

# MULTI-LEVEL KNOWLEDGE TRANSFER IN SOFTWARE DEVELOPMENT OUTSOURCING PROJECTS: THE AGENCY THEORY VIEW

*Research-in-Progress*

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## **Abstract**

*In recent years, software development outsourcing has become even more complex. Outsourcing partner have begun 're-outsourcing' components of their projects to other outsourcing companies to minimize cost and gain efficiencies, creating a multi-level hierarchy of outsourcing. This research in progress paper presents preliminary findings of a study designed to understand knowledge transfer effectiveness of multi-level software development outsourcing projects. We conceptualize the SD-outsourcing entities using the Agency Theory. This study conceptualizes, operationalises and validates the concept of Knowledge Transfer as a three-phase multidimensional formative index of 1) Domain knowledge, 2) Communication behaviors, and 3) Clarity of requirements. Data analysis identified substantial, significant differences between the Principal and the Agent on two of the three constructs. Using Agency Theory, supported by preliminary findings, the paper also provides prescriptive guidelines of reducing the friction between the Principal and the Agent in multi-level software outsourcing.*

**Keywords:** Outsourcing, Knowledge Transfer, Software, Agency theory

## **Introduction**

In recent years there has been an increased interest in software development outsourcing<sup>1</sup> (SD-outsourcing) in both academia and practice (Krishna et al. 2004; Rustagi et al. 2008; Wanjin et al. 2007). Countries like India, Sri Lanka and Philippines have gained a reputation of receiving software development outsourcing projects, mostly from western nations (Heeks 1999; Ramingwong and Sanjeev 2007; Siakas et al. 2006). According to recently published report on IT outsourcing trends (Economics 2006), most popular type of outsourcing is software development, followed closely by outsourcing of website/e-commerce, hosted applications, and outsourcing of disaster recovery services. They have identified that software development outsourcing category is also the category that is growing the most. The SD-outsourcing is complex, where the client ('Principal' as per agency theory) and outsourcing partner ('Agent' as per agency theory) interact to produce the required software product/service (Gopal and Gosain 2010). To produce the necessary outcome, the Principal must interact with the Agent to transfer knowledge of the requirements the software. The Agent in turn must interact with the Principal, as well as with other outsourcing partners. This involves significant technical activities combined with business knowledge from the various stakeholders (Gopal and Gosain 2010). Thus, such projects are highly knowledge intensive that necessarily draws upon knowledge between the Principal and the Agent. The success of a SD-outsourcing project will largely depend on the goodness of the knowledge transfer between the key parties. It is therefore expected that the required knowledge be transferred from the Principal to the Agent. The Agent, in turn should acquire the deliverable specific knowledge from the Principal, usually within a short time (Chua and Pan 2006). Though the concepts of knowledge transfer in SD-outsourcing are theoretically simple, it is one of the most challenging concepts to both the Principal and the Agent (Bjornson and Dingsoyr 2008). Over the years, many studies have addressed various aspects of SD-outsourcing process such as relationships and communication between the outsourcing partners (Alami et al. 2008; Gopal et al. 2002), organizational controls and risks (Gefen et al. 2008; Gopal and Gosain 2010a) and the opportunities and challenges in SD-outsourcing (Haddad and Vincent 2007; Jones 2009). Some studies specifically explored the importance of knowledge transfer in SD-outsourcing (Betz et al. 2010; Salger and Engels 2010), knowledge transfer issues and the impact of those issues for SD-outsourcing projects (Dedrick et al. 2011; Williams 2011) and the factors influencing the knowledge transfer process (Alavi and Leidner 2001). Grant (1996) in his discussion of the Knowledge Based Theory, illustrates that the efficiency of knowledge integration, a concept that parallels with two parties merging knowledge together, is determined by two components: (1) the extent to which basic common knowledge exists between participants, and (2) the level of coordination or communication among team members. Similarly, Curtis et al. (1988) identified three major challenges in software development projects: (1) thin spread of application domain knowledge between the parties, (2) fluctuating and conflicting requirements, and (3) communication and coordination breakdowns. Software development team's ability to produce quality applications depends on understanding and strict management of requirements and consistent communication throughout the software lifecycle (Chakraborty et al. 2011; Green 2011).

