Knowledge Transfer Difficulty in Inter-Organizational Networks: An Empirical Study of Absorptive Capacity and Causal Ambiguity

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Abstract

While most research dealing with the issue of inter-organizational knowledge transfer takes the position that some type of network alliance is superior to a non-networked group of entities for the purposes of knowledge transfer, limited theory, or empirical research, addresses how different network types experience knowledge transfer and its associated factors differently. This issue is addressed within the current study. Specifically, this study develops and empirically tests two distinct parts of a research model. The first part of the model examines two factors of knowledge transfer – absorptive capacity and causal ambiguity – and puts forth hypotheses regarding how these factors affect inter-organizational knowledge transfer difficulty. The second part of the model hypothesizes how these factors are expected to vary within two different network types. A total of eight hypotheses are developed and tested empirically using a combination of PLS and ANOVA based upon survey data, taken from 102 financial organizations.

Our findings indicated that absorptive capacity was a significant factor of inter-organizational knowledge transfer. However, although causal ambiguity has been shown in previous research to be a significant factor of intra-organizational knowledge transfer, it was not found to be a significant factor of knowledge transfer in an inter-organizational context. In addition, we found differences to exist between two network types for both absorptive capacity and causal ambiguity, providing some initial insight into how different network types experience knowledge transfer differently.

Key Words: Knowledge Sharing, Organizational Networks, Survey Research Methods, Field Studies
INTRODUCTION

Increasingly organizations are forming and joining networks to satisfy their needs for knowledge and other resources to help cope with environmental uncertainty (Gulati and Gargiulo, 1999). Consequently, inter-organizational or networked relationships represent a significant conduit for the transfer of knowledge (Madhavan et al., 1998). For instance, Hamel et al. (1989) studied alliances among entities within the same industry for 15 years and identified many examples in Japan, the US and Europe, where multi-firm alliances (including alliances with competitors) represented the lowest cost alternative to gaining access to knowledge.

Previous research has shown that well-structured networks are the basis for superior economic gains, in part because of their efficiency in accessing and transferring knowledge (e.g. Burt, 1992). However because such gains are contingent upon the knowledge transfer capabilities of member organizations, they are not guaranteed. Difficulties associated with knowledge transfer can be alleviated within inter-organizational networks in part by addressing the constraints or isolating mechanisms (Knott, 2003) associated with a firm’s “knowledge reception” capabilities. Two such capabilities most frequently reported in the extant organizational learning and strategy literature, and thus considered in the present study, are absorptive capacity, defined as the ability to recognize, assimilate and apply new knowledge (Cohen & Levinthal, 1990) and causal ambiguity (Szulanski, 1996; Mosakowski, 1997; Wilcox-King & Zeithaml, 2001) associated with process uncertainties.

Although networked organizations are expected to realize superior economic gains from their increased access to knowledge within a network relative to non-aligned firms or independently operating firms (e.g., Argote, 1999; Carlsson, 2002; Uzzi, 1996; Baum &
Ingram, 1998), there is very little theoretical guidance available regarding how such networks should be configured to foster knowledge transfer. Availability of such guidance can be critical since there is more than one type of multi-organizational network in practice, and organizational decision makers can have a choice in the way they structure and manage their networks. Since all extant work on absorptive capacity as an enabler of knowledge transfer and on causal ambiguity as an isolating mechanism of knowledge transfer are limited to treating these factors as intra-organizational concepts (e.g., Tsai, 2001; Szulanski, 1996) or, at best, as dyadic (e.g., Lane & Lubatkin, 1998), we lack an understanding of how these concepts work in multi-organizational networks. This is because inter-organizational networks involving more than two firms demonstrate complexities not found in more simplistic intra-organizational or dyadic contexts.

Simmel (1950), who studied social relationships, found that social triads (and relationships involving more than three entities) had fundamentally different characteristics than did dyads. For example, there is no majority in a dyadic relationship – there is no peer pressure to conform. In any group of 3 or more, an individual organization can be pressured by the others to suppress their individual interests for the interests of the larger group. Second, individual organizations have more bargaining power in a dyad. This is true because if one member withdraws from a dyad, the dyad disappears – this is not true in a network, where proportionately each member of the network generally has less influence than do members of a dyad. Finally, third parties represent alternative and moderating perspectives when disagreements arise. As a result of these differences, multi-organizational networks are more complex and knowledge transfer factors such as causal ambiguity and absorptive capacity may play out differently at the network level than at an intra-organizational level. This leads us to our first research question – Given that previous studies have found absorptive capacity and
causal ambiguity to affect knowledge transfer within intra-organizational contexts, do these same factors of absorptive capacity and causal ambiguity have an effect on knowledge transfer difficulty in an inter-organizational network context?

There are early indications that inter-organizational network types experience knowledge transfer difficulty differently. For example, in their study of the biotechnology industry, Powell et al. (1996) found that organizations embedded within R&D networks generated more scientific papers, with more citations per paper, and generally experienced greater sales than did similar firms that were less integrated within a network. Darr et al. (1995) found that members of a pizza franchise experienced shorter operational learning times, as measured by decreasing unit costs, than did similar pizza outlets not part of the same franchise. Ingram and Simons (2002) found that experiential knowledge transfer was greater among kibbutzim (agricultural co-operatives in Israel) within the same federation (organized network), while the kibbutzim outside of a federation did not demonstrate the same degree of experiential knowledge transfer and experienced negative economic consequences. In 1999, the multi-billion dollar Mars Climate Orbiter was lost in space because some engineers from one of several subcontractors involved in the network project incorrectly entered data in English units instead of metric units (Postrel, 2002).

The above four studies examined a loosely affiliated R&D network of biotechnology firms, a hierarchical network of pizza franchises, a decentralized agricultural network of kibbutzim and a network of sub-contracted engineers, respectively – clearly a highly diversified set of networks. These networks accommodated, for example, different levels of competition, different types of governance policies, and had different objectives. In addition, they experienced absorptive capacity and causal ambiguity differently. The success of knowledge transfer within each of these networks varied. This variation raises
an important question for researchers and practitioners, and represents the second research question of our study – How does absorptive capacity and causal ambiguity vary with inter-organizational network type?

In an effort to address these two research questions, we will first discuss absorptive capacity and causal ambiguity and how they have been shown to influence knowledge transfer in previous studies. We will then investigate whether the influence of these two factors are extendible into the inter-organizational network context and develop the first two of our eight hypotheses. Subsequently, we will discuss two types of inter-organizational networks and how absorptive capacity and causal ambiguity would be expected to behave within these network types, as well as within a group of non-networked firms. This discussion will form the basis for the remaining six of our eight hypotheses. We will then present our research model and discuss our findings.

FACTORS OF KNOWLEDGE TRANSFER

Knowledge has been described as a “sticky” asset that is costly to acquire and difficult to transfer between locations, both intra-organizationally as well as inter-organizationally – the former being the subject of most studies (e.g., Szulanski, 1996; von Hippel, 1994; Tsai, 2001). An underlying theme of these studies is when knowledge cannot be transferred from one location to another, the organization may experience negative implications. These implications have been described in terms of the incremental expenditures required to transfer knowledge from source to recipient (von Hippel, 1994) as well as the extent to which ad hoc solutions are required or current practices need to be adapted to facilitate transfer (Szulanski, 1996). In this section, the two predominant factors of knowledge transfer – absorptive capacity and causal ambiguity – are examined in terms of their affects on inter-organizational knowledge transfer.
While we acknowledge that knowledge can assume different forms – e.g., tacit versus explicit – we do not believe that different forms of knowledge would be uniquely associated with different types of networks; knowledge can exist in any form within any inter-organizational network context. Therefore, although other studies have demonstrated how the transfer of knowledge is affected by the form of knowledge in question (Nonaka, 1991; Winter, 1987), our focus is on those factors expected to be variant with network type. Therefore, form of knowledge is not considered in the present study.

