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The Influence of Outsourcing Models on Vendor Knowledge Integration

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Abstract:

In this paper, we attempt to address the role of outsourcing models (Global Delivery, Global Shared-services, and Build-Operate-Transfer models)—on vendor knowledge integration, i.e., the understanding of the project requirements and client needs by the vendor. Specifically, the paper examines the role of team identification, requirements ambiguity, and infrastructure diversity in vendor knowledge integration, and the moderating effect of the type of outsourcing model on the respective relationships of team identification, requirements ambiguity, and infrastructure diversity with vendor knowledge integration. Theories of Social Exchange and a Knowledge-based view are utilized. Using a sample of sixty-six outsourced software development clients, we show that team identification and infrastructure diversity influence vendor knowledge integration, which then influences project success. Further, use of appropriate outsourcing model has a moderating effect on these relationships.

Keywords: outsourcing, information systems development, knowledge integration, Social Exchange theory, Knowledge-based view.

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INTRODUCTION

Outsourcing and offshoring (Prikladnicki et al. 2007) have proved to be a prominent trend of the last decade in the field of Information Systems, as well as in other functional areas. As more and more companies take advantage of this trend to reduce costs, increase flexibility, and enhance their competitive advantage, this trend is likely to get even stronger (Kishore et al. 2003). However, managing these projects is fraught with challenges. Challenges of managing these projects arise from a multiplicity of locations, cultures, and time zones, less face-to-face interaction, limitations of time, and the asynchrony of communication. These constraints lead to decreased communication, reduced visibility into the project and individual work status, heterogeneity in infrastructure, and cultural differences between customer and vendor countries.

The complexities of the IT project requirements have always been difficult to transfer from users to developers; the dynamic and ever-changing project requirements and priorities are exceedingly difficult to handle. While these challenges exist in all types of information technology (IT) outsourcing, software development adds its own complexities when outsourced. Further, management of outsourced projects adds a layer of complexity, due to a need for knowledge transfer between users and developers in a context where parties operate from different mental models and speak different languages, so to speak. The sharing of knowledge between the client and the vendor is an important antecedent of success (Koh et al. 2004). Based on interviews with practitioners, Rottman and Lacity (2004) contend that bridging the learning curve is vital for deriving value from the outsourcing arrangement. Lacity et al. (1995) posit that continuous learning in negotiating with an external supplier is necessary for a successful outsourcing relationship. In software development, in addition to the social exchange of knowledge, clients and vendors also need to act on each others' knowledge and bring it to bear on the project (Faraj et al. 2000).

Thus, software development project performance is dependent on successfully addressing the challenges of coordination and integration of team members' knowledge, since project requirements can be complex and difficult to transfer (Okhuysen and Eisenhardt 2002; LitchField 2008; Santanen et al. 2004; Robert, Dennis and Ahuja 2008). The client's business routines, system requirements, and IT infrastructure need to be transferred from the client to the vendor to facilitate the development of the desired system. Such knowledge integration generates shared understanding between client and vendor about how a software system's functionality and design can support the project's business objectives (Sanchez and Mahoney 1996), thus leading to positive project outcomes.

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In this paper, we argue that vendor learning of client requirements is a critical antecedent to outsourced ISD project success. Specifically, we propose that outsourced ISD project success may be influenced by such knowledge integration, which in turn, is affected by team, project, and technical infrastructure characteristics. We select one key antecedent—related to teams (team identification), projects (requirements ambiguity), and technical infrastructure

CONTRIBUTION

This paper makes a contribution to IS research in several ways. To our knowledge, ours is among the first studies to examine the effect of outsourcing models on knowledge integration. While several studies have investigated knowledge sharing and other knowledge-related factors in outsourcing teams, they have not yet examined how outsourcing models can make a difference in project outcomes. This study also extends the research on the post-contract phase of outsourcing ISD projects. The study provides evidence that team identification and infrastructure diversity influence vendor knowledge Integration, which then influences project success. Further, use of an appropriate outsourcing model has a moderating effect on the relationship of independent variables on the outcome of Information System Development projects.

In sum, the study provides insight on antecedents of vendor knowledge integration, which is an important determinant of information systems development project success. The findings reveal several ways to improve the effectiveness of outsourced projects.

(infrastructure diversity) characteristics—that seems particularly relevant to diverse project teams based in different contexts and examine those items' impact on knowledge integration. Team identification is important in this context because it reflects the extent to which the team was able to come together as a unit. Requirements ambiguity and infrastructure diversity are key challenges in ISD projects, made even more daunting by potential organizational, language, and cultural differences.

Thus, the first goal of this paper is to address the role of certain project-related antecedents in vendor knowledge integration. We consider the impact of team identification, requirements ambiguity, and infrastructure diversity on this outcome. One way client firms attempt to manage the challenges presented by team dynamics, requirements ambiguity, and infrastructure diversity outsourcing projects is to select an appropriate outsourcing model. The right outsourcing model, given the project needs, is often determined by the knowledge integration needs of the project. That is, the extent to which a vendor needs to clearly understand and incorporate the client knowledge into its work product and processes can determine the project outcomes.