Despite a wealth of studies on knowledge transfer in SD-outsourcing projects (Cha et al. 2008; Tiwana 2004; Williams 2011), thus far, all studies to the best of our knowledge, observe knowledge transfer as a uni-directional transaction between the Principal and the Agent. Software development process is becoming more and more complex (Dinh and Fillion 2007) and the successfulness of those projects depends on the common knowledge of the project team (Adelson and Soloway 1985; Cheney and Lyons 1980). Information System (IS) researchers believe that the users and the information system developers should integrate the technical and application domain knowledge to achieve the project success (Tesch et al. 2009). Hence, knowledge transfer between the outsourcing partners is crucial to the project success. Prior studies fail to recognize multi-tiers of outsourcing (Agent outsourcing to another outsourcing partner) in SD-outsourcing. Knowledge transfer in contemporary SD-outsourcing involves multiple layers of participants, both within and across organizations. Within the outsourcing partner, the business

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<sup>1</sup> SD-outsourcing is different to service outsourcing, where the outsourcing partner provides on-going support (for more details see; Sahay, S., Nicholson, B., and Krishna, S. 2004. "Global It Outsourcing Software Development across Borders." Cambridge University Press.)

requirements are gathered by the consultants and then transferred to the technical staff. In more contemporary SD-outsourcing projects multiple outsourcing partners are involved, where the Agent further outsources parts of the project to the other outsourcing partners (Olsson et al. 2008). In such circumstances, the Agent's outsourcing partners do not have direct access to the Principal and solely rely on the knowledge transfers of consultants of the Agent. Since there is an involvement of the Principal and the Agents in different levels, we term it as multi-level of outsourcing. Recent industry reports suggest that software development organizations are increasingly outsourcing sub processes like Quality Assurance to extended outsourcing partners (Capgemini 2011 ; Initiative 2012). Lengthen the hierarchy of the Principal and the Agents leads to greater inefficiencies (McAfee and McMillan 1995) and that highlights the need of exploring the multi-level knowledge transfer instead of single level transfers. With increasing global competitiveness, driven by the efficiency gains, multi-level knowledge transfers are not only common, but essential. Information Systems research is yet to fully understand this multi-tier knowledge transfer in SD-outsourcing projects. Thus, our driving research question attempts to address the question of "How to improve the multi-level knowledge transfer in software development outsourcing projects?"

Multi-level knowledge transfer in SD-outsourcing can be observed in three distinct levels; Level 1; the Principal transfers knowledge of the software requirements to the consultants at the Agent (outsourcing partner). Level 2 involves, when the knowledge attained is transferred by the consultants to the technical staff at the Agent and level 3 occurs when the Agent partially outsources software development to another outsourcing company. In all levels, consultants at the Agent play a pivotal role acting as a conduit, absorbing knowledge of the requirements from the Principal, translating them to technical specifications to the technical staff. We acknowledge that there are three terms as 'offshore-outsourcing' (for level 1 outsourcing) (Kliem 2004), 'insourcing' (for level 2) (Chua and Pan 2006) and 'outsourcing' (for level 3), we use the term 'outsourcing' to simplify the scenario.

This research-in-progress paper reports our early observations of knowledge transfer between the consultants and the technical staff of the Agent (Outsourcing level 2). Herein, we apply the Agency Theory (Pavlou et al. 2007) to understand the partnerships and improve knowledge transfer between the Principal and the Agent. Knowledge transfer is conceptualized using past related work (Goldoni and Oliveira 2010; Herbsleb and Moitra 2001; Kirsch and Haney 2006) using three constructs; (1) Domain knowledge, (2) Communication behaviors, (3) Clarity of requirements. We then identify the variance of the effective knowledge transfer factors and suggest several methods to reduce the variance using the Agency theory. The second phase of this research is still in progress at the time of submission. Second phase involves data collection on the outsourcing level 1 and 3 to validate the preliminary findings of the first phase of the research. The analysis and recommendations presented here are preliminary; however they provide insight into the landscape of the multi-level knowledge transfer factors in software development outsourcing.

## **Knowledge Transfer Effectiveness: Developing the Preliminary Model**

The purpose of this section is to develop constructs associated with knowledge transfer effectiveness. It is noted that we do not attempt to characterize knowledge transfer; instead we observe knowledge transfer effectiveness. We begin stating why knowledge transfer is important to SD-outsourcing, and then identify constructs of knowledge transfer effectiveness.

