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Knowledge Transfer in Supply Chain Partnership: Characteristics and Research Propositions

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Abstract

Supply Chain Partnership as conduit of interfirm knowledge transfer is attracting increasing attentions from practitioners and academics. Nevertheless previous research appears to give limited clarifications on characteristics of supply chain partnership. Thus particular characteristics of knowledge transfer in supply chain partnership are less clarified. We commented that among various types of alliances, such as franchise, R&D alliance, joint-venture, etc., supply chain partnership is a specific type of alliance. It has unique characteristics such as vertical functional cooperative interface, loosely defined contractual agreement, more indirect performance target, and potential network-based partnership extension. All these characteristics make supply chain knowledge transfer to be different from that in other interfirm relationships. In this paper characteristics of knowledge transfer in supply chain partnership were discussed. A number of propositions were developed regarding relationship factors that are more likely to affect conduction of interfirm knowledge transfer in supply chain partnership based on existing theories.

Key Words

Supply Chain Management, Supply Chain Partnership, Knowledge Transfer, Interfirm Relationship

Introduction

Intefirm knowledge transfer is attracting more and more attention from practitioners and academics. However, an intensive literature review suggested that a substantial number of studies have been conducted to examine interfirm knowledge transfer but have not specified the interfirm relationship or have not differentiated the particular nature of interfirm alliances (He et al., 2006). It is suggested that interfirm alliances encompasses a wide range of equity or non-equity arrangements, including strategic alliance, joint ventures, collaborative advertising, R&D partnerships, lease service agreements, shared-distribution, cross-manufacturing, and cross-licensing, etc. (for example Pekar & Allio, 1994). According to Koka and Prescott (2002), the number and type of alliances, nature of the partners and their alliance structures as well as relationship dynamics determine firm's access to knowledge spillover and its ability to leverage information. Thus, the usefulness and amount of knowledge available to firms and the mechanisms of knowledge transfer tend to be varied with respect to the alliance structure and the relationship nature. Clear definition of the relationship context ensures that theoretical models are more accurately developed and interpretation of empirical results more robust.

Supply chain partnership as a particular type of interfirm alliances is also considered as important conduit to knowledge transfer. However, little research effort has been taken to clarify the particular nature of supply chain partnership and the particular nature of knowledge transfer in supply chain partnership. This paper intends to distinguish supply chain partnership from other interfirm partnerships, so that to find out what are the characteristics of knowledge transfer between supply chain partners. The clarification of supply chain knowledge transfer characteristics also facilitates the determination of relationship factors more likely to affect the effectiveness of supply chain knowledge

transfer. It is worth noting that this paper focuses on interfirm relationship nature as major influence factor, although previous literature suggests such factors as nature of knowledge transferred and the internal characteristics (e.g. organizational structure and organizational routine) also vary the effectiveness of interfirm knowledge transfer. Based on existing literatures, some research propositions were developed linking relationship factors and knowledge transfer in supply chain partnership.

Characteristics of Supply Chain Partnership

Literature reveals that interfirm partnership is generally regarded as the mediate form in the relationship spectrum ranged from arms-length to vertical integration (e.g. Gardner et al., 1994; Golicic et al., 2003; Lambert et al., 1999; Macbeth & Ferguson, 1994). Noticeably, although relationship between supply chain firms could be any type between arm-length to vertical integration, concept of partnership is frequently reflected in the discussion of supply chain relationships. Under the scenario of supply chain management, researchers are commonly referring to partnership as the main relationship structure between supply chain firms, (Knemeyer et al., 2003; Lambert et al., 1996; Mentzer et al., 2000; Moberg & Speh, 2003; Spekman et al., 1998). Moreover, as Spekman et al. (1998) argued, co-operation is the starting point for supply chain management and has become a *necessary* but not sufficient condition, i.e. partnership between supplier and buyer firms exists as long as they operate under supply chain management. Due to these concerns, this paper will concentrate on the partnership other than arm-length or integrated relationship between supplier and buyer firms when examining interfirm knowledge transfer. In this paper it is commented that supply chain partnership could be distinguished from other types of interfirm partnerships by four aspects of characteristics: cooperative interface, nature of contract, potential benefits of partnership, and partnership structure.

Cooperative Interface

Although most interfirm alliances are formed because of each counterpart's complementarities, supply chain partnership is typically formed on the basis of vertical complementarities in functions along the supply chain (Porter, 1985). The cooperation between partners is vertical as oppose to horizontal, because in a supply chain partnership, one firm normally uses other firms' output as input of its own value-added process (Christopher, 1998). Gulati and Lawrence (1999) used the notion of value chain alliances (VCAs) to describe the links between independent firms operating at successive stages in the production chain. Through supply chain partnership the individual functions of each partner firm are integrated into the whole value-added process from initial material to end customer (Bowersox et al., 2002). On the contrary, other types of interfirm partnership are not necessarily formed on the basis of vertical functions of partner firms, such as R&D alliance, licensing agreement, etc. (Pekar & Allio, 1994).

Literature suggests that firms are seeking supply chain partnership upstream the value chain through "go slim" strategies, in which vertical disintegration, supplier-base reduction, focusing of operations, outsourcing, Just-in-Time, and partnership sourcing are the major strategic options of firms (Harland, 1996). All of these strategic moves give much emphasis to the supply chain partnership, especially with firms providing stable vertical complementary functions. Murray (2001) advocated that companies can readily achieve strategic flexibility and effectiveness by partnering with suppliers with complementary strengths. Mills et al. (2004) pointed out that instead of producing components or generating functions within the firm boundary, more and more firms turned to outsource certain functions to the outside product or service suppliers. Likewise, firms are also seeking partnerships downstream the value chain, for instance, through forming strategic alliances

among manufacturing and distribution firms (Aulakh & Kotabe, 1997), adopting ECR (efficient customer response) strategy (Mills et al., 2004), and outsourcing transportation or distribution functions to third party logistic providers (e.g. Bowersox et al., 2002; Gentry, 1996).

Overall, supply chain partnership normally establishes across vertical boundaries of firms. Through forming partnership with firms that provide vertical complementary functions, firms are able to reduce the redundant operations and concentrate on their core competencies. This allows them to be more specialized and be more agile to the fluctuated market demand (Sornn-Friese & Sorensen, 2005).

Nature of Contractual Agreement

Transaction cost theory advocates that implicit or explicit safeguard mechanism is necessary to safeguard against the hazard of opportunistic behavior between parties, when there is presence of transaction specific investment and parties have bounded rationality (Williams, 1985). The purpose of safeguard is to provide control and promote commitment to the exchange at minimum cost. The safeguard or governance structure could take various forms, such as legal contract (such as classical and contingency contract) and self-enforcing agreement (such as informal relational or goodwill trust and reputation, and formal financial hostages) (Dyer, 1997). Unlike other types of interfirm alliances, such as joint ventures, R&D partnership, and cross-licensing, etc., supply chain partnership is generally known as loosely organized in terms of informal, non-targeted and less-specified contractual agreement (e.g. Frankel et al., 1996; Lambert et al., 1996; Wilson, 1995). Lambert et al. (1996) advocated that strongest supply chain partnership generally have the shortest and least specific agreements or even no written agreement at all. Sometimes the partnership is purely based on trust and handshakes (Lambert et al., 1996). When contracts are negotiated

in some supply chain partnerships, responsibilities of the partners are usually less specified or are operational based (Handfield et al., 1999). In many cases, specified contract is unnecessary because of a social network of prior alliances or future cooperation (Heide & Miner, 1992; Kogut et al., 1993).