Therefore, our second goal is to examine the moderating role of outsourcing models on this relationship because we believe that these can help manage the effect of team identification, requirements ambiguity, and infrastructure diversity on vendor knowledge integration. We attempt to address the role of three key outsourcing models—Global Delivery (Contract) model, Global Shared-services (Captive) model, and the Build-Operate-Transfer (BOT) model—on vendor knowledge integration, i.e., the understanding of the project requirements and client needs by the client. We ask—how does the type of outsourcing model moderate the respective relationships of team identification, requirements ambiguity, and infrastructure diversity with vendor knowledge integration?

We begin by presenting the contribution of this work to the information systems research. We then present the theoretical perspectives utilized in this paper and develop a model of vendor knowledge integration. Next, we describe our study methodology, followed by a discussion of our findings. Implications for theory and practice are offered as well.

THEORETICAL PERSPECTIVES AND MODEL DEVELOPMENT

Outsourcing is often part of a firm's strategy for achieving a competitive advantage, gaining knowledge that may be missing in the firm, or focusing on the firm's core competences (Kishore et al. 2003). Thus, a successful outcome of these decisions is crucial and depends largely on effective knowledge integration of client needs. In order to address the above research questions in a post-contract outsourcing context, we rely on the assumptions of the knowledge-based view, considering knowledge as a resource that must be successfully exchanged so that both parties are on the same page. The post-contractual stage of an outsourced ISD project begins when the client and the vendor have signed the outsourcing contract and ends when the vendor has signed-off on the deliverables, and typically includes analysis, design, and implementation. Prior research in the field of global teams and project management indicates that this stage includes two important considerations for the client. First, the social exchange of knowledge between the client and the vendor teams is crucial in the successful completion of the project. Project performance is dependent on successfully addressing the challenges of coordination and integration of team members' knowledge, since project requirements can be complex and difficult to transfer (Faraj et al. 2000). Additionally, infrastructure differences among the parties add to the difficulties of coordination and knowledge transfer.

This work is related to the research on the role of boundary-spanning activities between the vendor and the client—enable knowledge sharing across organizational boundaries (Gopal and Gosain 2009). Gopal and Gosain showed that boundary spanning between the vendor and client moderates the relationship between formal controls and project performance. They showed that formal and informal control modes in software development teams influence project outcomes, but boundary-spanning activities significantly improve the effectiveness of formal controls. One way controls can be leveraged and designed in desired configurations is to choose an appropriate outsourcing model. Each outsourcing model provides for a certain coordination and control mechanism by specifying when, where, and by whom the work in done and transferred, as well as levels of reciprocity and exchange.

Therefore, we consider the specific models employed by outsourcing arrangements. This is an important managerial decision because the management of the ISD projects and choice of control and coordination of vendor activities varies, based on the types of outsourcing models agreed on by the vendor and the client. Different outsourcing models facilitate different types of project controls in order to directly and indirectly influence the outcome and behavior of the vendor (Kirsch, Sambamurthy, Ko, and Purvis 2002) and are likely to affect the extent to which the vendor team absorbs the knowledge of what was the intended outcome and, therefore, whether this outcome is accomplished.

In any intra- or inter-organizational dyadic arrangement, the exchange consists of "voluntary transactions involving transfer of resources between two or more individuals (i.e., the actors) for mutual benefit." The exchange of

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resources is contingent on rewarding reactions from others, but "does not connote reciprocity" (Kern et al. 2000; White et al. 1961). As Kern and Willcocks (2000) point out, in outsourcing arrangements, the decisions of actors are made, not as a result of the actions of the other actor, but based on the environmental parameters. We consider some of these environmental factors in this research and examine their role in knowledge integration. We note that while Transaction Cost Economics is a worthy topic of investigation, it is not the focus of this study. Rather, we aim to examine knowledge integration and its link to team-, project-, and infrastructure-related antecedents and the moderating effect of outsourcing models on these relationships.

Social Exchange theory (Blau 1964; Roloff 1981) suggests that people interact socially in order to obtain rewards, such as enhancement of status, reputation, approval, and respect. Information sharing occurs when the agents concerned believe that this will result in creating value for the others in the firm and when they can expect to retain some of the value for themselves (Nahapiet et al. 1998). Repeated exchanges in this environment should result in peer-to-peer relationships of trust and mutual cooperation based on reciprocity and concern for reputation because of the collaborative nature of the work situations (Kollock 1994). In fact, building and maintaining reputation provides a strong motive for participation in information exchange actions (Constant et al. 1994; Jones et al. 1997).