Several studies have researched ways of improving the relationship between the client and its outsourcing partner/s (Lee et al. 2004; Miranda and Kavan 2005), with most focus on how the partnerships between the client and the outsourcing partner are established and improved (Kern and Blois 2002; Kern and Willcocks 2002; Mani et al. 2011). Kern & Willcocks (2002) use the 'interaction approach' to improve the understanding of IT outsourcing relationship practices, alluding to the importance of knowledge transfer mechanisms. Bharadwaj et al. (2010) demonstrate that, both client and the outsourcing partner are responsible for building a good relationship between each other and that conducive relationship between the client and the outsourcing partner results in a 'win-win relationship'. Amongst studies specifically identifying knowledge transfer as a critical aspect of SD-outsourcing (Betz et al. 2010; Lee 2001; Salger and Engels 2010), Blumenberg et al. (2009) suggest that the outsourcing partner must transfer technology-specific knowledge to the client and in turn the client must provide business-specific

knowledge to the outsourcing partner, where effective knowledge transfer at both ends lead to higher outsourcing performance (Blumenberg et al. 2009). According to Gottschalk, (2006) effective knowledge management has to transcend organizational boundaries to include outsourcing partners in order to improve the accuracy of the outsourcing projects.

Rottman (2008) is amongst the first to explain the importance of knowledge transfer for successful outsourcing software development, showing that strong relationships among staff involved in the software projects is critical for outsourcing project success. Xiaohong et al. (2010) suggest that effective transfer of software requirement knowledge is one of the key factors of decreasing requirements volatility, solving conflicts between requirements, ensuring the quality of software project and customer satisfaction. Their study shows that the client pays more in SD-outsourcing projects as a result of knowledge asymmetries between the clients and the outsourcing partners. Furthermore, Dibbern et al. (2008) observe (1) weak requirements specification and design, (2) lack of knowledge transfer methods, (3) lack of control and (4) lack of coordination, increase costs in SD-outsourcing projects. Using the framework in Sedera & Gable (2010), a cross-reference can be developed along with knowledge of the software, against the key players of SD-outsourcing using (1) software-specific knowledge, and the (2) knowledge of the client organization.

Alavi & Leidner (2001) demonstrate that there are three factors which influence the knowledge transfer; (1) absorptive capacity of the receiver, (2) nature of the message (causal ambiguity in knowledge) and (3) the relationship between the source and the recipient (ease of communication). Lin et al. (2005) propose a sender-receiver framework for studying knowledge transfers under asymmetric or incomplete information. They illustrate how information incompleteness and asymmetry may negatively influence knowledge transfers, and propose solutions to alleviate these negative impacts. In the work of Knowledge Based Theory (Grant 1996) and its adoptions in Information Systems (Newell et al. 2006; Pan et al. 2007; Wang et al. 2007) suggest that in order to manage knowledge effectively, employees must have similar levels of common knowledge. Similarly, previous research findings suggest that employees must have effective communication behaviors to maximize knowledge transfer (Giannakis 2008; Ko et al. 2005; Thompson et al. 2006). More specific to Information Technology outsourcing, several studies (Coughlan et al. 2003; Kirsch and Haney 2006) have recommend that clarity of the requirements should increase.

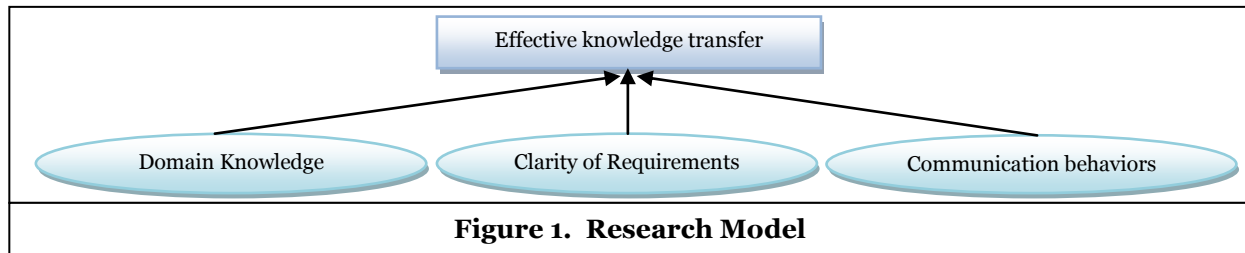
A study by Klepper (1995) explores the methods and the techniques to enhance long term relationships between the outsourcing partners, suggesting communication, expectation development and reward mechanisms as techniques for building relationships between the client and the outsourcing partner. Pan et al. (2007) depict that various kinds of knowledge need to be shared in information system implementations, even after the adaptations. They have identified that different types of relationship building is required in various phases of the projects. Ramchand & Pan (2012) highlight that effective knowledge transfer depends on the relationships of the employees of the organization.