The issue of partnership formation is beyond the coverage of this paper and conveys another research agenda. Nevertheless previous research suggests that the establishment of supply chain partnership is likely to go through a prolonged process, which involves phases of spot exchange, awareness, exploration, expansion, and commitment (Dwyer et al., 1987). Such process is accompanied by activities of continuous interaction, partnership readjustment and conflict handling (Andersen & Kumar, 2006; Dwyer et al., 1987; Parkhe, 1993). Sometimes relationship may break up before partnership matures or officially recognized. Partnership, which survives and lasts longer, is more likely to develop trust and commitment (Parkhe, 1993), given mutual dependence is the basis of cooperation. Moreover, transaction specific investments (i.e. physical assets specificity, site specificity, human resource specificity) are more likely to be committed as cooperative relationship continues (Williams, 1985). Thus partners become more reluctant to act opportunistically which very likely will result in termination of partnership and losing value of nonrecoverable investments (Parkhe, 1993). Unlike other types of interfirm alliances, implicit safeguarding mechanisms are cultivated before partnership is formally settled. Trust between partners in turn reduces the perception of opportunistic behavior, and thus eliminates the need of formal contractual structures (Dyer & Chu, 2003; Parkhe, 1993; Zaheer et al., 1998). Consequently, supply chain partnerships are more likely to form on the basis of implicit safeguarding mechanisms (e.g. trust, commitment, shared meaning and interdependence) other than explicit written contractual agreements.

Researchers generally agree that supply chain partnerships does not necessarily have specified contractual agreement to achieve effective alliance relationship (Frankel et al., 1996; Lambert et al., 1996). Wilson (1995) pointed out that unlike joint ventures, buyer-supplier partnerships seldom have legal structures that define the boundaries of the partnership. In the author's opinion, supply chain partnership should be considered as an informal organization developing a governance structure drawing on, but not governed by the structure of the parent organization. According to Frankel et al. (1996), formal contract may sometimes hinder alliance practice, since the experimental nature of alliance may precluded documentation of every conceivable contingency. Formal contract may limit the conduction of the cooperation given changes in circumstance may raise the ex ante cost of negotiating and rule out the benefit of contractual agreement. Even if a contract is required to guide the implementation of alliance, it would be difficult for the partners to achieve the full benefits of individual creativity and joint synergy (Frankel et al., 1996).

On the contrary, other types of interfirm alliance, such as R&D partnership and Joint-venture, are usually governed by much more formal and specified contracts, which clarify the duties and responsibilities of each partner firms, define the partnership boundaries and duration to avoid opportunistic behaviors of each party when partnership is established (Ingham & Mothe, 1998; Kogut, 1988). In addition, the contract often reasonably specify the objectives to be achieved through the partnering activities to ensure each party have mutual understanding on the fair share of benefits and the adequate monitoring of partnership performance.

Moreover, supply chain management researchers generally regard supply chain partnership

as non-equity based. According to Stuart (1997), although different definitions of supply chain alliances exist, strategic buyer-supplier alliances are generally considered as being long-term relationships between buying and supplying firms that involve mutual collaboration and benefit in the absence of any direct equity investment. Such non-equity based arrangements also imply that supply chain partnership is based on influence, trust, and mutual values as opposed to the use of formal authority (Stuart, 1997). Likewise, Lambert et al. (1996) suggested that although certain level of financial resources sharing may strengthen the partnership, joint equity arrangement is neither a sufficient nor a necessary condition for supply chain partnership.

Informal mechanisms consider the historical and social context of a relationship as well as specifically acknowledging that the performance and enforcement of obligations are an outcome of mutual interest between parties (Frankel et al., 1996). Supply chain firms may form long-term partnerships solely based on the strategic concerns of the participating firms and mutual benefits to be achieved from the partnership. The governance of the partnership relies not on the detailed contract or joint equity investment, but on the trust and commitment arise from mutual dependence. Opportunistic behaviors of partner firms are outweighed by the concentrated effort to jointly improve quality and productivity and to reduce overall costs (Landeros & Monczka, 1989) and the concerns over reputation maintenance (Houston & Johnson, 2000). Consequently, it is implied that supply chain partnership is not determined by formal contract or hierarchical control mechanisms. In the absence of formal contract or joint equity investment, firms could still form effective partnership based on informal safeguarding mechanisms, such as trust, commitment, shared meaning, and interdependence (e.g. Frankel et al., 1996; Lambert et al., 1996).

Potential Benefits of Partnership

The lack of well-specified contractual agreement in supply chain partnership implies that the partnership is usually non-targeted in nature. This means that supply chain firms may not have specific requirements in benefits and returns from the partnership. According to Lambert et al. (1996), firms have to have certain drivers or compelling reasons to partner before they form any interfirm partnerships. Prior research reveal that the most common benefits of supply chain partnership could be quality enhancement, time efficiency improvement, inventory reduction, and innovation (Christopher, 1998; Ellram, 1992; Fiala, 2005; Monczka et al., 1998; Wilson, 1995). Compared with other types of interfirm alliances, supply chain partners concentrate more on enhancing operational efficiencies, which does not necessarily lead to immediate financial or economical returns (Li et al., 2006). Operational benefits are actually means to achieve ultimate performance improvement, such as cost reduction, profit enhancement, and market occupation (Wilson, 1995).

On the other hand, other types of interfirm alliances have more intention to achieve benefits, which are more immediate, tangible, predictable, or reasonably quantifiable. Lambe and Spekman (1997), for example, illustrated how firms may form alliances driven by various explicit motivations, such as, gaining access to new market, acquiring market share, reaching economy of scale, acquiring external technology, reducing cost, enhancing profit, etc. Even if the expected returns are intangible, partners can reasonably predict the outcome of the relationship most of the time.

Partnership Structure

According to Christopher (1998) supply chain is better understood as a network of organizations that are involved through upstream and downstream linkages in the value

production process. The network view of supply chain relationship emphasizes firms' role as nodes of larger supply network (Mills et al., 2004). Dyadic relationships (i.e. relationship between two firms) is regarded as the building blocks of a chain and network of supply chain firms (Harland, 1996). Therefore, supply chain partnership goes beyond dyadic interfirm partnership into chains and networks of interfirm partnership. According to Lamming et al. (2000, p. 675), "the articulation of supply network, as an extension of supply chain, seeks to accommodate and explain the commercial complexity associated with the creation and delivery of goods and services from the source of raw materials to their destination in end-customer markets."

The network view of supply chain structure has three major implications to the understanding of supply chain partnership. First, although a supply chain partnership could be a dyadic partnership in nature, it is the network view which gives the most comprehensive understanding of the supply chain relationship (Harland, 1996). Second, dyadic partnership is not the only form of interfirm partnership existing in the supply network. A supply chain partnership could also be multilateral, i.e. involving more than two firms in the same supply chain, and formed by a group of partner firms, which contribute to the same value-added process, such as the Keiretsu formed by Toyota (Nishiguchi, 1994). Third, a bilateral or a multilateral supply chain partnership is not isolated from the rest of the supply network. They tend to be interrelated and together determine the nature of the supply network. One single supply chain partnership may be largely affected or determined by other firms or interfirm partnerships in the value chain, though the change of one partnership could also trigger the change of the whole supply network (Gentry, 1996; Petrovic et al., 1998).

Table 1 gives a comparison of supply chain partnerships to other types of interfirm alliances.

Based on the above discussions on the unique nature of supply chain partnership, we define the supply chain partnership as "an *enduring relationship* between two *independent firms* in the *successive stages of the industry chain* based on *vertical complementarities*, and which yields a competitive advantage resulting in *greater business performance* than would be achieved by the single firm alone".