Absorptive Capacity

Absorptive capacity can be defined as:

…the ability of a firm to recognize the value of new, external information, assimilate it and apply it to commercial ends is critical to its innovative capabilities. We label this capability as a firm’s absorptive capacity… (Cohen and Levinthal, 1990, p.128)

Many studies (e.g., Szulanski, 1996; Van den Bosch et al., 1991; Lane & Lubatkin, 1998; Boynton, 1994; George et al., 2001) have found that the recipient’s absorptive capacity is one critical factor to an effective transfer of knowledge in an intra-organizational context (i.e., when the knowledge transfer involved two sub-units of a single organization). Within this context, the ability to sense new external knowledge and have the processes in place to then bring it internal to the organization quickly becomes a competitive advantage when translated into economic rents. This “sensemaking” is an important function (Teece, 1998) that enables the organization to more effectively connect with its environment and allocate resources efficiently. However, developing this capability represents a unique challenge to most organizations, and it involves creating and fostering four organizational commonalities: language, base knowledge, process, and problem solving.
Investments in communication codes – or common *language* – have been shown to increase the speed and lower the cost of intra-organizational knowledge transfer (Cohen & Levinthal, 1990). As the economies of scale and scope of operations rise, the benefits associated with investments in commonality of language also rise (Grant, 1997; Kogut & Zander, 1992, 1996; Heiman & Nickerson, 2002). The example of the failed Mars Climate Orbiter represents a particularly expensive repercussion of NASA not having invested in creating a common language for data entry among its engineers and subcontractors (Postrel, 2002). The second contributor to organizational absorptive capacity is the presence of common or *base knowledge*. Grant (1997) describes the presence of this base knowledge as a mechanism needed to facilitate the transfer of knowledge that would be *incremental* to the receiver. It is important to note that base knowledge translates to an intersection, not an overlap, of knowledge held by the knowledge sharing agencies or networked organizations – a complete overlap of knowledge among organizations is inefficient and represents limited opportunity for transfer. The third contributing commonality for absorptive capacity is that of understanding (or utilization) of common *processes*, defined as the operational systems used to produce a product or service. A common process coordinated through a hierarchical structure improves the efficiency of knowledge transfer while decreasing the associated costs (Grant, 1997). The fourth contributing commonality to absorptive capacity is one of common *problem solving*. Lane and Lubatkin (1998) found that the more common experiences firms have in solving similar types of challenges, the easier the transfer of knowledge between (among) them.

Most studies have approached the role of absorptive capacity in fostering knowledge transfer from an intra-organizational or dyadic perspective. Extending the observations from these studies into the inter-organizational domain (three or more organizations), we
posit that a network can provide a “platform” for these commonalities of absorptive capacity to exist and grow that might not be available in an intra-organizational domain. For example, unlike a collection of independent firms, a network can ensure common processes and common problem solving approaches through a standardization of operations, imposed by a hierarchical authority. One specific example would be compliance with an operations manual provided to all owners/managers of franchises within a fast food chain to ensure a common customer experience. Similarly, a research network of biotechnology research, such as the Human Genome Project, would afford the organizational participants access to common documents and discussion forums, fostering a common base knowledge that would not be available to firms operating outside of the network.

In summary, absorptive capacity has been demonstrated in previous studies to be an important contributing factor of intra-organizational knowledge transfer. And, the identified commonalities of language, base knowledge, process, and problem solving can help an organization create the absorptive capacity necessary for the transfer of knowledge. Thus, we extend the findings of previous studies to posit that absorptive capacity plays a similar role in the transfer of knowledge for firms operating within inter-organizational networks.

\textbf{H1:} Organizational absorptive capacity will have a negative relationship with knowledge transfer difficulty for firms operating within an inter-organizational network.

\textbf{Causal Ambiguity}

The concept of causal ambiguity centers around “knowability” (the extent to which something \textit{can} be known) and “knownness” (the extent to which something \textit{is} known) of the organizational inputs and the causal factors used in combination to generate outcomes
– in this context, there is no ambiguity about the eventual outcome but rather with how it was generated.

Organizational inputs can be understood as the raw materials used to manufacture a product and causal factors can be viewed as the routines employed. When an organization does not understand what combination of inputs and routines cause a known final outcome, their knowledge is at best causally ambiguous.

Causal ambiguity represents an interesting paradox for organizations. On the one hand, causal ambiguity can impede a firm’s ability to imitate valuable resources, such as knowledge, within its boundaries, limiting the ability to leverage such resources to create a competitive advantage (Reed & DeFillipi, 1990). We will refer to this form of causal ambiguity as “internal” causal ambiguity. On the other hand, causal ambiguity within a firm or a network can inhibit replications of valuable competencies by other firms and therefore protect competitive advantage (Lippman & Rumelt, 1982; Wilcox-King & Zeithaml, 2001). Knott (2003) identified causal ambiguity in this context as an isolating mechanism, preventing the transference of knowledge. As a result, in some contexts causal ambiguity may actually be an organizational objective to prevent replication by competitors. We will refer to this form of causal ambiguity as “external” causal ambiguity. Both forms of causal ambiguity have been studied and operationalized in previous research (see Appendix A for details).

Mosakowski (1997) observed this paradox and similarly determined that although increased causal ambiguity has the impact of decreasing knowledge transferability within the firm (or network), and by association its application, it also has the potential to
increase competitive advantage by increasing the difficulties associated with imitation of valuable resources by competitors.

When knowledge is causally ambiguous, it becomes an isolating mechanism, making its transference difficult, if not impossible. We extend this logic to firms operating within the inter-organizational network domain.

**H2**: Organizational causal ambiguity will have a positive relationship with knowledge transfer difficulty for firms operating within an inter-organizational network.

The two hypotheses developed above represent an expansion of the scope of what had previously been understood with respect to absorptive capacity and causal ambiguity and their respective relationships with knowledge transfer difficulty. Previous research on absorptive capacity and causal ambiguity had been primarily confined to intra-organizational domain. As stated previously, before we can address the main focus of our study – how the factors of absorptive capacity and causal ambiguity vary with inter-organizational network type – we first needed to establish the role of these factors in the generalized inter-organizational network domain.

**INTER-ORGANIZATIONAL NETWORK TYPES**

We approached network study through the integrated lens of three established and relevant perspectives: Transaction Cost Economics, the Knowledge Based View of the Firm and Social Network Theory. Transaction Cost Economics recognizes that in a world of minimizing transaction costs, exchange agreements must be governed and, contingent on the transactions to be organized, some forms of governance are better than others (Williamson, 1973, 1975). Specifically, this includes examination of centralized and decentralized governance. The Knowledge Based View of the Firm perceives the firm as a bundle of idiosyncratic resources and capabilities where the primary task of
management is to maximize value through the optimal deployment of existing resources and capabilities, where knowledge is recognized as the most strategically important of these resources (Grant, 1997). The firm or network of firms will organize in such a way as to maximize the efficiencies associated with the development, transfer and application of knowledge. Finally, Social Network Theory examines the individual “nodes” and “linkages” within a network to explain how organizations (or individuals) will interact (Westlund, 1999; Granovetter, 1985). Using these well-established perspectives as a basis, we differentiate network types using the two primary characteristics of an inter-organizational network that would be expected to have a particular influence on the transfer of knowledge – Governance Structure and Intensity of Competition.

**Governance Structure**

Researchers have looked to networks of organizations as an organizing principle residing between pure market-based transactions and complete organizational self-sufficiency (Thorelli, 1986). However, once within the network, questions regarding the affects of inter-organizational governance structure remain. In his work on Transaction Cost Economics, Williamson (1973, 1975) describes a hierarchical governance structure as providing the authority to address issues related to opportunistic behavior, information impactedness and bounded rationality. A (formal or informal) hierarchical authority would also have the ability to mandate standardization of operations, language, policies, etc. Alternatively, a decentralized governance structure is described as one of peer group associations, without subordination, involving collective and usually co-operative activities. This governance structure is deficient in its ability to address opportunism and free rider abuses. However, recent research has found a decentralized structure to be particularly well-adapted to facilitate innovation and new knowledge creation, where the
former structure has been found to better facilitate the diffusion and implementation of existing knowledge (Galbraith and Merrill, 1991; Adler, 2001; Van den Bosch et al., 1991; Volberda, 1998).

**Intensity of Competition**

Within Social Network Theory, an important component of network structure that has been found to have significant impact on how well knowledge does or does not transfer is the ties or linkages among network entities (Uzzi & Lancaster, 2003; Dacin et al., 1999; Granovetter, 1985). The linkages that exist among network entities have been described as being either ‘embedded’ (integrated) or at ‘arm’s length’ (Dacin et al. 1999).

