Table 1, the sample client firms represent multiple industries. Most of these organizations are large for-profit firms; however, the sample also includes five large educational institutions, four government agencies, and two community organizations. Additional descriptive details are provided in Table 2. Many of the projects were in one of two implementation phases, and they varied in project complexity and size. The respondents also varied in terms of ERP experience and organizational tenure. For the consultants, ERP experience with respect to the number of implementations (of the same ERP module as reported in the instrument) ranged from zero to nine implementations (average of 2.47 implementations, standard deviation of

1.54). The number of years in their current positions ranged from 1 to 8 years, with an average of 2.79 years (standard deviation of 1.71).

The business clients had position titles such as financial analyst, purchasing agent, and inventory manager. The number of years in their current positions ranged between less than a year and 24 years (average = 6.46 years; standard deviation = 5.28). In all, 76 business clients reported having no prior implementation experience (of the same ERP module as reported on in the instrument) while 17, 2, and 1 indicated 1, 2, and 5 implementations, respectively (average = 0.27; standard deviation = 0.67). The amount of time the business clients worked with their consultant partners on the projects studied ranged from 2 to 20 months (average = 8.04 months, standard deviation = 4.06). The business clients in approximately 75 percent of the projects indicated they had prior experience working with these or other consultants.

Instrument Development

To develop the survey instrument, generally accepted instrument development guidelines were followed. Scale items are shown in Appendix A. Many items were derived from earlier work, as shown in Appendix A. However, scale items for knowledge transfer were newly developed. Although many scholars have conceptualized knowledge transfer, relatively few have attempted to measure it directly. The measure used in this study is a direct operational measure of detailed aspects of knowledge transfer in ERP implementation that a business client is likely to experience: configuration, testing, and training (Bancroft et al. 1998; Lozinsky 1998; Markus and Tanis 2000).

The development of the knowledge transfer measure was grounded in the work of Argote and Ingram (2000), who argue that there are two ways to evaluate knowledge transfer: assessing changes in the recipient’s performance attributed to the transferred knowledge or assessing induced changes to the knowledge base in the recipient. The measure developed here includes items that

Table 1. Industry Representation of Client Firms

Industry	Number of Firms	Number of Projects
Technology/Network	14	18
Manufacturing	11	15
Products/Food & Beverage	14	14
Shipping/Transportation	8	12
Non-Profit (e.g., Education, Government)	11	12
Financial (e.g., Banking, Insurance)	9	11
Software	5	5
Telecommunication	4	5
Others (e.g., Health Care, Entertainment)	4	4
TOTAL	80	96

Table 2. Project Description

Project Phase ^a		Project Complexity ^b		Project Size ^b	
Phase	# of projects	Percent of customization	# of projects	# of full-time equivalents	# of projects
Design	0	0% – 20%	26	Fewer than 5	17
Construction and Testing	16	21% – 40%	32	5 – 6	21
Operational Implementation	52	41% – 60%	21	7	13
Post-Implementation	28	61% – 80%	10	8	20
		81% – 100%	6	More than 8	22
TOTAL^c	96		95		93

^aProject Phase descriptions, derived from Markus and Tanis (2000) and Bancroft et al. (1998):

- **Design** – define the targeted business process (e.g., develop design, gain user acceptance, and understand the implications of the changes).
- **Construction and Testing** – develop and test the business application (e.g., develop a comprehensive configuration, build and test interface programs, and test the systems).
- **Operational Implementation** – get the business application and the system up and running (e.g., build the networks, install desktops, training and support users, and go live).
- **Post-Implementation** – come to grips with the implemented business application and resume normal business operations.

^bThe grouping of responses into specific categories is for illustrative purposes only.

^cN = 96. Due to missing data, the total may be less than 96.

capture both aspects. Thus, items were created to assess whether the client learns from the consultant's implementation knowledge and whether the client is able to apply this knowledge. As shown in Appendix A, six items were developed to assess both the learning component and the application, or performance, component.

Three control variables were included in the analysis: project size, complexity, and phase. Respondents were asked to select among the four project phases shown and defined in Table 2. Project complexity was addressed by asking what percentage of project effort was associated with customization of the packaged ERP module. Customization requires in-depth knowledge of the software and adds to the overall challenge of the implementation (Holland and Light 1999). Implementing an ERP package "out of the box" is generally considered a less complex undertaking than modifying a package. Hence, the level of customization was seen as a reasonable proxy for project complexity. Project size was measured by asking business clients to indicate the number of consultant full-time equivalents (FTE) and business client FTE who worked on the ERP module. The total number of FTE was used as a proxy for project size.

Both instruments were subjected to pretesting and pilot-testing using consultants and clients who were not in the main sample. They were also reviewed by academics with expertise in survey methods and by masters students who had ERP implementation experience.

Data Analysis and Results

PLS has the ability to handle relatively small sample sizes, making it an appropriate choice for testing the research model. With PLS, the psychometric properties of the scales used to measure the variables are tested and the strengths and directions of the prespecified relationships are analyzed (Barclay et al. 1995).

Assessing the Measurement Model

The adequacy of the measurement model is determined by examining internal consistency and convergent and discriminant validities (Hulland 1999). Internal consistency is assessed by examining the loadings of the measures with their respective constructs. A generally accepted rule of thumb is to accept items with loadings of 0.70 or above, which suggests that there exists more shared variance between the construct and its measures than error variance (Barclay et al. 1995). An internal consistency measure developed by Fornell and Larcker (1981) is typically reported. It is similar to Cronbach's alpha (Barclay et al. 1995), and can be similarly interpreted. As shown in the "Fornell" column in Table 3, all measures of reliability exceed 0.84, and thus are deemed to be reliable.

In Table 3, the diagonal values represent the square root of the average variance extracted (AVE), providing a measure of the variance shared between a construct and its indicators, or convergent validity. Hence, convergent validity is established since each construct has an AVE of at least 0.5 (Fornell and Larcker 1981).