Table 1. Comparisons of Supply Chain Partnership and Other Types of Interfirm Alliances

Partnership Characteristics	Other Interfirm Alliances	Supply Chain Partnership	Sources
Cooperative Interface	Partnership is typically based on horizontal complementarities.	Partnership is typically based on vertical complementarities.	(Porter, 1985); (Harland, 1996); (Aulakh & Kotabe, 1997); (Christopher, 1998); (Bowersox et al., 1999)
Nature of Contract	Contract is more targeted and the goals of partnership are well-specified; Relationship boundaries are clearly specified; Partnering activities are clearly defined; Terms and responsibilities are clearly specified; May involve shared equity.	Contract is non-targeted and the goals of partnership are less-specified; Relationship boundaries is less-specified; Partnering activities are loosely defined; Terms and responsibilities are loosely defined; Does not involve shared equity.	(Kogut, 1988); (Landeros & Monczka, 1989); (Wilson, 1995); (Frankel et al., 1996); (Lambert et al., 1996); (Stuart, 1997); (Anand & Khanna, 2000)
Potential Benefits of Partnership	Attempts to achieve tangible benefits directly; Benefits tend to be realized in shorter term; Benefits are more predictable; Benefits are more quantifiable.	Attempts to achieve operational efficiency which indirectly enhance tangible performance; Benefits tend to be realized in longer term; Benefits are less predictable; Benefits are less quantifiable.	(Wilson, 1995); (Lambe & Spekman, 1997); (Maloni & Benton, 2000); (Graham et al., 1994); (Kalwani & Narayandas, 1995)
Partnership Structure	Partnership is bilateral; Relationship is dyadic and isolated from other partnerships.	Partnership could be bilateral or multilateral; Relationship is network based and interrelated with other partnerships.	(Gentry, 1996); (Harland, 1996); (Turnbull & Ford, 1996); (Petrovic et al., 1998); (Lamming et al., 2000); (Mills et al., 2004)

Note: other types of interfirm alliances include joint venture, R&D partnership, licensing agreement, collaborative advertising, lease service agreements, shared-distribution, and cross-manufacturing, etc.

Characteristics of Knowledge Transfer in Supply Chain Partnership

Since the last decade, more and more researchers are interested in knowledge transfer within the context of supply chain or buyer-supplier relationship (e.g. Beecham & Cordey-Hayes, 1998; Dyer & Chu, 2000; Heide & Miner, 1992; Hult et al., 2004; Kotabe et al., 2003). However, most of the empirical studies derived the research hypotheses based on the general

interfirm relationship theories, and lacked the clarification on what makes the knowledge transfer to be different in the supply chain context. For example, Kotabe et al. (2003) examined the influence of link duration on the technical exchange and technological knowledge transfer and the supplier performance. Hult et al. (2004) conducted a empirical study on a large firm's supply chain to examine the effect of knowledge development on cycle time performance. Nevertheless, very little research provided explicit discussions on the relationship between unique nature of supply chain structure and interfirm knowledge transfer. Extensive review of literatures suggests that supply chain knowledge transfer is different from knowledge transfer in other relationship context, because of the vertical knowledge exchange interfaces, the less targeted and thus less guaranteed knowledge transfer activities, and higher risk of knowledge spillover due to extended supply network. Moreover, supply chain knowledge transfer is better to be understood as a multiple-stage process other than a black box. Table 2 summarizes the characteristics of knowledge transfer in supply chain partnership. Following subsections will explore each of these characteristics.

Table 2. Summary of Characteristics of Knowledge Transfer in Supply Chain Partnership

Facets of Characteristics	Nature of Knowledge Transfer	Implications	Sources
Knowledge transfer interface	Knowledge transfer typically takes place due to vertical complementarities of partners	- Level of knowledge transfer between supply chain partners depends on the level of interdependence between firms - Shared meaning is necessary to harness the knowledge exchange activities	(Barney, 1991); (Bates & Slack, 1998); (Dyer & Nobeoka, 2000); (Kotabe et al., 2003); (Hult et al., 2004)
Expected outcome	Knowledge transfer is generally non-targeted and less guaranteed	- Knowledge transfer is more likely to take place informally - Knowledge transfer is less likely to be bounded by written contract - Balanced power influences the nature of knowledge transfer	(Beecham & Cordey-Hayes, 1998); (Heide & Miner, 1992); (Provan & Skinner, 1989); (Maloni & Benton, 2000)
Knowledge protection	Potential network extension of partnership increases the concerns of partners over unwanted knowledge spillover	- Willingness to exchange knowledge depends on level of trust and commitment between partners - Knowledge transfer is more likely to occur when the needs to exchange	(Beecham & Cordey-Hayes, 1998); (Dyer & Nobeoka, 2000); (Heide & Miner, 1992)

		knowledge outweigh the danger of knowledge spillover	
Process of knowledge transfer	Process of knowledge transfer is better to be understood as multiple-stage process	- Types and effectiveness of knowledge acquisition depends on the level of complementary contributions of partners - Overlaps of expertise and shared meaning between partners influence the internalization of knowledge - Direct use of knowledge is often rare, and the outcome of particular knowledge use is often less obvious	(Deshpande & Zaltman, 1982); (Menon & Varadarajan, 1992); (Weiss, 1980); (Wiig, 1997)

Knowledge Transfer due to Vertical Complementarities

Some of the prior studies have recognized the vertical complementarities exist between supply chain partners. For instance, Kotabe et al. (2003) concluded from their literature review that a firm can benefit from harnessing complementarities with suppliers. Such interfirm relationship could have extensive division of labor, in which able supplier not only in manufacturing parts according to the supplier's detailed specification, but also in designing the parts and the corresponding manufacturing and technical processes. Moreover, this division of labor is accompanied by exchanges of knowledge about products and processes to ensure suitable coordination. The division of labor may vary accordingly over time, and varying it requires knowledge transfer between partners (Kotabe et al., 2003). The vertical complementarities based knowledge transfer has two implications.

First, knowledge transfer between supply chain partners depends on the level of interdependence between firms. Unlike other types of interfirm alliances, in supply chain partnership vertical functional complementarities are the primary soil for relationship development and maintaining. Both Industrial Marketing and Purchasing Research Group (IMP) and Resource-based view of firm highlight the interdependence arise from complementarities of need and resources (Barney, 1991; Bates & Slack, 1998). Supply chain partners develop mutual interdependence as they rely on each other to get access to

resources and capabilities which otherwise are unable to be reached to complete the entire value-added process.

Secondly, knowledge transfer based on functional complementarities also draws on the shared meaning between supply chain partners. Unlike those interfirm alliances with joint organizations or explicit boundaries for cooperation, such as joint ventures or R&D partnership, supply chain partnership lacked the soil to develop strong organizational identity or culture (Hult et al., 2004). The relationship is built upon repeated transactions and reliance of other party's capability to complete the value chain process, rather than shared investment and benefits or contracted objectives. The partnership will be solidified only when both parties realize each other's irreplaceable role in completing the value chain process. The identity and culture are even weaker when partner firms are operating at different industrial stages possessing different expertise and specialization. In absence of strong identity or culture, shared meaning is necessary to harness the collective action in supply chain (Hult et al., 2004). Knowledge exchange will also be limited when partner firms lacked the common language.

Non-targeted Transfer of Knowledge in Supply Chain

When firms participate in a more bounded interfirm partnership, such as R&D alliance the target of knowledge generation is normally written into the contract, as well as the contributions and responsibilities of each partner. In many cases new firms or joint ventures are established to facilitate the co-development. The knowledge exchange processes in these alliances are monitored and performance of knowledge transfer is frequently assessed to make sure that the knowledge exchange and generation processes are kept at high quality and good progress.