Integrated ties

…are considered to create behavioral expectations that…shift the logic of opportunism to a logic of trustful co-operative behavior in a way that creates a…basis for knowledge transfer … (Uzzi & Lancaster, 2003, p.384)

By contrast, linkages at ‘arm’s length’ are

…cool, impersonal, atomistic…motivated by instrumental profit seeking”. (Uzzi & Lancaster, 2003, p.384)

Although it may initially appear counterintuitive that organizations voluntarily join networks while maintaining “arm’s length” ties, consider the VISA network. Individual banks are fierce competitors, yet collectively benefit from the functionality of global payment card acceptance afforded by the VISA network – their relationships are “cool and impersonal,” with linkages created for collective purposes (e.g. decreased transaction costs). In addition, Powell et al. (1996) found that as the technological sophistication of an industry increases, the intensity and number of competitive alliances also increases. These authors found that although relationships are “cool and impersonal,” organizations form networks to reduce the costs associated with R&D –
When there is a regime of rapid technological development, research breakthroughs are so broadly distributed that no single firm has all the internal capabilities necessary for success…Firms thus turn to collaboration to acquire resources and skills they cannot produce internally, when the hazards of cooperation can be held to a tolerable level. (Powell et al., 1996, p.117)

We will refer to this network characteristic as “intensity of competition” among the network members, with low intensity of competition equating to integrated linkages and high intensity of competition equating to arm’s length linkages.

We recognize that given these two characteristics, many different network types could be argued to exist. Consider the Inter-O rganizational Network Framework presented in Figure 1.

A network type characterized by a decentralized governance structure and low intensity of competition would be represented by an R&D network of pharmaceutical firms, universities, and non-profit research firms with a common objective of the development of a new drug. A network type characterized by a centralized governance structure and high intensity of competition would be represented by a single manufacturer and a large network of suppliers engaged in the development and production of automobiles (“centralization” of governance would occur through the economic influence of the manufacturer).

We have chosen to study the two network types occupying the opposite diagonal – the franchise network and the co-opetive network. The franchise network type is characterized by a highly centralized governance structure and a low intensity of competition, such as the case of a corporation relying on franchise outlets for the purpose
of distributing its products or services (e.g., Holiday Inns, McDonalds). Alternatively, the term “co-opetive” has been used to describe a situation where traditional competitors have agreed to cooperate to achieve a common objective (Brandenburger & Nalebuff, 1996; Loebecke et al., 1999; Shapiro & Varian, 1999), and we describe a co-opetive network as an inter-organizational network characterized by a decentralized governance structure with a high intensity of competition. These network types were chosen for this study because of their presence in practice as well as for their unique respective roles in the study of inter-organizational networks in the extant literature. The franchise type is appropriate to include because it has received a significant amount of previous research attention (e.g., Darr et al., 1995, Knott, 2003). Therefore the findings associated with this network type should be confirmatory and extending. On the other hand, the co-opetive network represents the least studied inter-organizational arrangement. Therefore the findings associated with this network type should be more foundational. The practical need for a theory that links these two types of organizational networks with their respective conditionings of absorptive capacity and causal ambiguity is critical for both researchers and practitioners. Understanding such linkages will enrich the theory that attempts to explain strategic leveraging of knowledge-based relational rent (Dyer and Singh, 1998) among differently networked firms. Such development in theory can make way for normative prescriptions for preferential choice of some network type over no network, given a strategic goal. An assessment of how organizations operating within these two network types would be expected to experience absorptive capacity and causal ambiguity is developed below.

**The Franchise Network and Absorptive Capacity**

A franchise network is generally considered to have a strong centralized governance structure, binding the franchisees through restrictions related to operational routines.
Competition is generally low among members of franchise networks, because of collective brand identity and economic interdependence (Volberda, 1998). When organizations are engaged in similar operational routines, as would be the case in a franchise network, it is logical to conclude that they would have developed a common base of knowledge related to these routines, they would experience and solve problems in a similar fashion and the franchises would have developed a common language to describe their tasks. These commonalities would be expected to foster absorptive capacity, in part because they facilitate deeper and more meaningful communication, contributing to a more complete transfer of knowledge among franchises than would otherwise be possible among a group of independent firms (Cohen and Levinthal, 1990).

**H3a:** Firms operating within a franchise network will demonstrate a greater level of organizational absorptive capacity than will independent firms operating outside of a network.

**The Co-opetitive Network and Absorptive Capacity**

A co-opetitive network represents the least studied, but arguably the most complex, inter-organizational arrangement. Such an arrangement is complex because conflicting characteristics are permitted to exist. For instance, since organizations are allowed to compete and cooperate at the same time, such organizations can have homogeneous and heterogeneous products and services, and a propensity to share and protect organizational knowledge simultaneously. Consequently, the influence of a co-opetitive network and its accompanying levels of competition, differentiation, trust, and governance structure on inter-organizational knowledge absorptive capacity and to inter-organizational knowledge transfer represent a challenge to discern.

One example of a well-known co-opetitive network is VISA International. Highly competitive banks engaged in very similar operations join the VISA payment network, in
part, because it is economically infeasible for any single bank to develop and manage a
global transaction processing system that would facilitate credit card transactions at any
of 22 million merchant locations around the world. And although VISA provides forums
for discussion and provides discounts for members through the aggregation of orders to
suppliers, ultimately VISA is a weakly centralized organization with limited authority to
punish members for opportunistic behavior. Organizations are motivated to participate in
networks of competitors, like VISA, to access knowledge related to operational routines,
emerging technologies, regulatory changes, etc.

Like the franchise network, the co-opetive network includes organizations that engage in
similar operational routines. Consequently, commonalities of base knowledge, language,
process and problem solving would be expected to be present. And independent
organizations operating outside of a network would be expected to demonstrate less
commonality of base knowledge, process, language and problem solving, because of a
lack of formal structure or governance.

**H3b**: Firms operating within a co-opetive network will demonstrate a greater level of
organizational absorptive capacity than will independent firms operating outside of a
network.

However, a co-opetive network is characterized by a decentralized governance structure,
with little ability to implement the standardizations that might be present in a franchise
network environment, where the governance structure is more centralized.

**H3c**: Firms operating within a franchise network will demonstrate a greater level of
organizational absorptive capacity than will firms operating within a co-opetive network.

**The Franchise Network and Causal Ambiguity**

Where organizations are engaged in similar processes, they would be expected to have a
common understanding of the inputs and causal factors contributing to particular
outcomes. The common processes which exist in a franchise network would be expected to support a common base knowledge of inputs and causal factors, both before and after outcomes associated with their use are known – thereby creating a low state of causal ambiguity. A related characteristic of causal ambiguity identified by Mosakowski (1997) is task complexity - the more complex tasks become, the more difficult it becomes to identify the specific cause and effect that each input or factor has on related outcomes. Where this complexity can be mitigated, causal ambiguity is reduced. Simon (1962) determined that a strong, centralized/hierarchical governance structure can mitigate task complexity through specialization of labor and standardization. Given the expected hierarchical central governance structure of the franchise network, complexity of task is expected to be low.

**H4a:** Firms operating within a franchise network will demonstrate a lower level of organizational causal ambiguity than will independent firms operating outside of a network.

**The Co-opetitive Network and Causal Ambiguity**

Although the common processes that exist within this network, as with the franchise network, would be expected to reduce the causal ambiguity associated with inputs and causal factors and therefore converge to low causal ambiguity, the significant risk of opportunism, as a function of intense competition, may override this. Specifically, because of the paradox of causal ambiguity discussed above, external causal ambiguity may actually be an organizational objective when intense competition is present – in other words, internal causal ambiguity may be tolerated when external causal ambiguity is needed to protect a competitive advantage. This would be particularly true in an environment of independent organizations not involved in a network where no structure or hierarchical governance exists.
**H4b:** Firms operating within a co-opetitive network will demonstrate a lower level of organizational causal ambiguity than will independent firms operating outside of a network.

Because a centralized governing authority can not only standardize processes, contributing to lower internal causal ambiguity, but can also punish opportunistic behavior, contributing to less external causal ambiguity, networks with more centralized authority would be expected to demonstrate less causal ambiguity.

**H4c:** Firms operating within a franchise network will demonstrate a lower level of organizational causal ambiguity than will firms operating within a co-opetitive network.