The resources that have been considered in the original Social Exchange theory include goods, materials, and non-materials (Kelley et al. 1978). Information or knowledge was not considered to be a resource at first in the traditional social exchange context (Jarvenpaa et al. 2000). However, a number of researchers emphasize knowledge as a resource, based on the knowledge-based theory of the firm, which posits that the ability to integrate members' knowledge is the primary reason for the existence of the firm. For instance, Grant (1996) asserts that, "[a]s the markets for resources have become subject to the same dynamically-competitive conditions that have affected product markets, so *knowledge* has emerged as the most strategically-significant resource of the firm." Thus, as Constant et al. (1994) state, information or knowledge sharing is an essential aspect of social exchange between actors. By using a Resource-Based View (RBV) theoretical perspective, we examine whether these different offshoring strategies translate into a sustainable competitive advantage.

Knowledge Integration

Knowledge integration is the process of absorbing knowledge from external sources and blending it with the technical and business skills, know-how, and expertise that resides in the business and information system units of a firm (Kogut et al. 1992; Szulanski 1996; Tiwana et al. 2003). The sharing of knowledge between the client and the vendor is considered an important antecedent of success (Koh et al. 2004). Based on interviews with practitioners, Rottman and Lacity (2004) contend that bridging the learning curve is vital for deriving value from the outsourcing arrangement. Lacity et al. (1995) posit that continuous learning in negotiating with an external supplier is necessary for a successful outsourcing relationship. In software development, in addition to the social exchange of knowledge, clients and vendors also need to act on each other's knowledge and bring it to bear on the project (Faraj et al. 2000). As actors in the dyadic relationship, clients and vendors exchange business and IS knowledge and integrate them with knowledge from external sources (Tiwana et al. 2003), in order to help facilitate information systems development. This aspect of social exchange of knowledge is termed *knowledge integration* and is defined as "the process of absorbing knowledge from external sources and blending it with technical and business skills, know-how, [and] expertise that reside in the business and IS units of a firm" (Tiwana et al. 2003). In the context of offshore information systems development, knowledge integration is accomplished by bringing together the disparate slices of knowledge of the client and the vendor, together with the knowledge obtained from sources external to the relationship, such as communities of practice and external social-networks.

Kogut and Zander (1992), describe the concept of combinative capability that reflects a firm's ability to synthesize and apply current and acquired knowledge. Yet knowledge can also be integrated and created in groups that cross organizational boundaries. For instance, Nonaka (1994) notes that, "In addition to the creation of knowledge within an organization, it is also possible that there will be formal provisions to build knowledge at an interorganizational level. This might occur if informal communities of interaction that span the link between customers, suppliers, distributors, and even competitors, are put on a more formal basis, for example, through the formation of alliances or outsourcing." While Nonaka (1994) is refering to formal arrangements, knowledge can also be integrated across informal, interorganizational, self-organizing teams, social networks, or "evolving communities of practice" (Brown et al. 1991). Brown and Duguid (1991) argue that the exchange and development of information within these evolving communities facilitate knowledge creation by linking the routine dimensions of day-to-day work to active learning and innovation. They note that evolving organizational structures practice often cross "the restrictive boundaries of the organization to incorporate people from outside."

Outsourcing Models

Outsourcing involves complex decisions with multiple factors. One important aspect of the outsourcing strategy is selecting the right model. The model that is best suited to handle the requirements' ambiguity, the diversity of the

infrastructure, and team-relationship factors will most likely facilitate successful knowledge integration needed to satisfy the specific business needs of the client. The three models currently most popular among business leaders are the Global Delivery (or contract) model, the Global Shared-services (or Captive) model, and the Build-Operate-Transfer (BOT) Model (Robinson et al. 2004). The main differences among these models lie in the ownership arrangement between the company and the offshore service-providers.

Global Delivery (Contract) Model

The Global Delivery model refers to contract outsourcing offshore with a third-party vendor (Robinson et al. 2004). The sourcing company effectively transfers the control of specific functions to an external service-provider in a different location, frequently another country. Typically a make-or-buy decision, the Global Delivery model takes advantage of cheaper labor and other fixed costs. The most popular, or classic, offshoring model is one in which the software service provider takes over the end-to-end program management and delivery from a client organization.

A somewhat more mature approach to this classic model involves an onsite team at the client location. This team acts to coordinate the tasks with the offshore team. The goal of this onsite team is to effectively transfer the knowledge to the team doing the development work at the vendor site, to ensure that the product delivered adheres to the client requirements, and to manage the relationship (Robinson et al. 2004). The Global Delivery model (or contract offshore outsourcing), while providing the most rapid speed to market, comes at a cost, as providers take a cut of the cost savings as their profit margin.

Global Shared-services (Captive) Model

In the Global Shared-services or Captivemodel, client companies establish independent offshore subsidiaries, or shared-services centers, for the purpose of performing all business process outsourcing in-house. The advantage of this model is that the company is still able to achieve economies of scale and generate cost savings, while maintaining control over the work performed.

Robinson and Kalakota (2004) suggest that, in the initial stages of the Global Shared-services model, companies often start with a form of joint venture. However, companies that are more sophisticated in their ISD capabilities and international operations may set up a subsidiary or local office without involving a joint venture. These have been variously described as offshore development center, captive development center, or, in some cases, simply branch or local office. Because these subsidiaries operate as independent business units or branches executing programs and projects for onsite teams, the issue of effective knowledge transfer is akin to that of the Global Delivery model employed by software service delivery companies. The difference is that the client has greater authority and, therefore, more control, as opposed to having to negotiate with the vendor. Examples of companies that fit the profile for this model include large software development companies such as IBM, Microsoft, and Oracle, as well as consulting companies such as Accenture, EDS, and Deloitte Consulting.