On the contrary, for supply chain partnership the contracts are usually less specified or non-targeted; responsibilities of participants are loosely defined; and the operating goals of partnership are less specified. Correspondingly, the achievement of partnership performance is non-targeted and operational-based. Knowledge transfer is largely a by-product of the cooperation other than a preplanned outcome. Management are normally unaware of the importance of knowledge exchange with supply chain partners (Beecham & Cordey-Hayes, 1998). In most circumstances, participants are uncertain about what types of knowledge and extent of knowledge they could acquire from the supply chain partner.

Consequently, there is a high level of performance ambiguity involved in the knowledge transfer activities (Heide & Miner, 1992). Especially, when supply chain partners set up safeguard policies to prevent other party to get access to its key knowledge in fear that the knowledge will be spilled over to potential competitors. As a result the participants rarely support knowledge transfer in supply chain explicitly. In supply chain partnership, knowledge transfer is seldom written into the contract. Partner firms rarely monitor the performance of knowledge transfer. Thus whether knowledge transfer will take place and will result in benefits is not guaranteed.

All these features suggest that the willingness to share knowledge and the extent of knowledge being shared in supply chain partnership is more likely to be bounded by the mutual dependence to complete the industrial process, as well as the trust, commitment, and the shared understanding cultivated during the daily transactions between partner firms other than written contracts or the performance expectations from participants. Knowledge transfer in supply chain is more likely to take place in an informal context. Amount of knowledge boundary spanners could bring to the counterpart is more determined by the

strength of the relationship and the contribution of such activities to the completion of supply chain tasks.

Moreover, since knowledge transfer activities are more loosely bounded, behaviors of the partners are less restricted by written agreement. As a result, knowledge transfer activities are likely to be influenced by the balance of power between supply chain partners. In supply chain partnership, asymmetric power between partners may arise from differences in sizes, business resources, number of alternatives, and reputations, etc. (Anderson & Weitz, 1989; Cox, 1999; Ganesan, 1994; Kim et al., 2004). In an asymmetrical relationship, exploitation rather than cooperation might result (Heide & Miner, 1992).

Concerns over Network-based Knowledge Spillover

Unlike other bilateral interfirm alliances, supply chain partnership could be extended to a network level, in that one firm may involve in several supply chain partnership at the same time. In this way, one partnership could be a node in a large network of partnerships, so that firms are related to each other through a network of direct or indirect relationships. However, the network extension of relationship could cause serious concerns of participants over information and knowledge retaining. When there is a lack of formal agreement of non-disclosure (in cases where knowledge transfer is not officially recognized and contracted), it is very likely for valuable information and knowledge to be spilled over to the potential competitors. Consequently, the openness of supply chain partners could be highly restricted when participants are aware of the potential danger of the knowledge spillover.

Under such scenario, effective knowledge transfer in a supply chain partnership is more dependent on the level of trust and commitment between partner firms. It is unwise for a

firm to expose its valuable knowledge to a mistrusted or uncommitted partner. Moreover, effective knowledge transfer also depends on the interdependence that exists between partners. In many occasions, completion of supply chain tasks requires the continuous input from all the participants and sharing of value information and knowledge (Beecham & Cordey-Hayes, 1998). When the need to exchange valuable information outweigh the danger of knowledge spillover, knowledge transfer is more likely to occur.

Multiple-stage Process of Knowledge Transfer in Supply Chain

Mowery et al. (1996) suggested interfirm alliance may enable one firm to gain access to key knowledge-based capability of another, but without actually internalizing or acquiring that capability. Under supply chain partnership, the effective knowledge transfer is even less guaranteed due to its non-specified and non-targeted relationship nature. Even when the relationship is close enough to allow buyer and supplier firms to get access to each other's knowledge, for example through formal or informal contact or by setting up joint development program to facilitate knowledge exchange between them (Handfield et al., 1999), overtime they may still find that knowledge acquired from their partners rarely benefits their businesses. The reasons could be that, having frequent contact does not mean that firms will exchange or acquire knowledge; setting up of knowledge transfer procedures between firms does not ensure that firms will learn from each other; to have knowledge acquired from the partner firm will not guarantee that knowledge could be utilized properly and effectively. The success of the supply chain knowledge transfer tends to be determined by a series of related process. Due to these concerns, this research attempts to unfold the process of knowledge transfer between supply chain partner firms.

Knowledge-based theory of firm implies that interfirm knowledge transfer tends to be a

multiple-stage process, in that the success of knowledge transfer is determined by a series of knowledge transfer activities, such as acquiring, storing and applying of the knowledge (Grant, 1996; Grant & Banden-Fuller, 1995). However, many previous research overlooked the multiple-stage nature of interfirm knowledge transfer in their empirical work and generally regard knowledge transfer as a black box (Calantone et al., 2002; Cavusgil et al., 2003; Kotabe et al., 2003; Mowery et al., 1996; Simonin, 1999).

Nevertheless, prior developed theories implied knowledge transfer to be a multiple-stage process. Grant (1996) argue that knowledge transfer involves both transmission and receipt of knowledge, so that flow and absorption of knowledge are separate stages of knowledge transfer. Powell et al. (1996) suggested that organizational learning is both a function of access to knowledge and the capabilities for utilizing and building on such knowledge. Lorange (1996) proposed that organizational learning depends on two complementary factors of discovery of new knowledge and the ability to adapt to the subsequent changes required. According to Wiig (1997), knowledge transfer is a complex process to bring knowledge from the various sources to where it can be utilized or its value otherwise realized.

It could be indicated from the literature that three main stages of knowledge transfer emerged, namely acquisition, internalization, and utilization (see table 3). As Nonaka (1994) argued, organizational learning is deeply related with action, in that it is a continuous process of learning, hence knowledge transfer process consists of three stages is also a continuous process. Accordingly, interfirm knowledge transfer in supply chain partnership is determined not only by firm's ability to access or acquire the external knowledge, but also by its ability to assimilate and apply the acquired knowledge. To include the notion of

dynamic knowledge transfer process, this paper defines supply chain knowledge transfer as "a continuous process through which a firm internalizes the knowledge acquired from supply chain partner firms and applies the knowledge to its commercial end to generate additional value".

Table 3. Knowledge Transfer Process in Prior Studies

Author(s)	Knowledge Transfer Process		
	Acquisition	Internalization	Utilization
(Cohen & Levinthal, 1990)	Recognize	Assimilate	Apply
(Inkpen & Crossan, 1995)	Interpreting	Integrating	Institutionalizing
(Ritcher & Vettel, 1995)	Perception	Internalization	Abstraction
(Inkpen & Dinur, 1998)	Acquisition	Sharing within organization	
(Lane & Lubatkin, 1998)	Recognize	Assimilate	Utilize
(Albino et al., 1999)	Acquisition	Communication	Application; acceptance; assimilation
(Andersen & Christensen, 2000)	Absorption	Communication	
(Hult et al., 2000)	Information acquisition	Information dissemination	
(Kale et al., 2001)	Capture	Codify; Communicate; Coach	
(Lane et al., 2001)	Recognize	Assimilate	Apply
(Cummings & Teng, 2003)	Acquiring	Internalizing	
(Hult et al., 2003)	Acquisition	Distribution	Interpretation; Memory
(Johnson & Sohi, 2003)		Dissemination of information	Shared interpretation of information
(Hult et al., 2004)	Acquisition activities	Information distribution activities	

Knowledge Acquisition

Knowledge-based view (KBV) posits that an organization's relative ability to acquire and develop knowledge differentiates its high and low performance (Grant, 1996). Knowledge acquisition refers to the process of getting access to and having an initial understanding of the desired skills and knowledge by members of organizations through direct or indirect contact or interaction with the source of the skills and knowledge. Acquisition is commonly

regarded as the first step of knowledge transfer (e.g. Albino et al., 1999; Hult et al., 2004; Inkpen & Dinur, 1998). At this stage, knowledge acquisition mechanisms, is vital to the success of knowledge transfer. Among various forms of knowledge acquisition activities introduced in prior research, typical supply chain knowledge acquisition mechanisms include joint problem solving, ongoing manual adjustment (Kotabe et al., 2003; Love & Gunasekaran, 1999), supplier co-design (Beecham & Cordey-Hayes, 1998; Handfield et al., 1999), etc.