Figure 2 below represents the comprehensive research model developed to test the eight hypotheses stated above.

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**DATA COLLECTION**

A survey was used to test the research model because this method provides a basis for establishing generalizability, allows replicability, has statistical power and allows for the examination of constructs that are difficult to measure directly using secondary data.

Following the process of survey instrument development by Churchill (1979), the first stage involved the specification and development of measurement items based upon a thorough literature review and utilization of previously validated items, where possible. Constructs have been previously developed to measure both absorptive capacity and causal ambiguity in the intra-organizational and dyadic contexts. These previously used and validated measurement items guided our own scale development. In total 31 measurement items were used including 26 previously validated and relevant measurement items and 5 new measurement items, developed specifically to accommodate the inter-organizational focus of the current study. A brief summary of
how other studies have approached the operationalization of knowledge transfer
difficulty, absorptive capacity and causal ambiguity is provided in Appendix A.

Sample Description

To test the research model in Figure 2, we examined two inter-organizational networks –
a franchise network and a co-opetitive network. The specific inter-organizational franchise
network studied was the SunTrust Branch network in Atlanta, Georgia, USA. Consistent
with the definition developed of a franchise network, the branches naturally exhibited
limited competition among members (branches) within the network, and were part of a
highly structured and centralized hierarchy. The specific inter-organizational co-opetive
network studied was the Credit Union National Association (CUNA). CUNA members
participate in the network for the purposes of lowering transaction costs, in part by
accessing existing knowledge at CUNA regarding operational best practices, marketing
materials, etc. (www.cuna.org/cuna/index.html). Although CUNA members are part of a
single network that affords them access to existing knowledge, CUNA members are
considered to be in intense competition with each other, with a high risk of opportunistic
behavior. An interview with the Senior Vice President of Association Services and
Research for CUNA, revealed that the intensity of competition within CUNA was “a 7 or
higher” on a scale of 1-10, with 10 representing the most intense degree of competition.
In addition, CUNA has a hierarchical and formalized, albeit loose, governance structure,
where CUNA provides forums for discussion and communication, but holds little
authority to punish for opportunistic behavior.
Initial Validations and Pilot Study

A process of conceptual and face validation was conducted. Phone interviews were conducted with CEOs/Branch Managers in both of the respective networks to ensure clarity of terminology and to confirm appropriate length of survey. Suggestions and feedback were incorporated appropriately. The survey was then pre-tested through the mail with 10 CEOs/Branch Managers. Again, suggestions and feedback were incorporated appropriately. A pilot survey was then sent to 100 credit union CEOs. Cronbach’s Alpha computations were performed based on the 39 usable responses received, which indicated that constructs for the survey instrument were stable and reliable.

The Survey

A package containing a cover letter stating the study objectives, a copy of the survey, and a postage paid return envelope was sent to a total of 550 credit union CEOs across the United States, and to 165 SunTrust Branch Managers in the Atlanta Metropolitan area. Bank branches and credit union CEOs that participated in the pre-test, in interviews, or in the pilot survey were excluded from the study. The survey contained a total of 59 questions, with most response options provided on a Likert scale from 1 to 7, with 1 indicating that the question or statement is “not representative” of their experience and 7 indicating that the question or statement is “completely representative” of their experience (see Appendix B for the relevant survey items). Scores on each measurement item for each entity within a network were averaged and used to represent the network score (Szulanski, 1996). The credit union CEOs were presented with an additional “filtering” question to determine if they “perceived” their credit union to be a member of CUNA. Although all credit unions were technically members of the non-profit
organization, we were told through several interviews with the management of CUNA that some credit unions may not recognize this membership. The credit unions that identified themselves as “not part of the network” were treated as a “control” group of independent firms operating outside of a network.

In total, 101 useable surveys were received from credit union CEOs, with 68 identifying their organization as operating within the CUNA network and 33 identifying their organization as operating outside of the CUNA network. A total of 70 useable surveys were received from the SunTrust Branch managers, who all considered their branch to operate within the SunTrust network. Response rates were 18% and 42% for the two networks, respectively. In an effort to determine if non-response bias was present, a key performance indicator, provided by senior management within each network, was examined for the respondents and non-respondents within each population. For the SunTrust branch managers, the number of sales per FTE (full time employee) in the branch was identified through interviews with the Atlanta Region management as the primary key performance indicator. For the credit union CEOs, the financial ratio Net Worth:Total Assets was identified as the key performance indicator.

Among the branch managers, the sales per FTE were 1.59 for respondents and 1.71 for non-respondents. This difference was not found to be statistically significant (t=1.28 and p=.21). Among the credit union CEOs, the Net Worth:Total Assets ratio was 10.49 for respondents and 11.17 for non-respondents. Again, this difference was not found to be statistically significant (t=1.30 and p=.19). Consequently, non-response bias was not considered to be present.

Because a single key informant was providing responses for both the independent variables (absorptive capacity and causal ambiguity) as well as the dependent variable
some external validation of response was needed to ensure that common method bias was not present. The same key performance indicators for the respective networks used to evaluate non-response bias were used to evaluate common method bias. Specifically, the key performance indicators were correlated with the dependent variable, where low knowledge transfer difficulty would be expected to be associated with strong performance. Within both networks, performance was highly (inversey) correlated with knowledge transfer difficulty (\( p<.05 \) for both networks). Consequently, common method bias was not considered to be present.

**ANALYSIS AND RESULTS**

**Measurement Model**

In the development of the measurement model, we tested the presence of four first order factors of absorptive capacity (commonality of language, knowledge, process and problem solving). As discussed above, the causal ambiguity factor is paradoxical with two-orientations – an internal orientation, where firms have difficulty identifying the inputs or processes that generate particular outcomes within their own boundaries and an external orientation where firms try to prevent other firms from identifying the inputs or processes that generated particular outcomes. Using this logic, we tested the presence of two first order factors of causal ambiguity (internal causal ambiguity and external causal ambiguity). Assessment of instrument validity through confirmatory factor analysis using Partial Least Squares (PLS) was then accomplished through the development of the measurement model, where the relationships between the observed variables and the latent (sub) constructs was specified (Ahire & Devaraj, 2001). Determination of reliability of the measurement model was accomplished through evaluation of three metrics – Cronbach’s alpha, the Fornell and Larcker Rho and the Average Variance Extracted (AVE).
As can be seen in Table 1, the metrics for the three constructs (and sub constructs) – knowledge transfer difficulty, absorptive capacity (common language, common base knowledge, common processes, common problem solving) and causal ambiguity (internal causal ambiguity and external causal ambiguity) – met or surpassed the minimum requirements for the three reliability metrics cited above. Measurement items were retained in any given scale if the loadings met or exceeded a value of .70, where it is argued that 50% of the variance is explained by the construct (Fornell, 1982).

The unidimensionality of the (first order) sub-constructs with the larger (second order) constructs of absorptive capacity and causal ambiguity was also evaluated. As can be seen in Table 2, all sub-constructs demonstrated stronger loadings with the proposed larger construct than with the non-proposed construct, indicating the presence of unidimensionality (Ahire and Devaraj, 2001).

Discriminant validity, or the extent to which indicators differentiate among (sub) constructs, was also explored. The square root of the AVE of the measures and the correlations among the measures were examined in an effort to establish discriminant validity (Chin, 1998; Klein, 2002). Where the square root of the AVE of a measure exceeded the correlations between the measure and all other measures, the discriminant validity of the measure is assumed to be adequate. In all cases the square roots of the AVEs well exceeded the intercorrelations of the other constructs, indicating that no discriminant validity issues were present. The results can be seen in Table 3.
Structural Model and Hypothesis Results

The research model in Figure 2 was estimated using PLS. The PLS technique was selected over co-variance based Structural Equation Modeling, for two primary reasons - its ability to accommodate smaller sample sizes and its unique ability to accommodate formative variables in the structural model.