The Global Shared-services model is a high-risk, high-reward proposition. While this outsourcing model provides the greatest potential for longer-term savings, the initial startup cost can be substantial. The model is also likely to require a strong commitment on the part of a client organization and, as such, involves a measure of risk.

Build-Operate-Transfer (BOT)

The Build-Operate-Transfer model is a joint venture or strategic alliance between the sourcing company and the service-provider. The model is seen as a hybrid which takes the form of a Global Delivery model until the offshore operation is “transferred” from the offshore partners to the sourcing company, at which point, it effectively converts to a captive model. In this model, an organization may collaborate with a local firm or company either by taking an equity stake or forming an independent company in which each company contributes resources (Babu 2006). The goal of this arrangement is to create a symbiotic relationship in which both client and vendor organizations hope to benefit from the other’s strengths. By capitalizing on the strengths of a local player, the client organization can mitigate some of the risks of internalization; similarly, the local player can benefit from partnering with a strong player and the opportunity to scale up the value chain. Joint venture contract may include Build-Operate-Transfer clauses in an attempt to motivate both parties to work toward a clearly defined exit strategy. The Build-Operate-Transfer, or its variation, Build-Own-Operate-Transfer (BOOT), may involve an option for the domestic company to sell its stake to the foreign company after a stipulated period or after agreed-upon milestones.

The Build-Operate-Transfer is a hybrid model that has the potential to provide the best of both worlds. However, as this is a relatively new concept, the merits and demerits of its use remain to be seen.

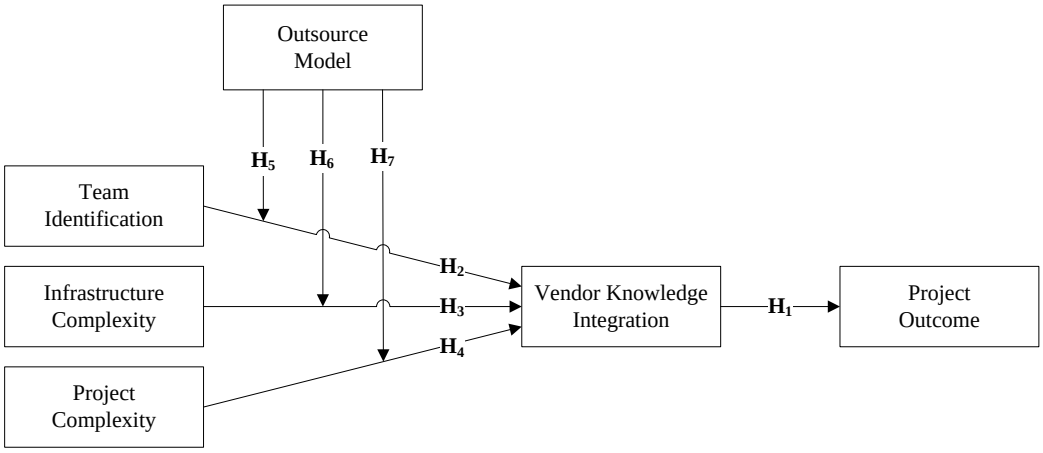

Figure 1: Hypothesized project outcome model.

THE RESEARCH MODEL

Figure 1 depicts the research model. The model posits that project outcomes are influenced by the extent to which the vendor is able to integrate the knowledge related to the project and client needs (vendor knowledge integration). Vendor knowledge integration, in turn, is influenced by team identification, requirements ambiguity, and infrastructure diversity. Finally, the outsourcing model moderates the relationships of team identification, requirements ambiguity, and infrastructure diversity with vendor knowledge integration.

In the paragraphs below, we discuss each of these relationships in further detail.

Vendor Knowledge Integration and Project Outcomes

The impact of the sharing of knowledge in outsourcing arrangements ultimately rests on the project team members involved in the information systems development. The team members act as conduits and storehouses of knowledge, and, in this regard, a different conceptualization of knowledge integration is adapted, as seen in Tiwana, Bharadwaj and Sambamurthy (2003), namely, external and internal knowledge integration. External knowledge integration refers to the extent to which the firm integrates knowledge from outside, whereas internal knowledge integration refers to the extent to which the development team builds on the knowledge of the stakeholders. As knowledge from disparate sources (Szulanski 1996) is brought together to bear on the project, the likelihood of a successful project increases (Faraj et al. 2000). Hence, knowledge integration is considered to be an important antecedent to a successful project.