In supply chain partnership, types and effectiveness of knowledge acquisition is more determined by supply chain firm's internal characteristics and interaction with other firms (Dyer & Nobeoka, 2000). First, given supply chain partnership is loosely bounded, formal procedures for knowledge transfer may not exist or is less supported by firms. Likewise, large scale of knowledge transfer could be restricted due to concerns of unwanted spillover of participants. Consequently, informal means of knowledge transfer such as individual communication or during-the-job information exchange may play a more important role than in other types of interfirm alliances (e.g. Awazu, 2004; Kotabe et al., 2003), especially when partnership is not strong enough. Under loosely bounded supply chain partnership interface, nature of organizational relationship and the intention of partners to acquire external knowledge will determine the forms of acquisition mechanisms and the amount of information exchange between partners (Beecham & Cordey-Hayes, 1998).

Second, because supply chain partnership tend to be strongest when partners are highly dependent on each other's complementary functions to complete the industrial process. Knowledge acquisition tends to be more promoted when participants could contribute differently and complementarily to the industry process. In that case, supply chain partners

will give more support to mechanisms such as joint problem solving and supplier co-design (Beecham & Cordey-Hayes, 1998; Dyer & Nobeoka, 2000; Handfield et al., 1999). On the other hand, when partners are operating in completely different industrial stages or areas, partners may have limited overlaps in knowledge and expertise. As a result, firms may have difficulties in understanding each other's knowledge.

Third, although the extended network relationship may restrict the willingness of partners to exchange knowledge in concerns of unwanted knowledge spillover, the network based partnership structure will allow more multilateral knowledge transfer mechanisms to occur. For instance, Toyota initiated the supplier association (Kyohokai) to invited its supply chain partners to jointly exchange information to successfully improve their collective performance (Dyer & Nobeoka, 2000).

Knowledge Internalization

Cohen and Levinthal (1990) argued that firm's innovative capabilities largely depends on its ability to assimilate new and external knowledge. Similarly, Kogut and Zander (1992), argue that the ability of the firm to learn is determined by the combinative capabilities of the firm. The combinative capability refers to firm's ability to generate new applications from existing knowledge, which is resulted from combining the internal learning and external knowledge acquisition. Nonaka (1994) used the notion of internalization to capture the idea of organizational learning, which is completed by transforming explicit knowledge to tacit knowledge of the organization. For interfirm knowledge transfer, the internalization of knowledge will be absorbing the acquired external knowledge into internal capabilities of the firm. This paper uses internalization to represent the process of storing, disseminating and combining existing knowledge with new knowledge in the organization.

Internalization is largely a function of firm's internal ability to store, absorb, and disseminating new knowledge (Grant, 1996; Kogut & Zander, 1992; Mowery et al., 1996; Wiig, 1997). Mowery et al. (1996) suggested that interfirm alliance offers the opportunity to access knowledge, but knowledge that is not internalized is unlikely to enhance organizational capability. A firm's ability to absorb knowledge influences whether or not the acquired knowledge can be successfully exploited (Cohen & Levinthal, 1990). Moreover, "only when a recipient internalizes knowledge can it be sufficiently understood and adapted by the recipient to allow for its effective re-creation, and ultimately its use" (Cummings & Teng, 2003).

Because supply chain partnership is often loosely bounded, knowledge transfer activities may not be officially recognized by the management agenda. Consequently, the dissemination of external knowledge could be restricted due to the lack of official support and the suspicious from management team over the value of the knowledge or the trustworthiness of its source. The barrier will be particularly high when management team lacked the common understanding or expertise with the supply chain partner. It seems unrealistic and risky for managers to disseminate new knowledge, which is beyond their conventional way of doing things. As a result, the absorptive capacity of partners could be restricted due to the lack of related knowledge or experience. Therefore, the overlap of expertise and shared meaning between supply chain partners may play an important role in the knowledge internalization process.

Knowledge Utilization

Knowledge utilization is considered as the last stage involved in the knowledge transfer

process, which refers to the process of getting acquired skills and knowledge institutionalized into the organization's internal processes and implementing such skills and knowledge into appropriate operation areas. It is at this stage acquired knowledge is going to realize their potential value to improve processes, practices, and products or services (Wiig, 1997). Even though not every new knowledge will be applied to commercial end, a firm could use the stored knowledge to enhance its "dynamic learning capability" (Dyer & Nobeoka, 2000) by improving its innovative capabilities and/or capacity for future knowledge creation (Calantone et al., 2002; Cavusgil et al., 2003). Accordingly, knowledge utilization tends to be a multi-dimensional concept, given utilization of knowledge could be realized in various forms.

Effective knowledge utilization is believed to generate additional benefits to the firm, which otherwise could not be realized. As suggested by Wigg (1997), firms are capable of pooling various sources knowledge into their knowledge base. In supply chain partnership, knowledge from supply chain partners is one of the many sources of external knowledge. Thus the knowledge base ready to be used by the firm may be a mixture of various external knowledge and internal generated knowledge. Direct use of external knowledge is often rare, particularly when the issues are complex, the consequences are uncertain, and a multitude of actors are engaged in the decision-making process (Weiss, 1980). Consequently, it is difficult to work out a linear relationship between outcome and particular knowledge. The effectiveness of knowledge utilization could not be indicated by the actual outcome of knowledge transfer or improvement in firm performance due to one or the other knowledge application. Obviously, this gives extra difficulties for knowledge transfer activities to be legitimized by the firm, especially when supply chain partners lacked formal recognition over the value of knowledge transfer activities.

Prior research suggests that effective use of knowledge also depends upon firm's ability to modify or give up obsolete existing practices to adapt to new ways of doing things (Beecham & Cordey-Hayes, 1998; Hamel, 1991). When old procedures becomes routine, members of firm may be more reluctant to believe that new procedure could improve efficiency (Probst et al., 2003). Knowledge transfer may not generate real benefits unless individuals have a more open-minded attitude toward new knowledge and willing to unlearn themselves. In supply chain partnership, the issue becomes more obvious when partner firms have limited mutual understanding and knowledge overlaps due to different functional specializations and less clear mission statement. Without sufficient understanding of the potential benefits, managers and employees may not risk themselves to give up already accepted procedures to try out new practice. Overall, effective knowledge utilization is not only a function of firm's intention to be ready to change and adapt to new knowledge, but also a function of supply chain partner's shared meaning and accumulation of related expertise.

Propositions

Above discussion suggested that the nature of supply chain partnership has made the conduction of knowledge transfer between supply chain partners to have different characteristics from knowledge transfer in other types of interfirm relationship. Particularly, the attributes such as trust, commitment, interdependence, shared meaning, and balanced power tend to determine the effectiveness of knowledge transfer activities in supply chain. With the support from existing literatures, a series of propositions regarding partnership nature and supply chain knowledge transfer is developed. Table 4 (see end of the paper) gives the literature review table and related propositions.