PLS does not require parametric assumptions. As a result, it is especially suited for the analysis of small data sets as well as data that does not necessarily exhibit multivariate normality, as required by covariance-based SEM (Chin, 1998). This characteristic of PLS is in contrast to covariance-based SEM, which requires a sample of at least 150 (Bollen, 1989), because of the sensitivity of $\chi^2$ to sample size (Bollen, 1989; Hair et al., 1998). Although our global dataset included a total of 171 observations, with 68 observations coming from the co-operative network and 70 coming from the franchise network, our need to develop an understanding of the differences at the network level, meant that SEM was not easily accommodated. Second, PLS supports both formative as well as reflective constructs. In this study, the constructs of absorptive capacity and causal ambiguity were formative (versus reflective). Covariance-based SEM does not readily support formative constructs (Bollen, 1989). The software used in this analysis included SAS v.8.2 and PLSGraph 3.0 (Chin, 2001).

From the structural model, the absorptive capacity factor did have a negative relationship with knowledge transfer difficulty as predicted in Hypothesis 1; the path loading was -.402 (t=-4.75, p<.01)). This influence continued to be true when this path was tested for each of the two network types separately, since the path loadings remained significant at -
.575 (t=5.75, p<.01) for the franchise network and -.435 (t= -2.87, p<.01) for the co-opetive network.

The causal ambiguity factor did not have a significant loading with knowledge transfer difficulty; the path loading was .03. Consequently, Hypothesis 2 was not supported. When this path was evaluated for each network separately, the loading was still found to be insignificant at .088 for the franchise network and .014 for the co-opetive network. These results are summarized in Table 4.

The remaining hypotheses were evaluated through numerous PLS-derived factor scores from the original measurement model using ANOVAs and Tukey’s post hoc pair-wise comparison test (Neter, et al., 1996), which are summarized in Table 5.

Hypotheses 3a, 3b and 3c addressed the relationship of absorptive capacity of firms operating within the two types of inter-organizational networks and the group of independent organizations operating outside of a network. The PLS-derived composite absorptive capacity scores were 11.45, 12.31 and 11.33 for the franchise network firms, the co-opetive network firms, and for the independent firms, respectively. The difference detected between the absorptive capacity score for the franchise network firms and the independent firms was not found to be significant, therefore Hypothesis 3a was not supported. The co-opetive network firms did generate a significantly higher score than did the independent firms, supporting Hypothesis 3b (p<.05). And, although the difference in scores between the franchise network firms and the co-opetive network firms was found to be statistically significant, the difference occurred in the opposite direction, therefore Hypothesis 3c was not supported.
An examination at the sub construct level provided some insight and explanation into these results. Firms within the co-opetive network generated a significantly higher score for the absorptive capacity sub construct common language relative to the firms within the franchise network ($p<.10$). The independent firms were also found to have a higher score than the franchise network firms on this sub construct ($p<.05$). One possible rationale for this unexpected result is the presence of two different branch categories within the franchise network. Specifically, within the SunTrust branch network, there were in-store branches (bank branches within grocery stores) and retail branches (traditional stand-alone bank buildings). Further analysis at the branch category level indicated that the retail branches generated a significantly higher score on this sub construct than did in-store branches ($p<.01$). This differential may indicate that the terminology used within this franchise network may not represent a true “common language” between the two branch categories.

The second absorptive capacity sub construct – common process – provided additional insight into the results. Firms operating within the franchise network generated significantly higher scores on this sub-construct than both the firms of the co-opetive network and the independent firms in the control group ($p<.01$). This result may be attributable to differences in governance structures. Specifically, the franchise network has a more centralized governance structure with greater authority to standardize processes. As a result, greater commonality of process for the franchise network is not unexpected. The third absorptive capacity sub construct – problem solving – did not produce any differences between the firms of the two networks. This result was expected. The only difference occurred between the firms of the franchise network type and the independent firms ($p<.05$). The final absorptive capacity sub construct – base knowledge – also did not produce any difference between the firms of the two networks.
And, firms within both networks were found to have significantly higher scores than the independent firms (p<.05).

Hypotheses 4a, 4b and 4c addressed the construct of causal ambiguity and how it varied among firms operating within the two network types and with firms operating outside of a network. The PLS-derived composite scores of causal ambiguity were 3.55, 3.95 and 4.48 for the franchise network firms, the co-opetitive network firms, and the independent firms, respectively. The franchise network firms demonstrated a significantly lower causal ambiguity score than did the independent firms, providing support for Hypothesis 4a (p<.01). Similarly, the co-opetitive network firms demonstrated a significantly lower causal ambiguity score than did the independent firms, supporting Hypothesis 4b (p<.1). And, the franchise network firms demonstrated a significantly lower causal ambiguity score than did the firms operating within the co-opetitive network, supporting Hypothesis 4c (p<.1). Again, the comparative results for the sub constructs were then examined.

The first sub construct examined for causal ambiguity was internal causal ambiguity. Recall that this sub construct described the knowledge of the inputs or factors within a firm’s own boundaries that contribute to a particular outcome. Here, a low score is indicative of low causal ambiguity. As expected, the franchise network generated a score that was significantly lower than the score for the co-opetitive network (p<.01), and both networks generated scores that were lower than the score for the independent organizations (p<.01 and p<.10, relative to the franchise and co-opetitive networks, respectively). The second sub construct for causal ambiguity – external causal ambiguity – was the ambiguity related to knowledge regarding the inputs and factors used by another firm to create a known outcome. Again, a low score indicates low causal ambiguity. On this sub construct, the franchise network and the co-opetitive network did
not generate statistically different scores. And although the franchise network did
generate a lower score than the independent firms (p<.05), there was no difference
between the co-opetive network and the independent firms. The fact that the score for the
external causal ambiguity sub construct for the franchise network was not lower than the
score for the co-opetive network (as had been expected), may be attributable to an
“artificial” competition that did not occur “naturally” among the branches, but was
induced by SunTrust Management. Specifically, only the top performing branches were
rewarded – creating a zero-sum game of required winners and losers. Given this imposed
competition, branches may have experienced the causal ambiguity described by Lippman
and Rumelt (1982), where bank branch managers may have attempted to prevent
imitation of their capabilities by their perceived competitors (other bank branch
managers) by purposefully making outputs causally ambiguous.

Given this outcome, one could question if SunTrust branches truly represented a
franchise network. SunTrust branches demonstrated the two characteristics of a franchise
network – a highly centralized governance authority and a “natural” low intensity of
competition. The management-imposed requirements for sales-generating “winners” and
“losers” artificially created an intensity of competition that would have otherwise not
existed – without management “interference” branches would not have had a rationale to
make their outcomes externally causally ambiguous to other branches. An alternative
example to the experiences at SunTrust could be represented by the business units within
British Petroleum, which have demonstrated a particularly strong ability to transfer
knowledge within a similar “franchise network” environment, fostered by a management-
induced interdependence among the individual organizational units (Prokesch, 1997).
This paper examined two parts of a research model. In the first part of the model, we examined the effects of absorptive capacity and causal ambiguity on inter-organizational knowledge transfer difficulty. As stated in the beginning of this paper, the effects of these two factors in the inter-organizational domain represent a unique challenge because of the complexities that are not found in intra-organizational or dyadic contexts.

We found that as absorptive capacity increased, the difficulties of inter-organizational knowledge transfer decreased. This finding was an extension of the scope of what researchers had previously understood about absorptive capacity – that it not only influences intra-organizational knowledge transfer, but inter-organizational knowledge transfer as well. Our second major finding was that although previous research had established causal ambiguity as an isolating mechanism for intra-organizational knowledge transfer, it was found to not have a significant role in the inter-organizational network domain. Given that we utilized measurement items that had been validated in previous research, this finding was unexpected but insightful and will be discussed in more detail below.

In the second part of the model, we explored if and how firms within different network types experience absorptive capacity and causal ambiguity differently. We found organizational absorptive capacity and causal ambiguity in fact, differ based upon the inter-organizational network type in question. This finding is an extension of previous research in inter-organizational learning – networks and multi-organizational alliances have been found to be superior to independent organizations for the purposes of knowledge transfer, but how these networks and alliances vary in this capacity had not previously been explored. Therefore the initial confirmation that organizational
absorptive capacity and causal ambiguity are manifested differently within different inter-organizational network types, which as we explained before are more complex to study than individual organizations or dyads, is in itself a significant contribution of this study.

We believe that in addition to these general findings, this study makes specific theoretical contributions to the Knowledge Based View of the Firm, and greatly expands what researchers currently understand about absorptive capacity and causal ambiguity, and their presence and relevance in networks of organizations. These contributions are discussed in turn.