***H_1**: Vendor knowledge integration will positively influence project outcomes.*

Antecedents of Knowledge Integration

Team Identification

Social Identity theory posits that individuals will try to belong to groups they believe compare favorably with, and are distinct from, other groups as a way to enhance their own self-esteem (Ashforth et al. 1989; Tajfel 1978; Tajfel et al. 1986). Research has shown team identification to be positively associated with several important outcome variables, including organizational citizenship behaviors (van Dick et al. 2006), job satisfaction (Marks et al. 2005), conflict management (Desivilya et al. 2005), and group performance (Gundlach et al. 2006; Scott 1997).

It is vital for team members to identify with their outsourcing team, just as they would with any other in-group member (Lembke et al. 1998). Two distinct reasons dictate whether a team will work effectively. One reason is identification, which creates an emotional bond between the team member and the target (in this case, the outsourcing team); this emotional bond increases the team member's commitment toward the target (Ashforth et al. 1989). Two, the identification process actually involves adopting the attitudes and commitments of the reference group (Becker 1992; Meyer et al. 2001; O'Reilly et al. 1986; Pratt 1998). In an outsourcing context, this means that the members must identify not just with their respective employers, but with the project team, consisting of the client and the vendor members. When team members identify with their team, their individual goals and personal interests recede and the goals and interest of their team dominate their actions (Lembke et al. 1998; Scott 1997).

We propose that, to the extent the client and vendor team members identify with the whole team, the more effective knowledge integration is likely to be.

***H_2**: Team identification within outsourcing teams will positively influence vendor knowledge integration.*

Infrastructure Diversity

Information technology infrastructure is comprised of the standards, tools, and platforms for hardware, software, and communication systems in a firm (Broadbent et al. 1999; Tanriverdi 2005; Zhu et al. 2002). Clearly, the nature and sophistication of the information technology project determines the type of hardware, software, and communication systems needed, whether in outsourcing or otherwise. More often than not, client and vendor organizations are likely to possess different hardware, software, and communication platforms (Ravichandran et al. 2005). These differences in hardware, software, and communication systems create complexities and difficulties in communication, interaction, and, subsequently, knowledge integration. The higher the diversity in these platforms, the more difficult it will be to develop a system at the vendor site that works seamlessly at the client site.

***H_3**: Infrastructure diversity within outsourcing teams will negatively influence vendor knowledge integration.*

Requirements Ambiguity

Software development is an inherently complex, highly creative task that involves several diverse, yet related, project activities (Pressman 1993) and requires participants to assume several different and very unique roles. At the same time, the activities are characterized by high levels of sequential, pooled, and reciprocal interdependency among team members (Thompson 1967). This high level of dependency, coupled with the need to bring multiple perspectives and knowledge to bear upon the task, makes the management of software development teams a highly complex process (Curtis et al. 1988). The more complex the project requirements, the harder it is to convey them. Thus, we propose:

***H_4**: Requirements ambiguity within outsourcing teams will negatively influence vendor knowledge integration.*

The Moderating Effect of Outsourcing Model Type on Vendor Knowledge Integration

For outsourcing teams, communication and inter-group interactions can be problematic because of the geographical distance between the client and the vendor teams. Because of the distance, clients and vendors communicate through digital technologies. Further, because of the separation of distance, time, culture, and organizations, members of outsourcing teams tend to exhibit less positive social behaviors that can lead to less positive social behaviors (Mortensen et al. 2001), lower satisfaction with team interactions (Peters et al. 2007), and assumption of the worst in the absence of information about their team members (Cramton 2001). Identification with the team can decrease these negative impacts by reducing the psychological distance perceived among team members (Hinds et al. 2005).

Different outsourcing models provide varying degrees of opportunities for face-to-face and computer-mediated interaction. The degree to which each of the outsourcing models allows opportunities for a rich exchange of information is likely to determine to what extent team identification will result in vendor knowledge integration. As discussed above, communication and the high quality of intergroup interactions are essential for vendor knowledge integration to occur. For instance, in the captive outsourcing model, these boundaries are somewhat less threatening, since the subsidiary is immersed in the culture of the vendor's country. It would be hardest for the team members in Global Delivery services to identify with their teams because the model does not provide for frequent interaction. In fact, the whole point of this model is to hand off the work to the vendor so that the client does not have to deal with it.

While we do not offer hypotheses regarding specific effects of each outsourcing model, we do propose that, on the whole, different outsourcing models will moderate the relationship of team identification with vendor knowledge integration. Note that, later in the paper, we will provide some ad-hoc analysis that will explicate on possible effects of each outsourcing model.

***H_5**: The outsourcing model will moderate the relationship between team identification and vendor knowledge integration.*

Information technology infrastructural differences between the client and vendor organizations present another layer of complexity to information systems development outsourcing. However, some sourcing models may be more susceptible to this problem. Outsourcing models, such as Global Delivery, that allow for development to take place in one location and then be transferred to another location will primarily require conversion efforts. On the other hand, jointly developing an application where the two locations have a different information technology infrastructure is problematic at every stage. In the captive model, the subsidiary is likely to have infrastructure that is somewhat compatible with the host company. The Build-Operate-Transfer model, in some sense, has the best of both worlds and may provide more flexibility, as the model changes over time. While we do not make specific propositions for

each of the models and do not have a large enough sample to test them, we propose that the outsourcing model will moderate the effects of infrastructure diversity on knowledge integration.