Trust and Commitment

Trust and commitment were commonly regarded as major factors determining the interfirm relationship strength. The two factors were given more emphasis in the supply chain partnership compared with other kinds of interfirm alliances (Moberg & Speh, 2003; Wilson, 1995). The loose contract nature of supply chain partnership suggests that trust between partners tends to be built upon the continuous successful transactions, and the awareness of the other party to fulfill the requirement of supply chain tasks that is unable to be accomplished by the focal firm itself. Although social network can reinforce the trust between supply chain partners, the often lack of written contract makes the relationship less restricted by institutional factors, such as legal systems. Similarly, commitment does not arise from the defined length of relationship (Frankel et al., 1996). Rather commitment between supply chain partners is more likely to be resulted from the interaction of three sources: vertical complementarities, opportunity costs involved in ending the partnership, and influence of social networks (Heide & Miner, 1992; Houston & Johnson, 2000; Landeros & Monczka, 1989). Therefore, both trust and commitment replaces the functions of written contract as key factors to bound the supply chain partnership. Although they are much less fixed in term, substantial trust and commitment are necessary to maintain the ongoing collaboration of partners.

Trust and commitment were commonly considered to be positively related to the interfirm knowledge transfer (e.g. Johnson & Sohi, 2003; Kale et al., 2000; Kraatz, 1998; Mody, 1993). Nevertheless, the non-targeted nature of knowledge transfer and more concerns over unwanted spillover involved in supply chain knowledge transfer has made trust and commitment to be more determinant. The loosely bounded nature of supply chain partnership implies that knowledge transfer will take place more informally (Awazu, 2004).

At the stage of knowledge acquisition high level of trust and commitment will ensure that supply chain partners to have lower concerns over knowledge leakage (Inkpen & Tsang, 2005; McEvily et al., 2003). According to Kale et al. (2000) mutual interaction and trust that engender relational capital not only will enable value chain alliance partners to work more unitedly, but also facilitate easier flow of information and skills between them. Similarly, Wu and Hsu (2001) suggested that development of mutual trust between a firm and an OEM buyer will be positively associated with the diversity and the quantity of knowledge transferred. Hence, barriers to information and knowledge access will be lowered and more forms of knowledge exchange will be allowed to take place. Therefore,

P_1: Extent of knowledge acquired by the firm from its supply chain partner is positively related to the level of trust between partners.

P_2: Extent of knowledge acquired by the firm from its supply chain partner is positively related to the level of commitment between partners.

At the stage of knowledge internalization, trust and commitment between supply chain partners are necessary to build the confidence of management towards the source and value of knowledge acquired. Dyer and Nobeoka (2000) found that strong ties between Toyota and its suppliers as well as offering better access to knowledge also assisted knowledge internalization. Cummings and Teng (2003) argued that level of trust between source and recipient of knowledge were positively associated with knowledge transfer success indicated by knowledge internalization. In a committed relationship, which is prolonged and more stable, individuals are more willing to maintain a working relationship or interaction with the knowledge and are willing to put in extra effort to work with the knowledge (Mowday et al., 1979). Consequently, higher extent of acquired knowledge will be absorbed into the existing

system. Therefore,

P_3: Extent of knowledge internalized by the firm from its supply chain partner is positively related to the level of trust between partners.

P_4: Extent of knowledge internalized by the firm from its supply chain partner is positively related to the level of commitment between partners.

Interdependence

Prior research revealed that higher level of interdependence tends to enhance the magnitude or the strength of partnership relationship (Golicic et al., 2003; Knemeyer et al., 2003; Spekman et al., 1998; Wilson, 1995). Since one of the main foundations for the supply chain partnership is the mutual complementarities in partners' functions, knowledge transfer between supply chain partners typically takes place due to the requirement of both parties to contribute differently to the completion of the same industry process. In other words, by entering into alliances, firms can gain complementary skills by tapping into the partners' know-how, sharing risks and gaining synergy (Powell, 1987). Since the vertical complementarities are the most important source of the interdependence between supply chain partners, level of interdependence becomes a major determinant to the exchange of knowledge and information. The influence become even more obvious when knowledge exchange activities are not bounded by the contract.

At the stage of knowledge acquisition, the more interdependent the partners are, the more necessary the exchange of information and knowledge to the completion of value chain tasks. According to Dussauge et al. (2000) link alliances (partners contribute differently, e.g. buyer-supplier partnership) are more likely to lead to capability transfers between partners

than scale alliances (partners contribute similarly, e.g. joint manufacturing). When contributions from partner firms to the value chain process are more different, partners tend to consider each other's knowledge to be more important to its own business. High level of interdependence also ensures that the opportunistic behavior will be ruled out by the recognition from both sides on the importance of the other party in completing the supply chain tasks. In addition, the knowledge of mutual dependence makes the partner firms to believe that they may carry on the cooperation in the future. The anticipated future interaction or extendedness will reinforce the cooperation of the partner firms (Heide & Miner, 1992). Thus the management may regard knowledge sharing to be more beneficial than safeguarding it. Therefore,

P_5: Extent of knowledge acquired by the firm from its supply chain partner is positively related to the level of interdependence between partners.

At the internalization stage, level of interdependence between supply chain partners also has potential influence. Higher level of interdependence means that partner firms need more coordination or ongoing adjustment (Beecham & Cordey-Hayes, 1998; Dyer & Nobeoka, 2000; Handfield et al., 1999). Such interaction between learning parties is found to promote internalization of knowledge (Cummings & Teng, 2003). Moreover, higher level of interdependence due to functional complementarities implies that knowledge from partner firm tend to have higher marginal value to the recipient firm. When perceived value of new knowledge is high, knowledge commitment will be developed among individuals in the recipient firm (Leonard-Barton, 1995). Such commitment to new knowledge promotes more efforts to work with and absorb new knowledge. Therefore,

P_6: Extent of knowledge internalized by the firm from its supply chain partner is positively related to the level of interdependence between partners.

Shared Meaning

Shared meaning is defined by prior researchers as the extent to which partner firms share a common understanding and approach to the achievement of tasks and outcomes (Hult et al., 2004; Inkpen & Tsang, 2005; Spekman et al., 2002). According to Inkpen and Tsang (2005), the appearance of shared meaning forms the cognitive dimension of the interfirm social capital. The level of shared meaning among supply chain partners determines partner firms' wiliness to cooperate with each other and their willingness to take short-term burdens for the future benefits of the supply chain.

The facts that supply chain partners usually have different specializations suggest that the level of shared understanding to procedures and tasks is likely to be limited. However, shared meaning is necessary to allow knowledge transfer to occur between supply chain partners. Significant level of shared meaning ensures partner firms have common vision over the necessity of knowledge sharing (Beecham & Cordey-Hayes, 1998), such that barriers to knowledge acquisition could be lowered. Moreover, certain level of common language between organizations fosters the communication between individual agents such as boundary spanners (Doney & Cannon, 1997; McEvily et al., 2003). As such, the chance of grasping new knowledge by boundary spanners, who plays as major knowledge acquisition agent, also increases (Awazu, 2004). Therefore,

P_7: Extent of knowledge acquired by the firm from its supply chain partner is positively related to the level of shared meaning between partners.

At internalization stage, presence of shared meaning reduces the uncertainty and ambiguity involved in learning external knowledge. According to Cummings and Teng (2003) lower level of norm distance and knowledge distance not only increases the level of knowledge commitment among individuals, but also facilitate knowledge satisfaction, which can reduce the recipient's stress and resistance levels in adapting and using the knowledge (Leonard-Barton & Deschamps, 1988), as well as reduce the likelihood of the not-invented-here syndrome occurring (Katz & Allen, 1982). Moreover, absorptive capacity is function of prior experience (Mowery et al., 1996), as such level of previously built common understandings to tasks and procedures also increases the level of absorptive capacity of the recipient firm. Therefore,

P_8: Extent of knowledge internalized by the firm from its supply chain partner is positively related to the level of shared meaning between partners.