Moreover, knowledge transfer (in some cases, the term 'knowledge sharing' is used when knowledge is shared by the client) is a mandatory obligation in contemporary SD-outsourcing. Koh et al. (2004) identify the critical client-outsourcing partner obligations in outsourcing relationships. Their study found that most outsourcing projects include effective knowledge transfer, effective inter-organizational teams, knowledge sharing and provision of clear specifications as mandatory obligations. Karhu et al. (2007) depict that software outsourcing and the knowledge transfer are very much interconnected. They have highlighted that transfer of organizational knowledge can be quite difficult to achieve because the knowledge resides in organizational members, tools and tasks.

In conclusion, the importance of knowledge transfer is highlighted in knowledge management literature as well as in SD-outsourcing studies. Yet, to-date, no study to our knowledge has observed multiple levels of knowledge transfer within and across organizations. Thus, we attempt to explore the level 2 and 3 of SD-outsourcing knowledge transfer.

Sender-receiver framework proposed by Lin et al. (2005) discusses about the completeness /incompleteness of the sender's and the receiver's information sets. In the outsourcing context the 'sender' is the Principal while the Agent becomes the 'receiver'. They highlight that the information sets of the sender and the receiver should contain common domain knowledge and ties between the sender and receiver (can be measured by the communication behaviors), in order to derive the expected value of the knowledge transfer process. Effectively conveying the expected value of its knowledge products

(requirements of the products) is crucial to obtain a complete information set. Based on the discussion by Lin et al. (2005) we can derive three constructs of effective knowledge transfer ; 1) Domain knowledge, 2) Clarity of the requirements and 3) Communication behaviors. One of the co-authors had the experience as a Business Analyst in SD-outsourcing project, informed with construct development as he had gone through the multi-level knowledge transfer process.



Following the guidelines of formative construct derivation and validation (Diamantopoulos 2009; Diamantopoulos and Siguaw 2006; Diamantopoulos and Winklhofer 2001; Jarvis et al. 2003; Petter et al. 2007), all constructs of the research are conceived as formative. As per Petter et al.'s (2007) guidelines for identifying formative variables, measures of the three constructs: (i) need not co-vary, (ii) are not interchangeable, (iii) cause the core-construct as opposed to being caused by it (arrows point in), and (iv) may have different antecedents and consequences in potentially quite different nomological nets.

In relation to knowledge and knowledge transfer aspects, Goldoni & Olivia (2010) state that specialized software development activities require constant update of new knowledge, and that effective knowledge management is essential to support and achieve companies' strategic goals. According to Correia & Aguiar (2009, p.1) "...Knowledge plays a key role in software development, and the effectiveness of how it is captured into artifacts and acquired by other team members, is crucial for project's success...". Grant (1996) illustrates that the efficiency of knowledge integration is determined by two components: (1) the extent to which basic common knowledge exists between participants, and (2) the level of communication among team members. The second construct elaborates that 'clarity of requirements' is the most important part of making software which satisfies the client. Accurate documentation and maintaining software requirements in software life cycle helps to make the software development process a success (Attarha and Modiri 2011). According to Kirsch & Haney (2006), one of the most significant challenges for any information systems (IS) project is determining information requirements. Karlsson et al. (2007) mentioned that, writing understandable requirements and understanding the stated requirements suggestions, is more complex when the stakeholders are having different ideas and interests. Communication plays an important role in software development (Perry et al. 1994). According to Herbsleb & Moitra (2001), absence of well established communication can lead to misalignment & rework in software development. They illustrate that this is even more complex and important in software outsourcing. According to Gefen & Carmel (2008), miscommunication in the software development is among the greatest contributors to software development problems, resulting in bugs that are the most expensive to correct. George (2010) depicts that one major reason for software failure is poor communication between the end-user and the software developer which leads to a lack of definition or scope of work. Therefore, 'communication behaviors' was selected as the third construct for analysis.