> ***H_6**: The outsourcing model will moderate the relationship between infrastructure diversity and vendor knowledge integration.*

As previously discussed, the discontinuities between vendor and client teams are many. The team members are frequently geographically, culturally, nationally, and organizationally diverse. These discontinuities make the task of transferring the project requirements to the vendor exponentially more difficult than it is when the work is performed by the same organization and at the same location, because each of these discontinuities of the differences in mental model of the participants. Since these models are the lenses through which information is interpreted, we propose:

> ***H_7**: The outsourcing model will moderate the relationship between requirements ambiguity and vendor knowledge integration.*

METHODS

The model was tested utilizing an online survey of IT project managers. Access to these IT project managers was provided by a market research company that contacted a panel of IT managers engaged in outsourcing software development projects who were engaged in "*a project that has either been completed (or nearing completed) within the last year or is currently in the implementation phase to answer these questions*." We received sixty-six complete and usable surveys, which formed the basis of this study.

Measures

Project Outcome measures were adapted from Grover (1996). Managers with firsthand knowledge were asked to evaluate their "perception of the project outcome" by rating six items on a 7-point Likert scale ranging from 1 "Strongly Disagree" to 7 "Strongly Agree." These items included statements such as, "We consider the project as successful" and "Overall, we are satisfied with the project outcome" (for a complete listing of all items, see Table 1). Due to the high degree of consistency between all six items (α = .96), and for the sake of simplification, these items were combined into a single variable representing Project Outcome.

To measure **Vendor Knowledge Integration**, we adopted a scale by Kim and Kim (2008). Analysis of the five items again yielded a single factor (α = .93); thus, the five items were subsequently averaged into the variable vendor knowledge integration.

In order to measure **Team Identification,** we utilized items from Becker, Billings, Eveleth, and Gilbert (1996); respondents were asked to rate, on a 7-point Likert scale ranging from 1 "Strongly Disagree" to 7 "Strongly Agree," the extent to which they agreed with the following five statements. "I have a strong preference to participate in this team rather than a different team," "I generally like the other team members," "My attitude and beliefs are similar to other members of the team," "I feel like I fit in with this team," and "This team acted as a unit and not as a bunch of individuals." Because the items load on a single factor (α = .91), these items were averaged into a single variable representing Team Identification in an effort to maintain consistency.

To assess the project's **Infrastructure Diversity,** we utilized items from Xia and Lee (2005). Managers rated the extent to which the project had certain components relating to diversity in terms of "multiple software environments," "multiple technology platforms," and "significant interaction with other systems." A 7-point Likert scale ranging from 1 "Not at all" to 7 a "Great Extent" was used. The items loaded on a single factor (α = .71) and were combined into a solitary variable.

Finally, to evaluate **Requirements Ambiguity**, managers were asked to rate the extent to which the project had components relating to the differing forms of complexity. The stem for this section began with, "To what extent does the project have …" and included the items "simple requirements," "an easy set of project guidelines," "clear specifications" as measures of the requirements ambiguity. Managers responded to these items on a 7-point Likert scale ranging from 1 "Not at all" to 7 a "Great Extent." The items loaded on one factor (α = .62) and was consequently combined into the variable requirements ambiguity. We acknowledge that the reliability of this item is less than ideal, but it is in the acceptable range (DeVellis 1991). Deville has indicated that alpha below .60 are unacceptable, and while the .60 to .65 range is not desirable, it is nevertheless acceptable for small samples.

Table 1: Factor Analysis of Survey Items

	Component				
	1	2	3	4	5
Project Outcome					
We consider the project as successful.	.876				
The strategic intent has been (or is expected to be) satisfied through this project.	.918				
The final project deliverables has satisfied (or is expected to satisfy) our requirements.	.786				
Project outcome has fulfilled (or is expected to fulfill) our expectations.	.909				
Overall, we are satisfied with the project outcome.	.985				
We expect the relationship with this partner to continue after this project.	.862				
Vendor Knowledge Integration (During the project, our interactions with the vendor improved their…)					
Understanding of the project		.940			
Ability to ask penetrating questions about this project		.879			
Knowledge of this project		.929			
Knowledge about this project's documentation		.806			
Knowledge about our own business process		.874			
Team Identification					
I have a strong preference to participate in this team rather than a different team.			.817		
I generally like the other team members.			.788		
My attitude and beliefs are similar to other members of the team.			.996		
I feel like I fit in with this team.			.851		
This team acted as a unit and not as a bunch of individuals.			.677		
Infrastructure Diversity					
Multiple software environments				.908	
Multiple technology platforms				.750	
Significant interaction with other systems				.700	
Requirements Ambiguity					
Simple requirements					.720
An easy set of project guidelines					.869
Clear specifications					.718

Extraction Method: Principal Component Analysis
Rotation Method: Promax with Kaiser Normalization
Rotation converged in 5 iterations.