Balanced Power

Extensive review of literature suggests that balanced power in the supply chain partnership arises from two perspectives, namely availability of alternatives and restraint in use of power. First, as advocated by marketing channel theory (e.g. Ganesan, 1994) and the bargaining theory (e.g. Yan & Gray, 1994), one of the important sources of dependence comes from the lack of alternatives. Although supply chain partnership is formed on the basis of vertical complementarities, which result in certain level of mutual dependence, the lack of alternatives of one party will limit the extent of equal say in the partnership (Anderson & Weitz, 1989). The lack of alterative buyer or supplier means that one of the partner firms is more attached to the relationship and is more dependent on the performance of the other

party.

Second, balanced power arises from restraint in use of power. Few partnerships have equal distribution of influence (New, 1998). However, the relative power may be neutralized given partners do not have the intention to use the power to take advantage of the counterpart (Muthusamy & White, 2006). If the long-term interests and future gains of alliance are taken into consideration, partner firms may switch to the restricted use of power as a fundamental policy in managing strategic alliances (Heide & Miner, 1992; Muthusamy & White, 2005). In particular, if the boundary-spanning alliance managers are willing to restrain the excessive use of power over their partner and at the same time allow the other party to have a say in the operations, then each partner is more likely to have positive feelings or psychological attachment to the relationship.

In an asymmetric supply chain partnership, exploitation other than cooperation plays more important role, such that reciprocal knowledge transfer may be limited (Maloni & Benton, 2000) . The supply chain partnership becomes vulnerable, especially when there is no explicit contract or the contract is loose defined, since there is more chance for the more powerful party to exploit the less powerful one. The more powerful partner could be more capable of restricting the flow of knowledge to protect its core proprietary assets or market position. Similarly, it may request more knowledge contribution from the less powerful party (e.g. Albino et al., 1999). On the other side, the protectiveness of the weaker party may limit the exposing of valuable information to the more powerful party to avoid exploitation and obsolescing itself (Anderson & Weitz, 1989; Provan & Skinner, 1989). In some cases, the less powerful party may be ignored for valuable knowledge exchange, due to the lack of recognition over its knowledge and information (Beecham & Cordey-Hayes,

1998). Therefore,

P_9: Extent of knowledge acquired by the firm from its supply chain partner is positively related to the level of balanced power between partners.

In an imbalanced relationship, activities of a weaker partner are more likely to be constrained in favor of the stronger party (Albino et al., 1999; Kim et al., 2004). As such, knowledge utilization of the weaker partner will be more passive and constrained, and the learning goals of the weaker partner may not be assured (Makhija & Ganesh, 1997). Consequently, the weaker party may not voluntarily implement the new practices which are only beneficial to the counterpart, or even have the intention to resist the allocated new practices to avoid being overly dependent. On the contrary, when the more powerful partner restricts use of power or use the power in a more catalytic way, the power differences could be neutralized or changed into a more favorable manner (Yilmaz et al., 2005). For instance, Dyer and Nobeoka (2000) demonstrated where strong partner is not using power to exploit others, but to create appropriate routines and climate to exchange and apply beneficial knowledge. Therefore,

P_{10}: Utilization of knowledge acquired from the supply chain partner by a firm is positively related to the level of balanced power between partners.

Relationship between Knowledge Transfer Stages

In this research we propose that acquisition, internalization, and utilization of knowledge are sequential processes with lag between each stage. Although three stages of knowledge transfer forms a continuous process, each stage is considered to be distinct in terms of learning related activities. Firstly, vertical complementarities between supply chain partners

suggest that knowledge from the partner contains higher marginal value to the firm. Concerns over information overload will be less significant (Hult et al., 2004). Once new knowledge has been acquired from supply chain partner, some (if not all) of the valuable knowledge will be disseminated by the firm. In this sense, the amount of knowledge internalized by the firm largely depends on the amount of knowledge firm acquired from the supply chain partner.

P_{11}: Firm's internalization of knowledge, which is acquired from its supply chain partner, is positively related to the level of its knowledge acquisition.

Secondly, according to Cohen and Levinthal (1990), although some of the external knowledge a firm acquires may be acted on immediately, it is more likely that it will have to be adapted and disseminated internally before it can be commercially utilized. Thus, extent of knowledge firm could use depends upon the extent of knowledge it has absorbed. Absorptive capacity of the firm also shapes the application of external knowledge (Lane et al., 2001). How well the firm is able to internalize external knowledge will affect its capability to utilize the knowledge. Therefore,

P_{12}: Firm's utilization of knowledge, which is acquired from its supply chain partner, is positively related to the extent of its knowledge internalization.

Conclusion and Future Research

Based on the understanding of uniqueness of supply chain partnership, this paper attempts to clarify the characteristics of interfirm knowledge transfer in the context of supply chain partnership. Through consultation of existing literatures, this paper suggests that knowledge

transfer in supply chain partnership is taken place mainly due to the vertical complementarities between partners. Unlike knowledge exchange activities in other types of interfirm alliances, supply chain knowledge transfer is generally non-targeted and less guaranteed. Moreover, the possible network extension of partnership also increases the concerns of partner firms over knowledge spillover. These characteristics suggest that supply chain knowledge transfer is better to be understood as a multiple-stage phenomenon other than a black box. All these characteristics also suggest that relationship factors, such as trust, commitment, interdependence, shared meaning, and balanced power, are more likely to affect the effectiveness of knowledge transfer.

Although this paper is exploratory in nature, it is believed to provide some further understanding of the relationship between partnership nature and interfirm knowledge transfer. Future researchers are recommended to clarify the nature of interfirm alliances before any empirical or theoretical work is conducted. This paper focuses on the relationship attributes as main influence factors of knowledge transfer. However, it is worth noting that other factors such as nature of knowledge to be transferred and internal organizational factors (e.g. organizational structure, organizational routines) are also likely factors influencing knowledge transfer in supply chain partnership. Future researchers could explore the effect of such factors on the effectiveness of supply chain knowledge transfer. Empirical testing of propositions developed in this paper in the context of supply chain partnership is also an interesting avenue for further research. Practitioners could possibly use the propositions to help diagnose their knowledge transfer activities, and develop more favorable interfirm relationship to facilitate supply chain knowledge transfer.

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Table 4. Summary of Findings of Previous Studies that Relate to the Propositions

Propositions	Authors	Relationship Focus	Type of Study	Findings Relevant
P1 Trust and knowledge acquisition	(Chen, 2004)	Strategic alliance	Questionnaire survey of 137 High-tech firms	Trust and adjustment have positive effects on knowledge transfer performance.
	(Kale, Singh, & Perlmutter, 2000)	Strategic alliance	Questionnaire survey of 212 firms in multiple industries	Relational capital based on mutual trust and interaction at the individual level between alliance partners creates a basis for learning and know-how transfer across the exchange interface. Simultaneously, it curbs opportunistic behaviour of alliance partners, thus preventing the leakage of critical know-how between them.
	(McEvily et al., 2003)	Intra-organizational relationship in general	Literature review and theory development	Trust encourages knowledge sharing by increasing the disclosure of knowledge to others and by granting others access to one's own knowledge. From the knowledge sender's point of view, trust in a receiver reduces concerns about knowledge appropriation and misuse.
	(Soekijad & Andriessen, 2003)	Competitive learning alliance	Case study of 2 learning alliances	Inter-organizational conditions at alliance level, such as relationship strength, mutual trust, need for cooperation, shared goals can facilitate knowledge sharing.
P2 Commitment and knowledge acquisition	Dyer and Nobeoka (2000)	Supply chain network	Case study of a automobile firm's supply chain network	Interconnected strong tie network is effective at the transfer of tacit knowledge.
	(Kale, Singh, & Perlmutter, 2000)	Strategic alliance	Questionnaire survey of 212 firms in multiple industries	Learning especially the acquisition of difficult to codify competencies is best achieved through wide-ranging, continuous and intense contact between individual members of the alliance partners.
	(Heide & Miner, 1992)	Buyer-supplier partnership	Questionnaire survey of 215 partner firms in manufacturing industry	Relationship extendedness and frequency of contact are associated with joint cooperation, which is indicated, by flexibility, information exchange, shared problem solving, and restraint in the use of power.
P3 Trust and knowledge internalization	(Cummings & Teng, 2003)	Strategic alliance	Questionnaire survey of 69 high-tech firms	Contextual dimensions need to be aligned to facilitate knowledge transfer, while organizational distance negatively related with internalization.