## Theoretical Grounding Using Agency Theory

The Agency Theory provides an overarching view to understand the purported 'conflict' between the Principal and the Agent. The Agency Theory is appropriate in that, it provides the ways to reduce the knowledge transfer variance, which will ultimately result in increasing the quality of outsourced software products. Agency theory has provided the theoretical foundation to the markets of imperfect information and to all types of transactional exchanges where information asymmetry, fears of opportunism, and bounded rationality exist. The Principal-Agent perspective has also been extensively examined in the Information System literature, such as information systems development projects and in Information Technology outsourcing (Pavlou et al. 2007). Therefore agency theory provides the theoretical grounding for our research.

The Agency theory is appropriate for this study as it attempts to explain the behavior in pervasive relationships, whereby one party (the Principal) delegates work to another, who performs that work (the Agent), similar to the scenario of SD-outsourcing. A key objective of agency relationships is to ensure that the Agent acts according to the requirements of the Principal. Often, goals of the Principal and the Agent are based on their own interests and are rarely in a perfect alignment (Huarng 1995). Eisenhardt (1989) explains two salient problems in agency relationships; (a) goals of the Principal and the Agent conflict (goal conflict) (b) it is difficult for the Principal to verify the actual Agent behavior (information asymmetries). Our intention of this study is specifically to contribute to these two issues in SD-outsourcing, through a better understanding of effective knowledge transfer mechanisms (Bjorkman et al. 2004; Zaheer et al. 2010), where effectiveness transfer of knowledge is measured using; (1) Domain knowledge, (2) Communication behaviors, (3) Clarity of requirements (Coughlan et al. 2003; Kirsch and Haney 2006).

## Context, Study Model and the Methodology

Most of the Software development organizations worldwide, follow the agile methods<sup>2</sup> in their software development projects (Dyba and Dingsoyr 2008). Agile methods break the tasks into multiple iterations with short time frames, where at the end of each iteration some proportion of the software product will be delivered to the clients (Boehm 1988). These iterations involves a team working through a full software development lifecycle including planning, requirement analysis, design, coding, unit testing<sup>3</sup>, and acceptance testing when the working product is demonstrated to the stakeholders. The agile methods reduce the overall risk of the software development projects and allow the project to adapt to the changes quickly. Iteration will not add enough functionality for a market release, but the goal of each iteration is to have a deliverable with minimum bugs. Multiple iterations will be required to release a complete software product for the clients (Sewell 2012). From the initial iteration to the final one, the knowledge gap between the Principal and the Agents will be declined, because with the time they get familiarized with the software project requirements.

We gathered data from a large software development outsourcing project which involves a stock brokerage firm (the Principal) and two large software development organizations (the Agents). The Principal is a stock brokerage firm in India, which consists of 16 departments with 583 employees. The Principal requires specific software that improves the efficiency of the settlement of the trades under its brokerage. The Agent has over a decade of outsourcing experience, especially in developing stock market related software applications. The Agent employs 116 consultants (employed as Business Analysts, Senior Business Analysts, Business Consultants and Senior Business Consultants) and 111 technical staff (employed as Software Engineers, Senior Software Engineers, Technical Leads, Technical Specialists and Software Architects). Frequently, the Agent outsources components to another global software development company, which has its operations in USA, UK, Australia, Canada, India and Sri Lanka. The selection of the study context (as well as the respondents for the preliminary survey) was carefully made to ensure that multi-level knowledge transfer is evident.

This complex scenario can be dissected into three outsourcing levels according to the knowledge transfer requirements (Figure 2). Level 1, client has outsourced the software development to an 'outsourcing partner'. Here, the knowledge is required to be transferred from the client (Principal-L1) to the consultants of the outsourcing partner 1 (Agent-L1) (inter-organizational level). Level 2<sup>4</sup>, knowledge