A factor analysis was performed on all survey items in order to ensure construct validity. This was based on Principal Component analysis, with Promax Rotation and Listwise Deletion. The analysis showed support for the instrument by achieving a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of .77, with items loading on the five theorized constructs, and explaining 76 percent of the variance. Loadings below the acceptable cut-off of .60 were eliminated. The items that were preserved and their loadings are reported in Table 1. We conducted Harman's one-factor analysis to test for the presence of a common method effect. Using this test, if a substantial amount of common method bias is present, either a single factor emerges from the factor analysis or one general factor will account for the majority of the covariance among the variables. No general factor was apparent in our data, and a common method bias is not expected to have contaminated our results.

RESULTS AND DISCUSSION

The goal of this research was to examine the role of team identification, requirements ambiguity, and infrastructure diversity in vendor knowledge integration. We also sought to examine the moderating effect of outsourcing models on the relationships of team identification, requirements ambiguity, and infrastructure diversity with vendor knowledge integration.

TABLE 2: Descriptive Statistics and Correlations Among Study Variables

	Variable	Mean	S.D.	1	2	3	4	5
1	Project Outcome	5.06	0.96	1.00				
2	Vendor Knowledge Integration	5.23	1.30	0.71	1.00			
3	Team Identification	5.11	1.24	0.52	0.29	1.00		
4	Infrastructure Diversity	4.42	1.61	0.15	0.29	0.08	1.00	
5	Requirements Ambiguity	4.24	1.19	-0.09	-0.19	-0.03	-0.14	1.00

n = 66

Table 2 reports the means, standard deviations, and correlations of the variables used in our model. Figure 2 shows the regression analysis results on the model. We first tested the effects of vendor knowledge on project outcome. As predicted, analysis confirms this relationship to be significant (R^2 = .51, p< .001, β = .719, p< .001), supporting Hypothesis 1.

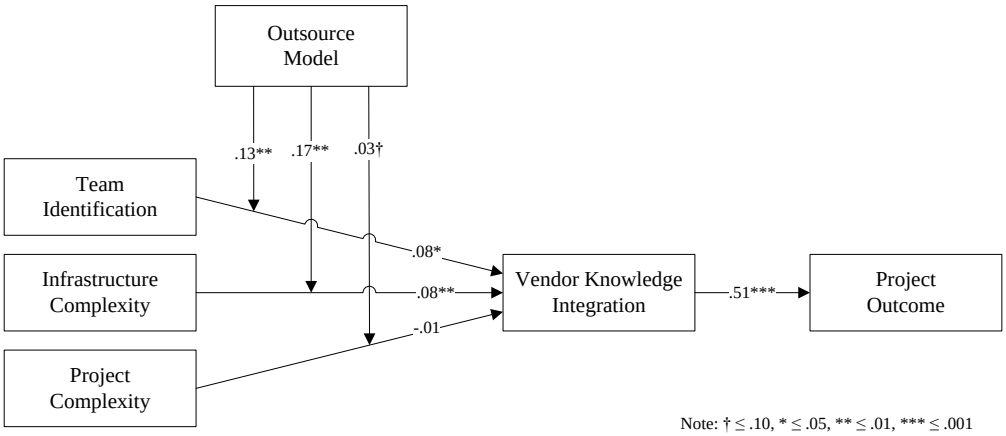

Figure 2: A model of antecedents of knowledge integration.

In order to test the antecedents of Vendor Knowledge Integration, we performed hierarchical regression analysis. In the first step, vendor knowledge integration was regressed against team identification, infrastructure diversity, and requirements ambiguity respectively. Team Identification (R^2 = .08, p < .05, β = .299, p < .05) and infrastructure diversity (R^2 = .08, p < .01, β = -.308, p < .01) showed significant relationships in the predicted direction on vendor knowledge integration, showing support for Hypotheses 2 and 3. However, the relationship between vendor knowledge and requirements ambiguity, Hypothesis 4, was not supported (R^2 = -.01, β = -.166, p =.17). A lack of support for the relationship between requirements ambiguity and vendor knowledge integration, Hypothesis 4, is counterintuitive. We conjecture that this is attributable to the current small sample size of sixty-six. As data collection is ongoing, it is expected that this relationship will gain significance once more data becomes available.

Next, the moderating effect of the type of outsourcing model was tested to evaluate Hypotheses 5, 6, and 7. The results show that the type of outsourcing model has a significant moderating effect on the relationship between team identification and vendor knowledge integration (ΔR^2 = .05, p < .01), supporting Hypothesis 5. Additionally, the outsourcing model was also shown to significantly moderate the relationship between infrastructure diversity and vendor knowledge integration (ΔR^2 = .09, p < .001), showing support for Hypothesis 6. Finally, the moderating effect of the outsourcing model on the relationship between requirements ambiguity and vendor knowledge integration was evaluated, supporting Hypothesis 7 (ΔR^2 = .02, p < .1).