**Contributions to Theory**

**The Knowledge Based View of the Firm** One of the primary foundational principles of this work – the Knowledge Based View of the Firm – provides insight into how firms organize within their own boundaries for the purposes of transferring knowledge. Organizing within a firm’s boundaries logically affects the factors of knowledge transfer, as examined in previous research (e.g., Galbraith & Merrill, 1991; Adler, 2001; Van den Bosch, 1991; Volberda et al., 1998). However, the finding that the factors of knowledge transfer – absorptive capacity and causal ambiguity – vary with inter-organizational network type now provides initial evidence that how a firm organizes outside of its own boundaries can influence these same factors, sometimes not in a similar way or not for the same reason.

The Knowledge Based View of the Firm perceives the existence of the firm as a knowledge integrator in terms of its superior efficiency in the transference of knowledge to produce goods and services relative to market-based interactions. Extending this view, this study sought to explain the role of the network in terms of transference of
knowledge. Firms experience bounded rationality (Williamson, 1973; Simon, 1962) regarding knowledge – no firm can know all that is knowable economically. As was evidenced through the works of Doz, et al. (1998), Madhavan (1998), Gulati and Gargiulo (1999) and others, firms join networks in part because networks represent a significant conduit for incremental knowledge. Argote (1999), Darr et al. (1995), Powell et al. (1996) demonstrated that networks are superior to independent firms for the purposes of knowledge transfer. The logic behind the superior performance of an inter-organizational arrangement has been the extension of one offered by the Knowledge Based View; “second-hand” knowledge can be obtained faster and more cheaply than “first-hand” knowledge (Hamel, 1991; Huber, 1991). Our study puts this logic under sharper focus by investigating knowledge transfer difficulty in different types of inter-organizational networks. That is we find the conditions, as expressed by assessing the levels of absorptive capacity and causal ambiguity, when this logic is valid or invalid. Since different network types were found to experience absorptive capacity and causal ambiguity differently, the universality of the above logic comes under scrutiny.

The Knowledge Based View of the Firm makes a case for the importance of base knowledge. Specifically, Grant (1996) defines common knowledge as a contributor to the exchange of new knowledge in a very general sense that incorporates common language. Using the definition of absorptive capacity, this study makes the argument for the existence of the four commonalities of base knowledge, language, process and problem solving as well as their respective different contributions to knowledge transfer in the inter-organizational domain.

**Absorptive Capacity** As stated early in this paper, absorptive capacity is well established in the knowledge management literature as a contributor to intra-
organizational knowledge transfer. Using the Cohen and Levinthal (1990) definition, researchers have established the link between absorptive capacity and knowledge transfer (Szulanski, 1996; Van den Bosch et al., 1999; Boynton, 1994; George et al., 2001).

The findings from the specified research model of this study related to absorptive capacity were consistent with prior theoretical work – increased absorptive capacity decreases the difficulties associated with knowledge transfer. This finding was consistent for each of the two network types studied. This reconfirms what was known for the franchise network from the works of Argote (1999) and Darr et al. (1995), and finds the same to be true for the co-opetive network. However, the state of absorptive capacity was found to be higher for the co-opetive network relative to the franchise network, a finding contrary to our hypothesis. Evaluation of the contributing sub factors provided insight into this finding.

Common language was found to be higher for the co-opetive network. Simon (1991) identified “intensity of interaction” as a guide for organizational structure, where “intense” interactions (defined as depth and frequency) facilitate common or shared language. Grant (1996) and others have referenced this work as a theoretical basis for organizational structure – individuals who are “reciprocally interdependent” will be closer organizationally than individuals who relate through “pooled interdependence” – a looser affiliation based upon common resources. Given the ability of the franchise network to institute standards through its hierarchical structure, it may have been expected to exhibit a greater common language among members than the more loosely governed co-opetive network. This research found the opposite to be true. Consideration of network structure suggests two possible explanations. First, the greater degree of competition that existed within the co-opetive network, relative to the franchise network,
may have contributed to a new level of intensity with more frequent and involved interactions that facilitated a greater shared language. We know, however, most prior work that follows Simon’s intensity argument assumes cooperation, and is neatly applicable to an environment that lacks inter-unit competition. Taken together this means that Simon’s intensity of interaction argument is not applicable to all organizational arrangements such as arrangements that can allow a mix of cooperation and competition. Thus, this sensitivity needs to be explored further. Second, and alternatively, it may be that Simon’s explanation of intensity of interaction as a basis for shared language is only a guide in an intra-organizational environment, and tends to be less relevant when the environment includes multiple organizations. That is, the heterogeneity built in an arrangement of multiple organizations can create enough noise for the intensity of interactions to form and take effect and thus can benefit from managerial attention. Simon (1991) and others have argued that hierarchy was an effective mechanism for coordination and standardization of process. Therefore, the finding that the more hierarchical network type – the franchise network – exhibited greater common process than the less hierarchical network type, was not a surprise, and is now confirmed across two types of inter-organizational networks. The other two sub factors of absorptive capacity – base knowledge and common problem solving – were not found to vary between the two network types indicating some early evidence that these two are more systemic and stable, and thus are less sensitive to network arrangements.

Given the fact that common language was the only one of the four commonalities of absorptive capacity found to be higher for the co-opetitive network and overall absorptive capacity was found to be higher for the co-opetitive network, it would be logical to conclude that common language has a stronger contribution to absorptive capacity than do any of the other commonalities identified by Cohen and Levinthal (1990) and Lane
and Lubatkin (1998). This finding provides new insight into the respective contributions of each element of absorptive capacity and provides initial evidence suggesting that common language, at least within the context studied, appears to be the primary contributor to absorptive capacity. This finding, at the least, has a practical explanation within the context of Financial Services. Unlike other industrial settings like manufacturing, retail, pharmaceutical or biotech, there is no tangible “product” in a financial services environment. As a result, there is nothing to complement the utilization of language in the transfer of knowledge; there is nothing tangible to “point to” or to provide as a further explanation of a concept. Therefore, it would be logical that in a service-based setting like Financial Services or Management Consulting, commonality of language could play a particularly significant role in the development of absorptive capacity. This differentiation has not been made in previous literature and it raises a new issue that absorptive capacity is not necessarily a concept confined to an organization as it is viewed now in the extant literature. Rather it is an extra-organizational concept and can be better understood if one considers the norms of processes and practices of the industry in which an organization is engaged.

**Causal Ambiguity** Most researchers have approached causal ambiguity from one of two perspectives. The first perspective is that of an internal causal ambiguity related to the inputs and factors that generate a specific and known outcome within the boundaries of the firm (e.g., Mosakowski, 1997; Barney, 1999; Szulanski, 1996). The second perspective is that of an external causal ambiguity related to one firm’s inability to decipher the inputs and factors that another firm utilizes to generate a specific and known outcome, defined as the competencies which create a competitive advantage (e.g., Knott, 2003; Wilcox-King & Zeithaml, 2001; Reed & DeFillipi, 1990; Lippman & Rumelt,
1982). In the current study, we utilized a more conceptually complete approach to causal ambiguity by acknowledging both perspectives.

And, interestingly, although both perspectives were acknowledged and tested in the current study, causal ambiguity was not found to be a significant variable in inter-organizational knowledge transfer difficulty. The above causal ambiguity perspectives were well established. And, when each perspective was tested as a separate independent variable, neither was found to have a significant impact on inter-organizational knowledge transfer difficulty. This finding, from the inter-organizational domain, is in apparent conflict with the findings of other researchers examining the intra-organizational or dyadic domains, regarding the role of causal ambiguity in knowledge transfer. Given that the relevant measurement items had been previously validated, we turn our attention to other potential explanations. We offer two rationales for this finding.

As stated in the beginning of this paper, multi-organizational arrangements are fundamentally different from dyads and intra-organizational domains, demonstrating higher levels of complexity (Simmel, 1950). Within the context of multiple organizations, it appears that the specific uncertainty related to the causal factors and inputs may be less relevant to knowledge transfer than had been found to be true for an intra-organizational context. This may be true, in part, because organizations may be less likely to engage in knowledge items for transfer where ambiguity is perceived to be high. That is, as the number of network members increases, the issues related to causal ambiguity (from either perspective) become less relevant.