There are two procedures for assessing discriminant validity. First, AVE values must be examined to see if they are consistently greater than the off-diagonal correlations. Second, each within-construct item must load highly on the construct it is intended to measure and cross-loadings need to be lower than the within-construct item loadings. All constructs meet these requirements.² When assessing discriminant validity, items not loading highly on their own constructs, but instead loading on other constructs, were deleted. Revised scales were subjected to the same validation process until acceptable psychometric properties were displayed. All items—dropped and retained—are indicated in Appendix A. Table 3 reflects the final scales.

²The data supporting the discriminant validities are voluminous and are available from the first author.

Table 3. Reliability and Validity

	Fornell	KT	AR	SU	SC	CE	CD	RIM	REM	AC	SIM	SEM	PH	CPX	SZ
Knowledge Transfer (KT)	0.919	0.81													
Arduous Relationship (AR)	0.904	-0.54	0.81												
Shared Understanding (SU)	0.929	0.43	-0.25	0.73											
Source Credibility (SC)	0.884	0.50	-0.41	0.19	0.85										
Communication Encoding (CE)	0.924	0.59	-0.46	0.39	0.34	0.80									
Communication Decoding (CD)	0.966	0.51	-0.53	0.15	0.37	0.67	0.92								
Recipient Intrinsic Motivation (RIM)	0.974	0.58	-0.36	0.42	0.45	0.70	0.57	0.95							
Recipient Extrinsic Motivation (REM)	0.871	-0.19	0.32	-0.06	-0.27	-0.43	-0.38	-0.36	0.83						
Absorptive Capacity (AC)	0.949	0.44	-0.39	0.25	0.21	0.55	0.58	0.45	-0.27	0.91					
Source Intrinsic Motivation (SIM)	0.902	0.44	-0.24	0.23	0.30	0.38	0.33	0.46	-0.22	0.29	0.84				
Source Extrinsic Motivation (SEM)	0.845	0.08	-0.08	-0.24	0.03	0.08	0.02	-0.03	-0.10	-0.05	0.03	0.80			
Project Phase (PH)	1	0.00	0.13	0.07	-0.12	-0.14	-0.14	-0.10	0.22	-0.03	-0.10	-0.03	1.00		
Project Complexity (CPX)	1	0.07	-0.20	-0.02	0.04	0.03	0.04	-0.08	-0.04	-0.07	-0.16	0.06	-0.28	1.00	
Project Size (SZ)	1	0.03	-0.11	0.10	0.01	-0.10	0.05	-0.13	0.07	-0.06	-0.12	0.03	-0.17	0.16	1.00

Assessing the Structural Model

Assessment of the structural model involves estimating the path coefficients and the R^2 value. Path coefficients indicate the strengths of the relationships between the independent and dependent variables, whereas the R^2 value is a measure of the predictive power of a model for the dependent variables. PLS Graph, version 3, was chosen using a bootstrap resampling method (500 resamples) to determine the significance of the paths within the structural model. The sample size of 96 exceeded the recommended minimum of 80, which represented 10 times the number of independent constructs influencing a dependent construct (Barclay et al. 1995).

The overall results of the analysis are shown in Figure 2. As hypothesized, knowledge transfer is significantly associated with arduous relationship (path coefficient = -0.236 , $p < 0.05$), shared understanding (path coefficient = 0.184 , $p < 0.10$), absorptive capacity (path coefficient = 0.134 , $p < 0.10$), recipient's intrinsic motivation (path coefficient = 0.247 , $p < 0.05$), source's intrinsic motivation (path coefficient = 0.176 , $p < 0.05$), and source credibility (path coefficient = 0.204 , $p < 0.05$), which together explain 58.3 percent of the dependent variable's variance. All six paths have effects in the direction hypothesized, and Hypotheses 1, 2, 3, 4, 5, and 8 are, therefore, supported. However, two independent variables—recipient's and source's extrinsic motivation—have no significant effect on knowledge transfer. Thus, Hypotheses 6 and 7 are not supported.

As shown in Figure 2, source credibility (path coefficient = -0.234 , $p < 0.05$) and communication decoding competence (path coefficient = -0.349 , $p < 0.01$) significantly influence arduous relationship, accounting for 34.8 percent of the variance and providing support for Hypotheses 9 and 10. Contrary to expectations, communication encoding competence did not significantly affect arduous relationship. Thus, Hypothesis 11 is not supported.

Similarly, communication encoding competence (path coefficient = 0.527 , $p < 0.001$) significantly influences shared understanding, accounting for

17.5 percent of the variance and providing support for Hypothesis 13. However, communication decoding competence had no significant effect on shared understanding and, therefore, Hypothesis 12 is not supported.

Table 4 provides a detailed summary of all the hypotheses test results.

As shown in Figure 2, approximately 35 percent ($R^2 = 0.348$) of the variance in arduous relationship, 18 percent ($R^2 = 0.175$) of the variance in shared understanding, and 58 percent ($R^2 = 0.583$) of the variance in knowledge transfer are explained. The standardized path coefficients ranged from 0.134 to 0.527, with six of the nine paths exceeding the suggested minimum value of significance at 0.20 (Chin 1998). Thus, the fit of the overall model is good. All significant constructs display strong positive loadings and high levels of statistical significance for all items.

Three control variables were included in the model: project phase, complexity, and size. Descriptive details are provided in Table 2. As shown in the table, no projects were in the design phase, and 80 percent were in one of the two implementation phases. Further, more than 60 percent of the projects customized less than 40 percent of their ERP module and more than 83 percent of projects customized less than 60 percent. Finally, the data indicate that 86 percent of the projects contained 4 to 12 members in their project. None of these control variables were found to be significant (see Figure 2).

Discussion and Implications

This study examined the antecedents of knowledge transfer between consultants and their business clients in the context of ERP implementations. It was motivated by the need to develop an integrated model incorporating the factors that may be predictive of an effective interfirm transfer of knowledge in the implementation of complex information systems.