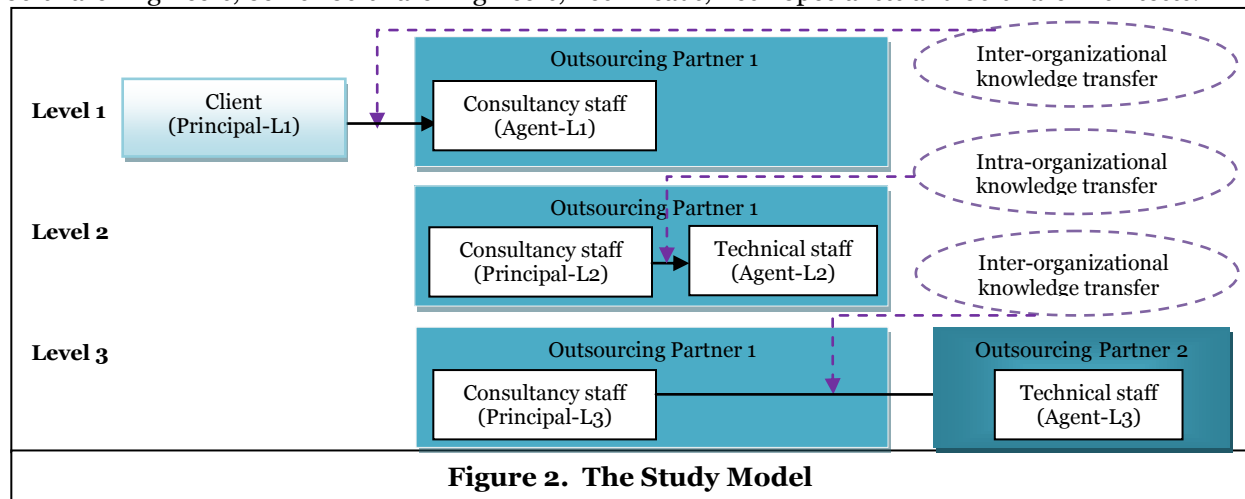
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<sup>2</sup> "Agile software development is a group of software development methodologies based on iterative and incremental development, where requirements and solutions evolve through collaboration between self-organizing, cross-functional teams." Sewell, L. 2012. "Agile Software Development." Research World.

<sup>3</sup> Unit testing occurs concurrently with development and is performed by the developers (technical staff). Each unit test is merely code written to verify the expected behavior and outcome of other code. This often results in each method of the tested code having multiple tests written to cover the possible parameter values that could yield differing results. Hall, G.M. 2011. "Pro Wpf and Silverlight Mvvm:Effective Application Development with Model-View-Viewmodel," in: *Pro WPF and Silverlight MVVM:Effective Application Development with Model-View-ViewModel*, J. Hassell (ed.). Paul Manning, pp. 145-162.

<sup>4</sup> Agent in outsourcing level 1 becomes the Principal in outsourcing level 2 because the consultancy staff delegates software development activities to the technical staff.

attained is transferred by the consultants (Principal-L2) to the technical staff (Agent-L2) (intra-organizational level). Level 3, outsourcing partner 1 partially outsources software development to another software development company (outsourcing partner 2). Here the knowledge is typically transferred to the technical staff of outsourcing partner 2 (Agents-L3) through the consultancy staff (Principal-L3) (inter-organizational level) (Oshri et al. 2008). This research paper focuses only on outsourcing level 2 and it discusses the effective knowledge transfer factors of the outsourcing process from Principal-L2 to Agent-L2 of the outsourcing partner 1. The preliminary survey was conducted at outsourcing partner 1 as an exploratory exercise designed to elicit knowledge transfer perspectives of; 1) Principle-L2: Business Analysts, Senior Business Analysts, Business Consultants and Senior Business Consultants, 2) Agents-L2: Software Engineers, Senior Software Engineers, Tech Leads, Tech Specialists and Software Architects.



**Figure 2. The Study Model**

The intention of the survey was to explore the effective knowledge transfer factors in software outsourcing in level 2 of our study model. The survey was designed as a web based application and the online responses were collected from the employees of the software development organization. Overall, 55 responses were obtained (23 consultants ('Principal - L2') and 32 technical ('Agent - L2')).

## Data Analysis

As per formative construct validation procedures described by Diamantopoulos and Winklhofer (2001), Variance Inflation Factors (VIF) were first computed separately for each measure to assess the possible existence of multicollinearity between formative measures. The VIF of all measures were below the common threshold of  $10^5$  (as recommended by Kleinbaum et al. (1998)). The study model is next tested using the Partial Least Squares (PLS) procedure (Wold 1989), and employing the SmartPLS software (Ringle 2005). Our PLS results establish convergent and discriminant validity of the model constructs. Convergent validity of the model constructs is supported by heuristics of (Gefen and Straub 2005), where all t-values of the Outer Model Loadings exceed 1.96 cut-off levels<sup>6</sup> significant at 0.05 alpha protection level. Moreover, construct reliability is assessed by examining the loadings of the manifest variables with their respective dimension. A minimum loading cut-off often employed is to accept dimensions with loadings of 0.70 or more, which implies that there is more shared variance between the dimension and its manifest variable than error variance (Carmines and Zeller 1979; Dwivedi et al. 2006; Hulland 1999; Kaiser 1974).