Overall, the results show good support for the proposed model. Our findings imply that vendor knowledge integration is an important antecedent to project success, explaining 51 percent of the variance in project outcomes. In other words, to the extent managers can make sure that an appropriate level of knowledge integration takes place, that is, the vendor understands the project and the client's business processes, the greater the likelihood the vendor will be able to deliver a product that will meet the client's expectations. This is also good news for the vendor, as this improves the likelihood of the outcomes of continuation of the outsourcing relationship with the client.

The results clearly show that the type of outsourcing model significantly moderates the relationship between team identification and vendor knowledge integration. This implies that the challenges arising from low team identification on vendor knowledge integration in boundary-spanning outsourcing teams can be mitigated if the appropriate outsourcing model is used.

To understand the unique effects of each model, a post-hoc analysis of each outsourcing model was conducted. We tested for moderating effect of each of the outsourcing models by conducting individual regressions for each outsourcing model, using dummy variables method for categorical variables.[1] We found that when the Captive outsourcing model was used, it significantly improved (β = -.423, p < .01) on the relationship between team identification and vendor knowledge integration than when the other two outsourcing models were used. The Build-Operate-Transfer (Joint Venture) model showed a small but insignificant effect, and the Global Delivery outsourcing

[1] For a detailed description of this method, please see http://www.psychstat.missouristate.edu/multibook/mlt08m.html.

model had no effect at all. This result makes sense, in that the Captive model allows organizational identification of the client company to carry over to the outsourcing unit of the firm. In the other two cases, the client is dealing with a different organization, and identity formation is not facilitated to the same extent. The results provide support for the notion that the identity formation is dependent on the organizational context and plays a significant role in Knowledge Integration.

As noted, we found that the type of outsourcing model moderates the relationship between infrastructure diversity and vendor knowledge integration. In our post-hoc analysis to further understand this relationship, we found similar results. The Captive outsourcing model had a significantly greater positive effect than the Build-Operate-Transfer (Joint Venture) model, and the Global Delivery model showing no moderating effect. In Captive models, the client-owned subsidiary unit is likely to have a more compatible infrastructure, thus allowing for better vendor knowledge integration. In the Global Delivery model, the infrastructure gap is likely to be the widest, thus creating more difficulties in vendor knowledge integration. One would expect these difficulties to show up in the implementation phase. The Build-Operate-Transfer model showed a small and insignificant moderating effect. In both of these scenarios, it is possible that the client is pleased with the vendor until the vendor starts implementing the system in the client organization, at which point the client and vendor might encounter difficulties due to compatibility issues.

We also conducted similar post-hoc regressions on the moderating effect of the outsourcing model on the relationship between requirements ambiguity and vendor knowledge integration. We found that the Captive Outsourcing model had a significantly greater effect on the relationship between requirements ambiguity and vendor knowledge integration than the other two models.

The overall conclusion of this post-hoc analysis is that the Captive model provides the best vendor knowledge integration, followed by the Build-Operate-Transfer model. The Global Delivery model provides little or no facilitation of vendor knowledge integration, as the interaction is severely limited in this case. These benefits, of course, must be considered along with the high cost and need for a high level of commitment on the part of the client organization in some scenarios. However, our results suggest that the cost and effort may be well worth it if outsourcing is a part of the core strategy. In the case where outsourcing is not a part of the core strategy and the costs are not justified, the organization should take steps to reinforce team identification, as well as assess the gaps in infrastructure early or create a plan to address it. These measures are likely to improve vendor knowledge integration and subsequently, project outcomes.

While these results are supportive of our model, some caveats are in order when interpreting our findings. First, we utilized self-report and single sources for our variables. We chose self-reported measures and single sources of data because it was not possible to get access to separate sources of independent and dependent variables for the same project for the sample size needed for our model. Although self-report measures (e.g., managerial assessments) are common in empirical studies in the IS field, we attempted to reduce subjective bias by using multi-item and validated measures. Also, we conducted Harman's one-factor analysis to test for the presence of a common-method effect and verified that common-method bias is not a major issue in our results. Third, the reliability of some of our items is less than ideal. It is, however, considered to be in the acceptable range (DeVellis, 1991).

CONCLUSIONS

This paper provided evidence that use of the appropriate outsourcing model acts to significant mitigate the adverse effects of factors related to team (identification), project (requirements ambiguity), and infrastructure (diversity) on Vendor Knowledge Integration, which, in turn, increases the potentiality for favorable project outcomes.

This study contributes to the information technology outsourcing research by examining the role of outsourcing models in the information systems development context. By showing that outsourcing models can influence the level of knowledge integration, it extends the research on knowledge integration in software development outsourcing. It also provides insight on team identification, requirements ambiguity, and infrastructure as antecedents of vendor knowledge integration, which is an important determinant of information systems development project success. The research reported here represents a preliminary but important step toward understanding success factors in information technology outsourcing. Future research should examine and test this model in other outsourcing contexts (e.g., information technology services) and from other views (e.g., vendors' view) and involving other data collection methods, such as case studies for richer understanding of this phenomenon.

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