The diminished relevancy of causal ambiguity in an inter-organizational context may represent an existing gap relevant to how organizations possessing knowledge
(knowledge sources) decide (or not) to transfer knowledge when multiple knowledge
recipient organizations may exist simultaneously. This gap in our understanding is
characterized specifically by a lack of understanding of the ambiguity regarding how
behavior of one organization will affect the actions of other organizations. What may be
more relevant in an inter-organizational context is the ambiguity surrounding the
outcome(s) generated as a result of sharing knowledge. Specifically, causal ambiguity
does not address (nor was it intended to address) the ambiguity present when the
outcome(s) are unknown or unknowable to the knowledge source in advance of the
transfer. This ambiguity associated with outcome(s) rather than causes may be more
relevant in an inter-organizational context, in part because the recipient organization(s)
can put the received knowledge to more than one use. Depending upon the governance
structure in question and the intensity of competition present – the network type –
outcomes associated with the transference of knowledge may include outcomes related to
opportunistic behavior on the part of the knowledge recipient (Simon, 1999), and/or
because the knowledge in question may be new and its application unknown (Szulanski,
1996). This “outcome” ambiguity is not captured in the deliberations on causal
ambiguity, and has not yet been isolated in research. However, this form of ambiguity
may represent a latent factor of inter-organizational knowledge transfer and is an
opportunity for further research.

**Contributions to Practice**

For managers currently operating within a network of entities, as more firms increasingly
do, this research study has several implications, including both descriptions of the
phenomena as well as prescriptions for improvement. In this study, absorptive capacity
was found to be a significant contributor to knowledge transfer difficulty, regardless of
the network in question. As a result, managers operating within inter-organizational
networks should look to invest in creating these commonalities to decrease the difficulties associated with knowledge transfer difficulty. As the example of the MARS Climate Orbiter cited in the beginning of this paper highlights, failure to invest in these commonalities can lead to difficulties associated with knowledge transfer.

Providing more specific insight for managers is the finding that the contributions of the four commonalities to absorptive capacity are not balanced. In this study, common language was identified as a primary contributor to absorptive capacity within the industrial context studied. This finding provides managers operating within inter-organizational networks with a prescription for the allocation of resources to support and develop absorptive capacity. Specifically, development of a common language, including common “codes” and terminology, appear to have a significant impact on the extent to which the difficulties associated with knowledge transfer can be mitigated.

Finally, the finding that causal ambiguity (from either an internal or external perspective) is not a factor of knowledge transfer may represent a learning for managers operating in inter-organizational networks. Specifically, where managers may have previously allocated resources to mitigate the effects of causal ambiguity as an isolating mechanism of knowledge, may now reallocate resources to develop the commonalities related to absorptive capacity as outlined above.
REFERENCES


Figure 1: Framework of Inter-Organizational Network Types

- **Franchise Network Type**
  - Low Intensity of Competition
  - Decentralized Governance Structure

- **R&D Network Type**
  - Low Intensity of Competition
  - Centralized Governance Structure

- **Co-opetitive Network Type**
  - High Intensity of Competition
  - Decentralized Governance Structure

- **Manufacturer Network Type**
  - High Intensity of Competition
  - Centralized Governance Structure

H4c: F<C
H4b: C<I
H4a: F<I
H3c: F>C
H3b: C>I
H3a: F>I

Figure 2: The Comprehensive Research Model

- **Franchise Network (F)**
- **Co-opetitive Network (C)**
- **Independent Firms (I)**

- **Inter-Organizational Network Absorptive Capacity**
- **Inter-Organizational Network Causal Ambiguity**

- **H1:** \( \sim \) Inter-Organizational Knowledge Transfer Difficulty
- **H2:** \( + \)
Table 1: Field Study Scale Reliabilities

<table>
<thead>
<tr>
<th>Retained Item</th>
<th>Construct (Sub-Construct)</th>
<th>Std Loading</th>
<th>All Respondents (N=171)</th>
<th>Co-opetive Network (N=68)</th>
<th>Franchise Network (N=70)</th>
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<td>AVE</td>
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<td>Knowledge Transfer</td>
<td>Absorptive Capacity (Common Language)</td>
<td>Absorptive Capacity (Common Process)</td>
<td>Absorptive Capacity (Base Knowledge)</td>
<td>Absorptive Capacity (Problem Solving)</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------------</td>
<td>---------------------------------------</td>
<td>--------------------------------------</td>
<td>--------------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Knowledge Transfer</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorptive Capacity (Common Language)</td>
<td>0.40</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorptive Capacity (Common Process)</td>
<td>0.32</td>
<td>0.14</td>
<td>0.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorptive Capacity (Base Knowledge)</td>
<td>0.36</td>
<td>0.51</td>
<td>0.44</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>Absorptive Capacity (Problem Solving)</td>
<td>0.31</td>
<td>0.10</td>
<td>0.58</td>
<td>0.47</td>
<td>0.91</td>
</tr>
<tr>
<td>Causal Ambiguity (External)</td>
<td>0.25</td>
<td>0.15</td>
<td>0.37</td>
<td>0.34</td>
<td>0.33</td>
</tr>
<tr>
<td>Causal Ambiguity (Internal)</td>
<td>0.20</td>
<td>0.10</td>
<td>0.46</td>
<td>0.38</td>
<td>0.44</td>
</tr>
</tbody>
</table>
### Table 4: Hypotheses 1 and 2 Testing Results (including Results by Network Type)

<table>
<thead>
<tr>
<th>Network Type</th>
<th>Independent Factors</th>
<th>Path Coefficient (Model $R^2$)</th>
<th>t-value</th>
<th>Hypothesis Supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td>All (n=171)</td>
<td>Absorptive Capacity</td>
<td>-.402</td>
<td>-4.75*</td>
<td>Hypothesis 1 Supported.</td>
</tr>
<tr>
<td></td>
<td>Causal Ambiguity</td>
<td>.03 (.174)</td>
<td>NS</td>
<td>Hypothesis 2 Not Supported.</td>
</tr>
<tr>
<td>Co-operative</td>
<td>Absorptive Capacity</td>
<td>-.435</td>
<td>-5.75*</td>
<td>NS</td>
</tr>
<tr>
<td>(n=68)</td>
<td>Causal Ambiguity</td>
<td>.014 (.182)</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Franchise</td>
<td>Absorptive Capacity</td>
<td>-.575</td>
<td>-2.87*</td>
<td>NS</td>
</tr>
<tr>
<td>(n=70)</td>
<td>Causal Ambiguity</td>
<td>.088 (.383)</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

*p<.01  
NS=Not Significant
Table 5: Hypotheses 3 and 4 Testing Results
(Using PLS-Derived Scores)

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Franchise</th>
<th>Co-operative</th>
<th>Independent Firms</th>
<th>Supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H3a</strong>: Firms operating within a franchise network will demonstrate a greater level of inter-organizational absorptive capacity than will independent organizations operating outside of a network.</td>
<td>11.45</td>
<td>12.31</td>
<td>11.33</td>
<td>N</td>
</tr>
<tr>
<td><strong>H3b</strong>: Firms operating within a co-operative network will demonstrate a greater level of inter-organizational absorptive capacity than will independent organizations operating outside of a network.</td>
<td>11.45</td>
<td>12.31</td>
<td>11.33</td>
<td>Y**</td>
</tr>
<tr>
<td><strong>H3c</strong>: Firms operating within a franchise network will demonstrate a greater level of inter-organizational absorptive capacity than will firms operating within a co-operative network</td>
<td>11.45</td>
<td>12.31</td>
<td></td>
<td>N</td>
</tr>
<tr>
<td><strong>H4a</strong>: Firms operating within a franchise network demonstrate a lower level of inter-organizational causal ambiguity than will independent organizations operating outside of a network.</td>
<td>3.55</td>
<td>3.95</td>
<td>4.48</td>
<td>Y***</td>
</tr>
<tr>
<td><strong>H4b</strong>: Firms operating within a co-operative network will demonstrate a lower level of inter-organizational causal ambiguity than will independent organizations operating outside of a network.</td>
<td>3.55</td>
<td>3.95</td>
<td>4.48</td>
<td>Y*</td>
</tr>
<tr>
<td><strong>H4c</strong>: Firms operating within a franchise network will demonstrate a lower level of inter-organizational causal ambiguity than will firms operating within a co-operative network.</td>
<td>3.55</td>
<td>3.95</td>
<td></td>
<td>Y*</td>
</tr>
</tbody>
</table>

*p<.1  
**p<.05  
***p<.01
Appendix A: Operationalization of Constructs From Previous Studies

Knowledge Transfer Difficulty
The dependent variable of our research model, “knowledge transfer difficulty”, has received a great deal of research attention. As a result, it has been operationalized in many ways. In his widely cited work on knowledge “stickiness”, Szulanski (1996), using a survey instrument, developed eight measurement items divided across three “technical success” indicators of an intra-organizational project to determine the extent to which knowledge transferred within an organization. These indicators, or constructs included time expended, budget and overall client satisfaction. Similarly, Hansen (2002) used product completion time as the construct of knowledge transfer in his survey of multi-unit organizations. Birkinshaw et al. (2002) used survey data to determine if the characteristics of knowledge, including its transferability, can be used to predict organizational structure. Finally, Tsai (2001) used several survey questions that loaded onto the two factors of “innovation” and “performance” to measure knowledge transfer. Referring to these studies, we operationalized knowledge transfer difficulty, the dependent variable of this research model, using a total of 8 previously validated measurement items to test knowledge transfer difficulty.