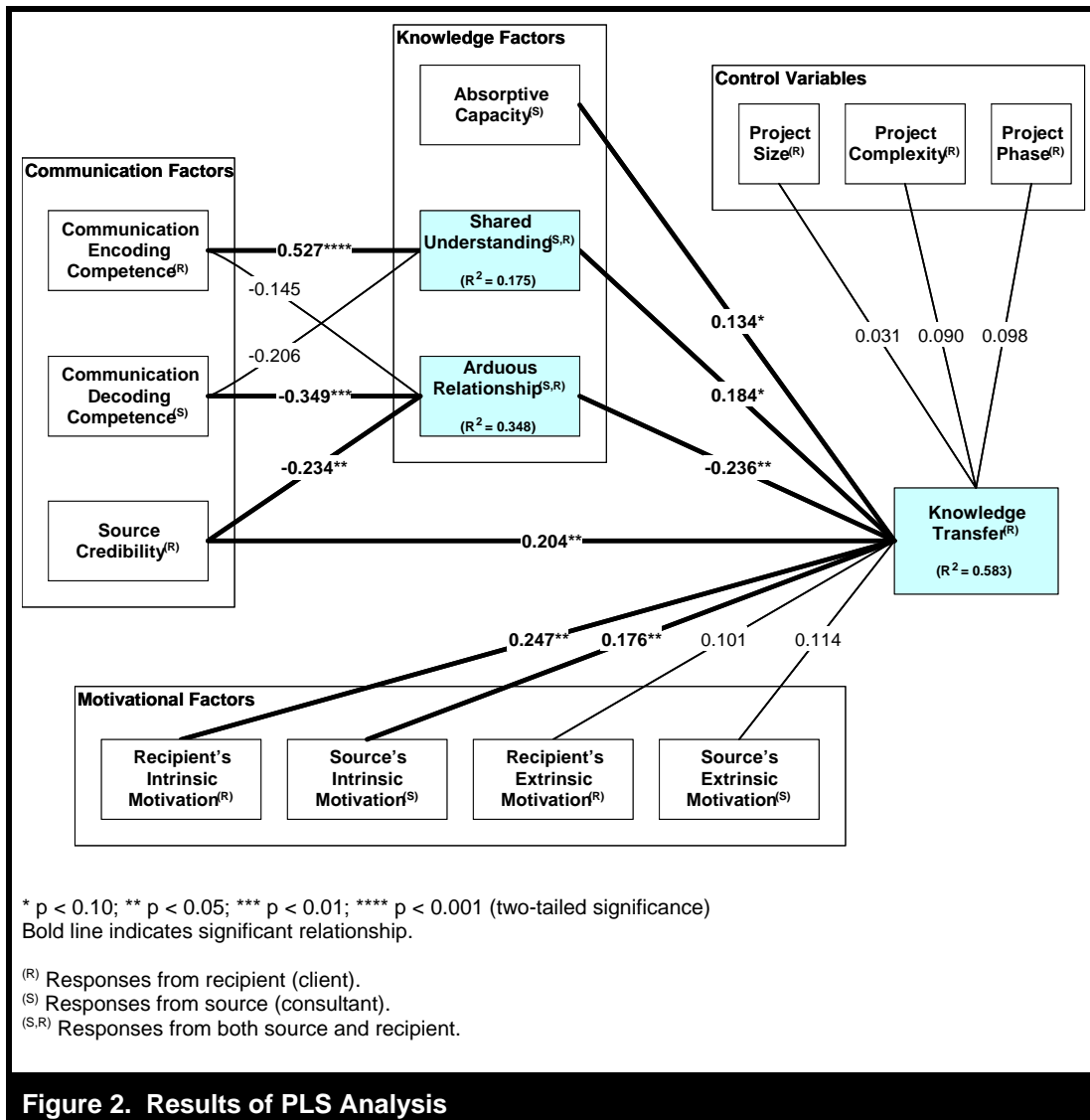


Figure 2. Results of PLS Analysis

Table 4. Tests of Hypotheses

✓ ^a		Hypothesis	Standardized Path Coefficient (Direct Effect)	t-Value for Path	Indirect Effect	Total Effect ^b
✓	H1	Arduous Relationship → Knowledge Transfer	-0.236	2.2426**		-0.236
✓	H2	Shared Understanding → Knowledge Transfer	0.184	1.8082*		0.184
✓	H3	Absorptive Capacity → Knowledge Transfer	0.134	1.7073*		0.134
✓	H4	Recipient Intrinsic Motivation → Knowledge Transfer	0.247	1.9854**		0.247
✓	H5	Source Intrinsic Motivation → Knowledge Transfer	0.176	2.0637**		0.176
	H6	Recipient Extrinsic Motivation → Knowledge Transfer	0.101	0.9284		0.101
	H7	Source Extrinsic Motivation → Knowledge Transfer	0.114	0.9972		0.114
✓	H8	Source Credibility → Knowledge Transfer	0.204	2.3839**	0.055	0.259
✓	H9	Source Credibility → Arduous Relationship	-0.234	2.5162**		-0.234
✓	H10	Communication Decoding Competence → Arduous Relationship → Knowledge Transfer	-0.349	2.7295***	0.082	-0.349 0.082
	H11	Communication Encoding Competence → Arduous Relationship	-0.145	1.2267		-0.145
	H12	Communication Decoding Competence → Shared Understanding	-0.206	1.4286		-0.206
✓	H13	Communication Encoding Competence → Shared Understanding → Knowledge Transfer	0.527	4.7260****	0.097	0.527 0.097
		Project Phase → Knowledge Transfer	0.098	1.2403		0.098
		Project Complexity → Knowledge Transfer	0.090	1.2717		0.090
		Project Size → Knowledge Transfer	0.031	0.4904		0.031

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$ (two-tailed)

^a“✓” indicates hypothesis is supported.

^bTotal Effect = Direct Effect + Indirect Effect. The relative importance of the direct and indirect effects of the antecedent constructs is shown. For example, the total effect of source credibility on knowledge transfer (0.259) is equal to the sum of its direct effect (0.204) and indirect effect (0.055). Thus, a one standard deviation increase in source credibility results in a 0.259 standard deviation increase in knowledge transfer.