Next, we analyzed the variance of the constructs between the Principal-L2 and the Agent-L2, using independent samples t-test. Independent samples t-test was selected in this instance due to its robustness when dealing with small (25-30), equally distributed sample sizes (Bridge and Sawilowsky 1999).

<sup>5</sup> The largest VIF for the study measures being 6.3.

<sup>6</sup> The t-values of the loadings are, in essence, equivalent to t-values in least-squares regressions. Each measurement item is explained by the linear regression of its latent construct and its measurement error (Gefen, D., and Straub, D. 2005. "A Practical Guide to Factorial Validity Using Pls-Graph: Tutorial and Annotated Example," *Communications of the Association for Information Systems* (16), pp 91-103.)

According to the results of the t-test, the significance of all the constructs for the Levene's test value all proved to be greater than 0.05(confidence level 95%). Sig (2-Tailed) value (Table 1) of the 'clarity of requirements' and 'communication behaviors' constructs which were 0.000 and 0.050 respectively, indicating statistically significant differences in those two constructs between Principal-L2 and Agent-L2. This suggests an unbalanced understanding of the client requirements by Principal-L2 and Agent-L2. The differences in the communication behaviors construct too was observed, which indicate diminutive inconsistency of communication behaviors between Principal-L2 and Agent-L2. The data did not demonstrate differences between cohorts for the domain knowledge construct. This would indicate that in this instance that Principal-L2 and Agent-L2 were equally knowledgeable in relation to the project content.

<b>Construct</b>	<b>T</b>	<b>Df</b>	<b>Significance</b>	<b>Std. Error</b>
Domain Knowledge	0.937	53	0.350	0.130
Clarity of Requirements	-3.455	53	0.000	0.090
Communication behaviors	-1.976	53	0.050	0.150

**Explaining Variation of Knowledge Transfer using Agency Theory**

SD-outsourcing projects present a unique situation with the transfer of intellectual property, rather than a physical asset (Walden 2005). Furthermore, as Gafen et al. (2008) said, SD-outsourcing requirements evolve constantly. Hence it is crucial that knowledge transfer of requirements is effective and efficient. Our study results (Table 1) indicated significant differences in the “Clarity of requirements” and “Communication behaviors” constructs between ‘Principal-L2’ and ‘Agent-L2’. Despite co-location (within one company), these differences highlight the difficulties in ensuring that the Agent is performing according to the requirements of the Principal.

According to the agency theory, two reasons behind the variation between the “Clarity of requirements” and “Communication behaviors” constructs are, the ‘goal conflict’ and ‘information asymmetry’ between the Principal and the Agent. Table 2 provides an explanation to the variations observed in ‘clarity of the requirements’ and in ‘communication behaviors’ constructs, using the Agency Theory. Goal conflicts, according to Agency Theory, arise in situations where the Principal-L2 attempts to deliver the client requirements, while the Agent-L2 places a greater emphasis on delivering the software within the expected time frame. Aspects, like perceived time pressure experienced by the Agent-L2 therefore may be negatively related to delivering the actual client requirements. On the other hand, the Principal-L2 is more concerned with improving their communication; whereas the Agent-L2 is typically more concerned with improving their technical knowledge.

In a Principal-Agent relationship, information asymmetry refers to a situation when one party in the relationship has more or better information than the other (Zu and Kaynak 2012). Information asymmetry, where the principles do not have complete knowledge of what the Agent’s actions are, allow the Agent to pursue their own interests without detection (Basu and Lederer 2011). Hence the Agent-L2 develops software which fails to satisfy the Principal-L2’s requirements. Previous researches depict that communication behaviors are crucial for the successfulness of the knowledge transfer process (Choi and Johanson 2012). Problems arise in the knowledge transfer process due to lack of the communication behaviors of the Agent-L2. If the Agent-L2 lacks communication behaviors, it is likely they will face difficulties when they need to inform their issues to the Principal-L2.