Absorptive Capacity
In their seminal work on absorptive capacity, Cohen and Levinthal (1990) reported R&D intensity within the context of a survey as a proxy for absorptive capacity. They reasoned, that “…a firm’s ability to exploit external knowledge is often generated as a by-product of its R&D…”. They specifically identified R&D intensity as R&D expenditures as a percentage of business unit sales. Similarly, George et al. (2001) used R&D spending in their study of bio-pharmaceutical firms as a measure of absorptive capacity. Although R&D spending has been used as a surrogate measure of absorptive capacity, this assumes that there is no differentiation between the two as a cause and an effect. We view R&D spending as a control decision that can be set as high or low, and, therefore it may not be an indication of absorptive capacity. That is, R&D spending may lead to absorptive capacity, but may not necessarily indicate the degree of “current” actual absorptive capacity.

Absorptive capacity is one of the nine independent variables Szulanski (1996) used in his study of intra-organizational knowledge transfer. The constructs that he used to operationalize the variable focused on commonalities of language and base knowledge. Similarly, Lane and Lubatkin (1998) used questions addressing commonalities of operations, knowledge base and of problem solving in their measurement of absorptive capacity. In their survey of IT-related absorptive capacity, Boynton et al. (1994) asked questions related to managerial IT knowledge and IT management process effectiveness.

In an effort to measure this latent variable, we defined the four sub-constructs to be the four commonalities of language, base knowledge, processes and problem solving, based in large part on the studies of Szulanski (1996) and Lane and Lubatkin (1998). Through a process of pre-testing and piloting, a total of 16 measurement items were developed to test absorptive capacity, including 9 previously validated measurement items and 5 measurement items newly developed for this study.

Causal Ambiguity
As an established factor of knowledge transfer, causal ambiguity has been operationalized in several previous studies. For example, Szulanski (1996) used causal ambiguity as one of his nine independent variables. Szulanki focused on internal “fundamentally irreducible” causal ambiguity –
When the precise reasons for success or failure cannot be determined, even ex post, causal ambiguity is present and it is impossible to produce an unambiguous list of the factors of production. (1996, p. 35)

Using survey data to assess external causal ambiguity in hospitals and the textile industry, Wilcox-King and Zeithaml (2001) focused on two constructs. The first, “Linkage Causal Ambiguity”, is based upon ambiguity regarding the link between a competency and its competitive advantage. The second, “Characteristic Causal Ambiguity”, is based upon ambiguity regarding the competency in question.

Mosakowski (1997) used a combination of illustrative examples, a secondary case study and analysis of secondary data to examine the general causal ambiguity variable, without specific attention to an internal or an external orientation. In the context of her analysis, she measures causal ambiguity using a monotonically decreasing function of a firm’s age – the natural logarithm of firm age is used to represent a function in which the rate of causal ambiguity decreases over time.

Although Mosakowski did measure this variable directly using secondary data, we agree with the position taken by Szulanski (1996) and Wilcox-King and Zeithaml (2001) that the variable is latent and cannot be measured directly with validity using a secondary data source. In total, we utilized 7 previously validated measurement items to test causal ambiguity, including both the internal and the external orientations of the variable.
Appendix B – Survey Instrument

Please indicate how relevant each statement is to your experiences as a XYZ Bank Branch Manager, by circling the appropriate number:

<table>
<thead>
<tr>
<th>Not Representative</th>
<th>Very Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
</tr>
</tbody>
</table>

Q1. XYZ Atlanta Region Management has provided knowledge of processes (including marketing or operations or risk, etc) to our branch that has enabled us to improve our performance.

Q2. Our branch has provided knowledge of processes (including marketing or operations or risk, etc) to XYZ Atlanta Region Management or to another XYZ branch that enabled performance improvement.

Q3. Our branch has received knowledge of processes (including marketing or operations or risk, etc) that was developed at another XYZ branch.

Q4. Other XYZ branches have received knowledge of processes (including marketing or operations or risk, etc) that was developed at our branch.

Q5. Our branch has piloted concepts that came from XYZ Atlanta Region Management or from another XYZ branch.

Q6. Our branch has implemented concepts that came from XYZ Atlanta Region Management or from another XYZ branch.

Q7. Our branch actively seeks out other XYZ branches for potential collaboration or assistance.

Q8. Other XYZ branches look to our branch for potential collaboration or assistance.

Q9. When we communicate with XYZ Atlanta Region Management, we believe that what we say is generally understood.

Q10. When we place a request for information to XYZ Atlanta Region Management, we never have to restate or explain our request.
Q11. When we place a request for information to XYZ Atlanta Region Management, the recipient who will respond to our request generally “gets it right” the first time.
1  2       3       4  5  6        7

Q12. We use similar terminology to that used by other branch employees to describe issues, concepts, processes, etc.
1  2       3       4  5  6        7

Q13. Other branch employees generally use terms that we understand.
1  2       3       4  5  6        7

Q14. When our branch receives documents or other communications from XYZ Atlanta Region Management, we always understand all terminology.
1  2       3       4  5  6        7

Q15. We rarely require any terminology clarification when reading XYZ documents or when speaking with XYZ Atlanta Regional Management.
1  2       3       4  5  6        7

Q16. What we do on a day-to-day basis is similar to what most other XYZ branches do on a day-to-day basis.
1  2       3       4  5  6        7

Q17. It would be easy for an employee from our branch to transition into another XYZ branch.
1  2       3       4  5  6        7

Q18. Employees at our branch understand the basic processes of most other XYZ branches.
1  2       3       4  5  6        7

Q19. The way that our branch employees approach problems at our branch is similar to the way that other branch employees approach problems at other XYZ branches.
1  2       3       4  5  6        7

Q20. Our branch employees resolve issues in the same way that other XYZ branch employees resolve issues.
1  2       3       4  5  6        7

Q21. The problem solving skills of employees at other XYZ branches are similar to the problem solving skills of employees at our branch.
1  2       3       4  5  6        7

Q22. All XYZ branch managers have access to the same basic knowledge of the banking industry.
1  2       3       4  5  6        7

Q23. XYZ Region Management makes the same basic knowledge available to all branch managers.
1  2       3       4  5  6        7
Q24. All XYZ branch managers have the same basic knowledge of the banking industry.

1  2       3       4  5  6        7

Q25. Our branch employees could create a specific list of the factors that do or do not contribute to an increase in the customer base.

1  2       3       4  5  6        7

Q26. Our branch employees could create a specific list of the factors that do or do not contribute to the retention of good personnel.

1  2       3       4  5  6        7

Q27. Our branch employees could create a specific list of the factors that do or do not contribute to high sales per FTE.

1  2       3       4  5  6        7

Q28. XYZ branch managers would agree about the factors which generate sales production at a branch.

1  2       3       4  5  6        7

Q29. Our branch employees understand what makes our branch a better/worse performer relative to other XYZ branches.

1  2       3       4  5  6        7

Q30. Our branch employees could create a list of the factors that differentiate our XYZ branch from other XYZ branches.

1  2       3       4  5  6        7

Q31. Our branch employees could create a list of the factors that do or do not contribute to sales production at other XYZ branches.

1  2       3       4  5  6        7