R^2 for Relationship Quality = 0.348

R^2 for Shared Understanding = 0.175

R^2 for Knowledge Transfer = 0.583

Before examining the results of this study and their implications, some of its limitations must be discussed. The first limitation is the relatively small sample size. Gathering matched-pair data is especially challenging; however, our sample size of 96 compares well with other matched-pair studies. The second limitation is the cross-sectional nature of this study. Because knowledge transfer is intensive and may evolve during ERP implementation, cross-sectional studies face a limitation of not being able to capture the temporal aspect of the activities. A third limitation concerns the measures and generalizability. The findings of this study may only reasonably be claimed to generalize to the ERP implementation domain, although there is reason to believe that they may be applicable more broadly to other Type III innovations (Swanson 1994). A fourth limitation stems from examining knowledge transfer in only one direction, from consultant to client. Knowledge may also transfer from clients to consultants; however, this was beyond the scope of this study and is left for future research.

The study integrates knowledge-related factors, motivational factors, and communication-related factors as antecedents of knowledge transfer. In so doing, this study demonstrates that knowledge transfer represents a powerful model for studying and improving complex IS implementations. As contrasted with more traditional information systems, these systems require understanding and learning by clients that is sufficient for application rather than the lower expectation of system *use* that has been prevalent in traditional models such as the technology acceptance model (Davis 1989). Knowledge transfer has been extensively studied in many non-IS areas and this research presents an opportunity for IS researchers to adapt knowledge transfer concepts, constructs, measures, and results to areas of IS where they may be appropriate.

Research Implications

The results of this study suggest a number of implications for researchers, from which several directions for future research can be derived.

First, this study extends and integrates prior theory and research in terms of several *knowledge* factors as identified by Szulanski (1996), including an additional factor: shared understanding. Shared understanding reflects similarities in heuristics and experiences between a consultant and client, which allow them to effectively transfer knowledge. Prior studies have observed similar effects of shared understanding in other settings (e.g., Nelson and Coopridge 1996), but more verification of the importance of this factor is required, particularly since it may have great impact on lowering knowledge asymmetry between consultant and client, or between IS and business stakeholders.

The results also suggest that other knowledge-related factors—absorptive capacity and arduous relationship—are important for minimizing barriers to effectively transfer knowledge. The relationships found between these factors and knowledge transfer are particularly salient because they demonstrate the importance of cooperative relationships among the parties and the client's knowledge endowment prior to the transfer. Future research might examine other knowledge-related factors such as knowledge observability (Birkinshaw et al. 2002), and factors reflecting knowledge relationships between members of a dyad, such as trust, to further enhance this important area.

In contrast to Szulanski's results, the model and analysis show that motivational factors also strongly influence knowledge transfer in complex information system implementations. In particular, the findings show that ERP implementation knowledge can be transferred successfully in the hands of intrinsically motivated consultants and business clients. On the other hand, extrinsic motivation was not shown to be important.

Hence, the results of this study contribute positively to the mixed findings regarding the relationship between motivation and knowledge transfer. To the extent that the knowledge transferred has more tacit than explicit components, these results are consistent with Osterloh and Frey's (2000) arguments that intrinsically motivated employees

are required when the knowledge being transferred is primarily tacit and when knowledge transfer outcomes cannot be easily measured. Since most knowledge transfer settings involve combinations of tacit and explicit knowledge, particularly in IS settings, this result may be of great significance. Future research is needed to empirically test the relative importance of intrinsic and extrinsic motivation for knowledge that differs in tacitness and complexity and is transferred in various IS contexts.

Further, prior literature suggests that the speed and depth of learning and understanding may suffer for extrinsically motivated individuals (Osterloh and Frey 2000). However, there is anecdotal evidence suggesting that extrinsic motivators are important in the initial stages of implementation (O'Dell and Grayson 1998). Future research could also examine the role and evolution of extrinsic and intrinsic motivation as IS development and implementation projects progress through phases over an extended period of time.

This study also posits and finds support for a third set of factors that influence knowledge transfer in this IS context. The results show that communication-related factors influence the transfer of ERP knowledge between consultants and clients both directly and indirectly. Specifically, source credibility is positively associated with knowledge transfer. The role that source credibility plays in such interactions is consistent with findings from other studies (e.g., Bashein and Markus 1997), which suggest that low credibility inhibits communication and learning. In addition, the relationship between source credibility and knowledge transfer appears to be mediated by arduous relationship. This implies that a consultant with low credibility is likely to experience an arduous relationship with a business client, which negatively influences the knowledge transfer between them. Another communication-related factor—the recipient's communication decoding competence—similarly influences knowledge transfer indirectly. Prior studies suggest that verbal communications are error-prone, which inhibits the transfer of knowledge due to ineffectual personal interactions

between clients and consultants (Salaway 1987; Scott and Vessey 2002). Thus, when a business client without the ability to listen or pay attention to the consultant has an arduous relationship with that consultant, knowledge transfer is negatively influenced. A fruitful avenue for future research is to empirically examine whether *communication competence-aligning* dyads are less likely to develop an arduous relationship. For example, determining whether an encoding competent source and a decoding competent recipient develop a less arduous relationship than an encoding incompetent source and a decoding competent recipient would shed light on how source-recipient relationships form.

The results also indicate a relationship between communication encoding competence and knowledge transfer but mediated through shared understanding. This suggests that a consultant's ability to express ideas clearly and be easily understood will likely allow a business client to develop heuristics, norms, and problem-solving approaches that are similar to that consultant. Such shared understanding removes barriers, allowing both parties to minimize disagreements and enhance their ability to work together for effectively transferring knowledge. Future research could examine whether knowledge type (e.g., tacit versus explicit knowledge) influences the source's ability to display communication encoding competence and to develop a shared understanding for effectively transferring knowledge.

Although hypothesized, there was no significant relationship between the source's communication encoding competence and arduous relationship. One plausible explanation for this insignificant finding between communication encoding competence and arduous relationship between the source and recipient is that other factors, such as source credibility, may dominate why a recipient is not willing to develop a positive relationship with a source. The relationship between the recipient's communication decoding competence and shared understanding was also not significant. These insignificant findings deserve further scrutiny.

Managerial Implications

This study provides guidance for the increasing number of complex information systems that are being implemented with the assistance of external consultants. This is important because IS managers in both consulting and client firms increasingly need to better understand how to facilitate knowledge transfer across organizational boundaries.

The arduousness of the relationship between consultant and client is important and, in practice, must be reduced. This suggests that it is important to create an environment where consultant-client pairs can, and must, interact frequently, thereby nurturing their relationship and facilitating the flow and more valid interpretation of knowledge.