<b>Agency Theory</b>	<b>Clarity of the requirements</b>	<b>Communication behaviors</b>
<b>Human Action:</b> The Principal delegate responsibility to the Agent who acts on behalf.	Consultancy staff (Principal-L2) delegate the software development responsibility to the technical staff (Agent-L2).	
<b>Goal Conflict:</b> The Principal and the Agent have different	Principal-L2 wants to deliver a product which satisfies the client requirements whereas the Agent-	Principal-L2 is more concerned to improve their communication behaviors whereas the Agent-L2



interests and goals.	L2 wants to deliver the software with in the expected time.	is more concerned to improve the technical knowledge.
<b>Information Asymmetry:</b> It is difficult for the Principal to verify the actual Agent behavior.	Principal-L2 cannot easily monitor how the Agent-L2 develops the software products.	Lack of communication behaviors of the Agent-L2 increases the information asymmetry.

## Discussion

The goal of the study was to explore the effective knowledge transfer factors in multi-level software outsourcing projects. This research-in-progress paper reports preliminary findings of an exploratory survey, which was conducted with multiple objectives: to test the suitability of the constructs, observe the appropriateness of the Agency Theory and to gain access to the organizations.

It is believed that this is one of the very few studies to have observed multi-level SD-outsourcing, which is far more complex (and real) than observation made from a single level SD-outsourcing studies. Moreover, our focus on knowledge transfer too is novel. Knowledge transfer has been widely accepted as a salient factor in SD-outsourcing. Our formative a-priori model helps researchers understand the effective knowledge transfer factors using three constructs, for three-tiered SD-outsourcing scenario. We extend current research on knowledge transfer (Heeks et al. 2001; Herbsleb and Moitra 2001; Tiwana 2004) to SD-outsourcing, which in turn is conceived as a multi-level concept. Data represented herein pertain to the level 2 of SD-outsourcing model. Survey sample, though small, is yet adequate to derive preliminary insights on the model, theory and implications.

Our analysis showed that the formative model is valid. Independent sample t-test results showed that there are significant differences between consultancy staff (Principal-L2) and technical staff (Agent-L2) on 'clarity of requirements' and 'communication behaviors' constructs, implying an unbalanced relationship between the parties. No significant differences were observed between the Principal-L2 and the Agent-L2 on the 'Domain knowledge'. Moreover, our preliminary results showed that, issues observed in effective knowledge transfer can be minimized using the application of concepts through the Agency Theory. As Kathleen (1989) asserted, this study seeks to understand how the Principal could get the Agent to behave in the interests of the Principal in a multi-level SD-outsourcing project through knowledge transfer perspective. We see that the study findings using Agency Theory could influence the SD-outsourcing contract governing methods, leading to; a) behavior based contract and b) outcome based contract (Rungtusanatham et al. 2007). This will further reduce the variation of the 'clarity of requirements' and 'communication behaviors' constructs. It suggests that the outcome-based approach is most appropriate for the situations where the information asymmetry and the goal conflict are high and the outcome uncertainty is low. Behavior based method is more appropriate for the situations where the information asymmetry and the goal conflict is low and when there is a high outcome uncertainty (Zu and Kaynak 2012). To the best of our knowledge, none of the above prepositions are tested in past Information Systems studies on multi-level SD-outsourcing projects.

Our preliminary study findings have the potential to influence the practice. First, our conceptual model allows practitioners to understand the complexity of knowledge transfer between multiple partners in a multi-level SD-outsourcing project. This conceptualization has much broader implications beyond our study premise on knowledge transfer (perhaps be extended into topics like intellectual property, virtual team compositions, etc.). Second, our research highlights the importance of communication, domain knowledge and clarity of requirements for the knowledge transfer in SD-outsourcing projects. Third, application of the agency theory guidelines for multi-level SD-outsourcing will result in improvement of knowledge transfer across its participants and ultimately, increasing the accuracy of the software products.

Our preliminary study results are heartening, further work is underway to establish our research objectives. A survey focusing on the knowledge transfer in SD-outsourcing at levels 1 and 3 are currently underway. These survey data will be used to validate the preliminary findings of the first phase of the research. Though several past studies have observed level 1 SD-outsourcing (between the client and the outsourcing partner) (Gopal and Gosain 2010; Tiwana 2004; Williams 2011), we are yet to identify any studies on level 3 SD-outsourcing, where one outsourcing partner, re-outsources to another outsourcing partner.

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