The client's knowledge endowment prior to the transfer—his or her absorptive capacity—also has a significant impact. There is prior evidence that, in such environments, individuals transfer knowledge learned from one task to another (Argote 1999). It may be that a client's stock of knowledge prior to the transfer allows him or her to leverage newly acquired knowledge to positively influence successful implementation. This result can be used in selecting individuals to be client team members.

The shared understanding between a consultant and a business client is an important consideration when transferring knowledge. Short of identifying individuals with similar work values, norms, and problem-solving approaches to work with each other, firms can initiate activities such as undergoing the same training programs, adopting a project methodology, and conducting problem-solving exercises together that will facilitate knowledge transfer.

Intrinsic motivation was found to be more important than extrinsic motivation. Thus, the use of monetary incentives and other explicit rewards is not indicated, except perhaps in the initial stages of implementation (O'Dell and Grayson 1998). As such, the results suggest that it is important to select intrinsically motivated consultants and

business clients for complex systems implementation projects. In other words, extrinsic motivators may not aid in effectively transferring knowledge; rather, intrinsically motivated individuals are needed to go the extra mile when necessary, especially when tacit knowledge, which is so prevalent in complex implementation projects, is involved.

The relationship between communication encoding competence and knowledge transfer is mediated by shared understanding. This suggests that a consultant's ability to express ideas clearly, have a good command of the language, and be easily understood by the client is associated with the successful transfer of ERP-related knowledge, but by means of developing a shared understanding. Since one objective for business clients is to acquire ERP-related knowledge so that they can maintain and operate the systems independent of the consultants, the clients may find consultants' encoding competence important in overcoming knowledge barriers resulting from the asymmetrical knowledge structure. This has important implications to the client's selection of a consulting firm and to the assignment of specific consultants to a project. It suggests that prospective clients know, in advance, who the individuals are who will be working on their project, so that they may factor this into contract negotiations.

Overall, the implications of these results for project personnel selection are significant. On the consultant side, a good knowledge of business and familiarity with the thinking of business people, as well as general interpersonal skills, are the major requirements for those to be assigned. On the client side, choosing for project duties those who have the least to learn will enhance project success even if it does not advance the knowledge of those who might learn more. Choosing client representatives who have previous experience at the tasks and also at working with consultants in other projects would appear to be important. Perhaps a client manager can conceptualize the overall transfer process in two stages: first, from consultants to the most knowledgeable business people and then second, from them to the client personnel who did not significantly participate in the system implementation.

Conclusions

This study examined the antecedents of knowledge transfer from consultants to clients in the interfirm complex information system implementation context using an integrated theory that posits that three sets of factors—knowledge-related, motivational, and communication-related—influence knowledge transfer. The results extend, augment, and apply prior research to an increasingly important and extensive IS context—enterprise-wide information systems—which is an important example of Swanson's (1994) Type III organizational innovations. Since these are the most important and most complex information systems with which organizations deal, there is a real need for an integrated theory for this domain. Given that the knowledge asymmetry and knowledge barrier issues, which are so pronounced in this setting, are endemic to much of the IS implementation world, such a model may have far-reaching application. In sum, this study contributes to theory and practice in the IS domain by focusing on knowledge transfer as the crucial aspect of IS implementation and integrating theory developed in other transfer contexts with that developed in the IS literature.

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References

- Aladwani, A. M. "An Integrated Performance Model of Information Systems Projects," *Journal of Management Information Systems* (19:1), 2002, pp. 185-210.
- Alavi, M., and Leidner, D. E. "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quarterly* (25:1), 2001, pp. 107-136.
- Amabile, T., Hill, K., Hennessey, B., and Tighe, E. "The Work Preference Inventory: Assessing Intrinsic and Extrinsic Motivational Orientations," *Journal of Personality and Social Psychology* (66:5), 1994, pp. 950-967.
- Anderson, V., and McLean, R. *Design of Experiments: A Realistic Approach*, Marcel Dekkar, New York, 1974.
- Argote, L. *Organizational Learning: Creating, Retaining and Transferring Knowledge*, Kluwer Academic Publishers, Boston, 1999.
- Argote, L., and Ingram, P. "Knowledge Transfer: A Basis for Competitive Advantage in Firms," *Organizational Behavior and Human Decision Processes* (82:1), 2000, pp. 150-169.
- Attewell, P. "Technology Diffusion and Organizational Learning: The Case of Business Computing," *Organization Science* (3:1), 1992, pp. 1-19.
- Bagchi, S., Kanungo, S., and Dasgupta, S. "Modeling Use of Enterprise Resource Planning Systems: A Path Analytic Study," *European Journal of Information Systems* (12:2), 2003, pp. 142-158.
- Bancroft, N., Seip, H., and Sprengel, A. *Implementing SAP R/3*, Manning Publications Co., Greenwich, CT, 1998.
- Barclay, D., Thompson, R., and Higgins, C. "The Partial Least Squares Approach to Causal Modeling: Personal Computer Adoption and Use as an Illustration," *Technology Studies: Special Issue on Research Methodology* (2:2), 1995, pp. 285-324.
- Barki, H., and Hartwick, J. "Interpersonal Conflict and its Management in Information System Development," *MIS Quarterly* (25:2), 2001, pp. 195-228.
- Bashein, B., and Markus, M. L. "A Credibility Equation for IT Specialists," *Sloan Management Review* (38:4), 1997, pp. 35-44.
- Baum, J. A. C., and Ingram, P. "Survival-Enhancing Learning in the Manhattan Hotel Industry," *Management Science* (44), 1998, pp. 996-1016.
- Bennett, J. L. "Building Relationships for Technology Transfer," *Communications of the ACM* (39:9), September 1996, pp. 35-37.

- Berman, S., and Heilweg, S. "Perceived Supervisor Communication Competence and Supervisor Satisfaction as a Function of Quality Circle Participation," *The Journal of Business Communication* (26:2), 1989, pp. 103-122.
- Birkinshaw, J., Nobel, R., and Ridderstrale, J. "Knowledge as a Contingency Variable: Do the Characteristics of Knowledge Predict Organization Structure?," *Organization Science* (13:3), 2002, pp. 274-289.
- Bock, G. W., and Kim, Y.-G. "Breaking the Myths of Rewards: An Exploratory Study of Attitudes About Knowledge Sharing," *Information Resources Management Journal* (15:2), 2002, pp. 14-21.
- Calder, B. J., and Staw, B. M. "The Self-Perception of Intrinsic and Extrinsic Motivation," *Journal of Personality and Social Psychology* (31), 1975, pp. 599-605.
- Chin, W. "Issues and Opinion on Structural Equations Modeling," *MIS Quarterly* (22:1), 1998, pp. vii-xvi.
- Cohen, W., and Levinthal, D. "Absorptive Capacity: A New Perspective on Learning and Innovation," *Administrative Science Quarterly* (35), 1990, pp. 128-152.
- Darr, E., and Kurtzberg, T. "An Investigation of Partner Similarity Dimensions on Knowledge Transfer," *Organizational Behavior and Human Decision Processes* (82:1), 2000, pp. 28-44.
- Davis, F. D. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13:3), 1989, pp. 319-340.
- Demarest, M. "Understanding Knowledge Management," *Long Range Planning* (30:3), 1997, pp. 374-384.
- Dholakia, R., and Sternthal, B. "Highly Credible Sources: Persuasive Facilitators or Persuasive Liabilities?," *Journal of Consumer Research* (3), 1977, pp. 223-232.
- DiRomualdo, A., and Gurbaxani, V. "Strategic Intent for IT Outsourcing," *Sloan Management Review* (39:4), 1998, pp. 67-80.
- Eagley, A., Wood, W., and Chaiken, S. "Causal Inferences about Communicators and Their Effect on Opinion Change," *Journal of Personality and Social Psychology* (36), 1978, pp. 424-443.
- Faraj, S., and Sproull L. "Coordinating Expertise in Software Development Teams," *Management Science* (46:12), 2000, pp. 1554-1568.
- Fornell, C., and Larcker, D. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research* (18), 1981, pp. 39-50.
- Galbraith, C. S. "Transferring Core Manufacturing Technologies in High Technology Firms," *California Management Review* (32:4), 1990, pp. 56-70.
- Gerwin, D., and Moffat, L. "Withdrawal of Team Autonomy During Concurrent Engineering," *Management Science* (43:9), 1997, pp. 1275-1287.
- Grewal, D., Gotlieb, J., and Marmorstein, H. "The Moderating Effects of Message Framing and Source Credibility on the Price-Perceived Risk Relationship," *Journal of Consumer Research* (21), 1994, pp. 145-153.
- Guinan, P. J., Coopridge, J. G., and Faraj, S. "Enabling Software Development Team Performance During Requirements Definition: A Behavioral Versus Technical Approach," *Information Systems Research* (9:2), 1998, pp. 101-125.
- Hamel, G. "Competition for Competence and Inter-partner Learning Within International Strategic Alliances," *Strategic Management Journal* (12), 1991, pp. 83-103.
- Hansen, M. "The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge Across Organization Subunits," *Administrative Science Quarterly* (44), 1999, pp. 82-111.
- Hartwick, J., and Barki, H. "Communication as a Dimension of User Participation," *IEEE Transactions on Professional Communication* (44:1), 2001, pp. 21-36.
- Hitt, L. M., Wu, D. J., and Zhou, X. "Investment in Enterprise Resource Planning: Business Impact and Productivity Measures," *Journal of Management Information Systems* (19:1), 2002, pp. 71-98.
- Holland, C. P., and Light, B. "A Critical Success Factors Model for ERP Implementation," *IEEE Software* (16:3), 1999, pp. 30-36.
- Huber, G. "Organizational Learning: The Contributing Processes and the Literature," *Organization Science* (2:1), 1991, pp. 88-115.

- Hulland, J. "Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent Studies," *Strategic Management Journal* (20:2), 1999, pp. 195-204.
- Kahai, S. S., and Cooper, R. B. "Exploring the Core Concepts of Media Richness Theory: The Impact of Cue Multiplicity and Feedback Immediacy on Decision Quality," *Journal of Management Information Systems* (20:1), 2003, pp. 263-299.
- Kelley, H. "The Process of Causal Attribution," *American Psychologist* (28:2), 1973, pp. 107-128.
- Krauss, R., and Fussell, S. "Mutual Knowledge and Communications Effectiveness," in *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*, J. Calegher, R. Kraut, and C. Egido (Eds.), Lawrence Erlbaum and Associates, Hillsdale, NJ, 1990, pp. 111-145.
- Kraut, R. E., and Streeter, L. A. "Coordination in Software Development," *Communications of the ACM* (38:3), March 1995, pp. 69-81.
- Lacity, M., and Willcocks, L. "An Empirical Investigation of Information Technology Sourcing Practices: Lessons from Experience," *MIS Quarterly* (22:3), September 1998, pp. 363-408.
- Lozinsky, S. *Enterprise-Wide Software Solutions* Addison-Wesley, Reading, MA, 1998.
- Malhotra, A., Majchrzak, A., Carman, R., and Lott, V. "Radical Innovation without Collocation: A Case Study at Boeing-Rocketdyne," *MIS Quarterly* (25:2), June 2001, pp. 229-249.
- Marakas, G. M., and Elam, J. J. "Semantic Structuring in Analyst Acquisition and Representation of Facts in Requirements Analysis," *Information Systems Research* (9:1), 1998, pp. 37-63.
- Markus, M. L., and Benjamin, R. I. "The Magic Bullet Theory in IT-Enabled Transformation," *Sloan Management Review* (38:2), 1997, pp. 55-68.
- Markus, M. L., and Tanis, C. "The Enterprise Systems Experience—From Adoption to Success," in *Framing the Domains of IT Management: Projecting the Future through the Past*, R. Zmud (Ed.), Pinnflex Educational Resources, Cincinnati, OH, 2000, pp. 173-207.
- McFarlan, F., and Nolan, R. "How to Manage an IT Outsourcing Alliance," *Sloan Management Review* (36:2), 1995, pp. 9-23.
- Mizerski, R., Golden, L., and Kernan, J. "The Attributional Process in Consumer Decision Making," *Journal of Consumer Research* (6), 1979, pp. 123-140.
- Monge, P., Bachman, S., Dillard, J., and Eisenberg, E. "Communicator Competence in the Workplace: Model Testing and Scale Development," in *Communication Yearbook*, M. Burgoon (Ed.), Transaction Books, New Brunswick, NJ, 1982, pp. 505-527.
- Nelson, K., and Coopridge, J. "The Contribution of Shared Knowledge to IS Group Performance," *MIS Quarterly* (20:4), December 1996, pp. 409-429.
- Nonaka, I. "A Dynamic Theory of Organizational Knowledge Creation," *Organizational Science* (5:1), 1994, pp. 14-37.
- O'Dell, C., and Grayson, C. J. "If Only We Knew What We Know: Identification and Transfer of Internal Best Practices," *California Management Review* (40:3), 1998, pp. 154-174.
- Osterloh, M., and Frey, B. "Motivation, Knowledge Transfer, and Organizational Forms," *Organization Science* (11:5), 2000, pp. 538-550.
- Quinn, J. "Strategic Outsourcing: Leveraging Knowledge Capabilities," *Sloan Management Review* (40:4), 1999, pp. 9-21.
- Robey, D., Ross, J. W., and Boudreau, M. "Learning to Implement Enterprise Systems: An Exploratory Study of the Dialectics of Change," *Journal of Management Information Systems* (19:1), 2002, pp. 17-46.
- Rus, I., and Lindvall M. "Knowledge Management in Software Engineering," *IEEE Software* (19:3), 2002, pp. 26-38.
- Sadagopan, S. "Enterprise Resource Planning," in *Encyclopedia of Information Systems* (2), H. Bidgoli (Ed.), Elsevier Science, 2003, pp. 169-184.
- Salaway, G. "An Organizational Learning Approach to Information Systems Development," *MIS Quarterly* (11:2), June 1987, pp. 245-264.
- Scott, J. E., and Vessey, I. "Managing Risks in Enterprise Systems Implementations," *Communications of the ACM* (45:4), 2002, pp. 74-81.
- Sheu, C., Chae, B., and Yang, C. "National Differences and ERP Implementation: Issues and Challenges," *Omega* (32), 2004, pp. 361-371.

- Slaughter, S., and Kirsch, L. J. "Transferring Evaluative Knowledge: The Case of Software Metrics," Working Paper #2000-08, Carnegie Mellon University, Pittsburgh, PA, 2000.
- Smith, M., Mitra, S., and Narasimhan, S. "Information Systems Outsourcing: A Study of Pre-Event Firm Characteristics," *Journal of Management Information Systems* (15:2), 1998, pp. 61-93.
- Soh, C., Kien, S. S., and Tay-Yap, J. "Cultural Fits and Misfits: Is ERP a Universal Solution?," *Communications of the ACM* (43:4), 2000, pp. 47-51.
- Stein, T. "Making ERP Add Up," *Information Week*, May 24, 1999, pp. 59-63.
- Swaab, R. I., Postmes, T., Neijens, P., Kiers, M. H., and Dumay, A. C. M. "Multiparty Negotiation Support: The Role of Visualization's Influence on the Development of Shared Mental Models," *Journal of Management Information Systems* (19:1), 2002, pp. 129-150.
- Swanson, E. B. "Information Systems Innovation Among Organizations," *Management Science* (40:9), 1994, pp. 1069-1092.
- Szulanski, G. "Exploring Internal Stickiness: Impediments to the Transfer of Best Practice Within the Firm," *Strategic Management Journal* (17), Winter Special Issue 1996, pp. 27-43.
- Timbrell, G. T., Andrews, N. M., and Gable, G. G. "Impediments to Inter-Firm Transfer of Best Practice in an Enterprise Systems Context," in *Proceedings of the Seventh Americas Conference on Information Systems*, D. Strong and D. Straub (Eds.), Boston, 2001, pp. 1084-1090.
- Zander, U., and Kogut, B. "Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities: An Empirical Test," *Organization Science* (6:1), 1995, pp. 76-92.

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Appendix A

Instrument Items

All scale measures except Arduous Relationship are based on five-point Likert scales, using “strongly agree” and “strongly disagree” anchors. Arduous Relationship, as adopted from earlier work, is measured based on four-point Likert scales.

Note that in the items listed in this appendix, the module, consultant, and client names are examples only. During the administration of the survey, appropriate names were supplied.

Knowledge Transfer^R is defined as the communication of knowledge from a source (consultant) so that it is learned and applied by a recipient (client). New items were developed.

- KT1 *During this (**Purchasing**) module implementation project, my interactions with (Consultant William) have increased my understanding of how this module integrates with other modules and/or systems.*
- KT2 *During this (**Purchasing**) module implementation project, my interactions with (Consultant William) increased my ability to ask penetrating questions about this module.*
- KT3 *During this (**Purchasing**) module implementation project, my interactions with (Consultant William) improved my knowledge of this module.*
- KT4 *During this (**Purchasing**) module implementation project, my interactions with (Consultant William) increased my knowledge about this module’s training documents for end-users.*
- KT5 *During this (**Purchasing**) module implementation project, my interactions with (Consultant William) increased my knowledge about setting up the configuration tables that support the client’s business processes.*
- KT6 *During this (**Purchasing**) module implementation project, my interactions with (Consultant William) improved my ability to develop test scripts for this module.*

Absorptive Capacity^S is defined as the ability for a recipient to recognize the value of external information, assimilate it, and apply it. Items were derived from Szulanski (1996).

- AC1 *(Client Alisha) and I have a common language to deal with the (*Purchasing*) module.**
- AC2 *(Client Alisha) has a vision of what the implementation of (*Purchasing*) module project is trying to achieve.*
- AC3 *(Client Alisha) has information on the state-of-the-art of the (*Purchasing*) module.**
- AC4 *(Client Alisha) has a clear understanding of goals, tasks, and responsibilities of implementing the (*Purchasing*) module.*
- AC5 *(Client Alisha) has the technical competence to absorb the technical knowledge about (*Purchasing*) module.*
- AC6 *(Client Alisha) has the managerial competence to absorb the business knowledge about (*Purchasing*) module.*
- AC7 *(Client Alisha) can best exploit new information about the (*Purchasing*) module.**
- AC8 *(Client Alisha) can help solve problems associated with the (*Purchasing*) module.**
- AC9 *(Client Alisha) has the necessary skills to implement the (*Purchasing*) module.**

Shared Understanding^{R,S} is defined as the extent to which a source and a recipient dyad's work values, norms, philosophy, problem-solving approaches, and prior work experience are similar. Some items were derived from Nelson and Coopridier (1996) and Gerwin and Moffat (1997); a few new items were also developed.

- SU1 (*Consultant William*) and I agree on what's important.
- SU2 (*Consultant William*) and I have very similar prior experience with implementation projects.
- SU3 (*Consultant William*) and I solve problems the same way.
- SU4 (*Consultant William*) and I understand each other when we talk.
- SU5 (*Consultant William*) and I don't have difficult time understanding each other.
- SU6 Our process for implementation was well understood at the time of this project.
- SU7 (*Client Alisha*) and I agree on what's important.
- SU8 (*Client Alisha*) and I have very similar prior experience with implementation projects.
- SU9 (*Client Alisha*) and I solve problems the same way.
- SU10 (*Client Alisha*) and I understand each other when we talk.
- SU11 (*Client Alisha*) and I don't have difficult time understanding each other.
- SU12 Our process for implementation was well understood at the time of this project.

Arduous Relationship^{R,S} is defined as an emotionally laborious, distant relationship between a source and a recipient. Items were derived from Szulanski (1996).

- AR1 Communication between (*Consultant William*) and me is:
- AR4 Communication between (*Client Alisha*) and me is:
 - Very easy
 - Fairly easy
 - Fairly demanding
 - Very demanding
- AR2 Collaboration between (*Consultant William*) and me:
- AR5 Collaboration between (*Client Alisha*) and me:²
 - Is sought after by me.
 - Is well received, but not sought after by me.
 - Is often avoided by me.
 - Occurs only if I have no other alternative.
- AR3 Collaboration between (*Consultant William*) and me:
- AR6 Collaboration between (*Client Alisha*) and me:
 - Is sought after by (*Consultant William/Client Alisha*)
 - Is well received, but not sought after by (*Consultant William/Client Alisha*)
 - Is usually avoided by (*Consultant William/Client Alisha*)
 - Occurs only if (*Consultant William/Client Alisha*) has no other alternative.

Intrinsic Motivation^{R,S} is defined as deriving satisfaction that lies in the content of the activity itself. Items were derived from Amabile et al. (1994).

- IM1 I enjoy learning business and technical knowledge about (*Purchasing*) module.
- IM2 The more difficult it is to understand business and technical knowledge about the (*Purchasing*) module, the more I enjoy learning it.¹

- IM3 I enjoy learning business and technical knowledge about the (*Purchasing*) module that are completely new to me.
- IM4 I have to feel that I'm personally benefitting from learning business and technical knowledge about the (*Purchasing*) module.^{1,2}
- IM5 I want to find out how good I really can be at learning business and technical knowledge about the (*Purchasing*) module.
- IM6 I'm more comfortable when I can set my own goals for learning business and technical knowledge about the (*Purchasing*) module.²

Extrinsic Motivation^{R,S} is defined as deriving satisfaction that is independent on the content of the activity itself. Items were derived from Amabile et al. (1994).

- EM1 I am keenly aware of the income goals I have for myself if I learn business and technical knowledge about the (*Purchasing*) module.²
- EM2 I am strongly motivated by the money I can earn if I learn business and technical knowledge about the (*Purchasing*) module.^{1,2}
- EM3 I am keenly aware of the promotion goals I have for myself if I learn business and technical knowledge about the (*Purchasing*) module.²
- EM4 If I learn business and technical knowledge about the (*Purchasing*) module, I want other people to find out how good I am.¹
- EM5 I am strongly motivated by the recognition I can earn from other people for learning business and technical knowledge about the (*Purchasing*) module.¹
- EM6 I have to feel that I'm earning something for learning business and technical knowledge about the (*Purchasing*) module.

Communication Encoding Competence^R is defined as the ability for a source to express ideas clearly, have a good command of the language, and be easy to understand. Items were derived from Monge et al. (1982).

- CE1 (*Consultant William*) has a good command of the language.
- CE2 (*Consultant William*) typically gets right to the point.
- CE3 (*Consultant William*) can deal with others effectively.
- CE4 (*Consultant William's*) written communication is difficult to understand. **(Reverse coded)**
- CE5 (*Consultant William*) expresses his/her ideas clearly.
- CE6 (*Consultant William's*) oral communication is difficult to understand. **(Reverse coded)**
- CE7 (*Consultant William*) usually says the right thing at the right time.

Communication Decoding Competence^S is defined as the ability for a recipient to listen, respond to messages quickly, and be attentive. Items were derived from Monge et al. (1982).

- CD1 (*Client Alisha*) is sensitive to others' needs.
- CD2 (*Client Alisha*) pays attention to what other people say to him/her.
- CD3 (*Client Alisha*) is a good listener.
- CD4 (*Client Alisha*) is easy to talk to.
- CD5 (*Client Alisha*) usually responds to messages (memos, phone calls, reports, etc.) quickly.

Source Credibility^R is defined as an attitude a recipient has about a source along multiple dimensions, including trustworthiness and expertise. Items were derived from Grewal et al. (1994) and McCroskey et al. (1974).

- SC1 (*Consultant William*) is trustworthy.
- SC2 (*Consultant William*) is open-minded.*
- SC3 (*Consultant William*) is experienced.
- SC4 (*Consultant William*) is an expert.*
- SC5 (*Consultant William*) is well-trained.
- SC6 (*Consultant William*) is credible.*
- SC7 I go out of my way to interact/communicate with (*Consultant William*).*

*Based on the instrument validation process, these items were deleted.

¹Based on the instrument validation process, these items were deleted from recipient's response only.

²Based on the instrument validation process, these items were deleted from source's response only.

^RResponses from recipient (client).

^SResponses from source (consultant).

^{R,S}Responses from both source and recipient.

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