	(McEvily et al., 2003)	Intra-organizational relationship in general	Literature review and theory development	Trust also reduces the screening of knowledge received from others. From the standpoint of receiver, trust affects the perceived veracity of knowledge, i.e. receiver is less likely to verify the knowledge for accuracy and is more inclined to accept the knowledge at face value.
	(Rich, 1991)	N.A	Literature review and theory development	The trustworthiness and the credibility of the data source are essential for understanding utilization.
P4 Commitment and knowledge internalization	(Dyer & Nobeoka, 2000)	Supply chain network	Case study of a automobile firm's supply chain network	Existence of relationship capital consist of trust, commitment and share goals between partners encourages firms to set up idiosyncratic knowledge-sharing routines to further facilitate the learning of specified and agreed-upon information and know-how between them.
	(Spekman, Spear, & Kamauff, 2002)	Supply chain partnership	Questionnaire survey of 160 firms in 22 supply chains	Commitment ensures longer-term interaction and continuous input from partners, so that it encourages learning between partners.
P5 Interdependence and knowledge acquisition	(Dussauge et al., 2000)	Strategic alliance	Archival based analysis of 227 manufacturing firms	Link alliances (in which partners contribute differently, e.g. buyer-supplier partnership) are more likely to lead to capability transfers between partners than scale alliances (in which partners contribute similarly, e.g. joint manufacturing).
	(Mowery et al., 1996)	Strategic alliance	Archival based analysis of 792 firms in multiple industries	Higher levels of knowledge transfer occur in bilateral non-equity arrangements than in unilateral contracts.
P6 Interdependence and knowledge internalization	(Cummings & Teng, 2003)	Strategic alliance	Questionnaire survey of 69 high-tech firms	Interaction between learning parties promotes knowledge transfer success, indicated by knowledge internalization.
	(Dyer & Nobeoka, 2000)	Supply chain network	Case study of a automobile firm's supply chain network	Perception of interdependence fosters strong network identity, which facilitates knowledge internalization across the network.
P7 Shared meaning and knowledge acquisition	(Mowery et al., 1996)	Strategic alliance	Archival based analysis of 792 firms in multiple industries	Distance, cultural differences could place obstacles to interfirm knowledge transfer.
	(Beecham & Cordey-Hayes, 1998)	Supply chain partnership	Case study of 27 automotive manufacturing firms	One of the main reasons why partnerships fail is due to managerial rather than technical reasons, i.e. inconsistent managerial attitudes toward partnership.

	(Dyer & Nobeoka, 2000)	Supply chain network	Case study of a automobile firm's supply chain network	Network can be superior to a firm as organizational learning unit, if network can create a strong identity and coordinating rules; rules are imposed to prevent knowledge hiding and free riding problem.
	(Awazu, 2004)	Interfirm relationship within global context	Literature review and propositions development	Aggregation and transfer of knowledge is useless unless sensemaking occurs. Sensemaking is preceded by schemas that are developed by common habits and shared experiments among individuals.
P8 Shared meaning and knowledge internalization	(Mowery et al., 1996)	Strategic alliance	Archival based analysis of 792 firms in multiple industries	Absorptive capacity, which is determined by the pre-alliance experience in related technological areas, influences the extent of knowledge transfer.
	(Cummings & Teng, 2003)	Strategic alliance	Questionnaire survey of 69 high-tech firms	Norm distance and knowledge distance between source and recipient of knowledge have negative influence on the transfer success, indicated by knowledge internalization.
	(Hult et al., 2004)	Supply chain partnership	Questionnaire survey of 58 supply chain in transportation industry	The study showed that information distribution activities shaped shared meaning. It concluded that shared meaning provides a common frame of reference and that it had a positive favorable relationship with the cycle time.
	(Lane & Lubatkin, 1998)	R&D alliance	Questionnaire survey of 31 alliances in biotech industry	One firm's ability to learn from another firm is argued to depend on the similarity of both firms' (1) knowledge bases, (2) organizational structures and compensation policies, and (3) dominant logics.
P9 Balanced power and knowledge acquisition	(Provan & Skinner, 1989)	Dealer-supplier relationship	Questionnaire survey of 226 farm and power equipment dealers	When supplier has control over dealer's decision, dealers are more likely to take opportunistic behaviour to resist.
	(Anderson & Weitz, 1989)	Supply chain partnership	Questionnaire survey of 690 relationship dyads	When one party possesses inordinate leverage over the other, the weaker party becomes mistrustful, i.e. apprehensive about the stronger party's intentions.
	(Albino et al., 1999)	Regional interfirm network	Archival based analysis of a regional firm network	Leader firm could choose to control the knowledge transfer process by either promote or restrict knowledge transfer in the industrial district in particular along the supply chain.
	(Maloni & Benton, 2000)	Supply chain partnership	Questionnaire survey of 180 first tier suppliers of two automotive firms	Power created dependence can lead to opportunism by partners and subsequently dissolve many of the relational elements necessary for the development of effective buyer-supplier relationships.

P10 Balanced Power and knowledge utilization	(Albino et al., 1999)	Regional interfirm network	Archival based analysis of a regional firm network	Leader firm could choose to control the knowledge transfer process (including application) by either promote or restrict knowledge transfer in the industrial district in particular along the supply chain.
	(Kim et al., 2004)	Industrial group	Secondary data analysis of 295 manufacturing firms	Keiretsu member firms that have stronger power in their keiretsu are likely to use their power in their favor and focus more on the growth benefits, while those that have weaker power are constrained by the keiretsu in focusing more on the profitability benefits so as to support the competitiveness of the keiretsu.
	(Makhija & Ganesh, 1997)	Learning related Joint-venture	Literature review and propositions development	JV partner with a greater distribution of power would be more able to affect the design and use of control systems. Because control mechanisms are the means through which capabilities are transferred, partners with less bargaining power would not be assured of achieving their goals through the JV.
P11 Knowledge acquisition and knowledge internalization	(Huber, 1991)	Intra-firm learning	Literature review and theory development	Many organizational members and units that serve as knowledge acquirers also have as part of their role, sharing what they have acquired with other organizational components.
	(Hult et al., 2004)	Supply chain partnership	Questionnaire survey of 58 supply chain in transportation industry	Knowledge acquisition activities shape information distribution activities.
P12 Knowledge internalization and knowledge utilization	(Cohen & Levinthal, 1990)	Interfirm relationship in general	Archival based analysis of 1719 manufacturing organizations	While some of the external knowledge a firm acquires may be acted on immediately, it is more likely that it will have to be adapted and disseminated internally before it can be commercially utilized.
	(Crossan & Berdrow, 2003)	Intra firm organizational learning	Case study of a firm in post industry	Activities associated with exploitation are well articulated and considered logical, having emerged through the processes of exploration – intuition, interpreting, integrating, and institutionalizing.
	(Lane et al., 2001)	International joint venture	Questionnaire survey of 78 firms in multiple industry	The IJV's strategy and training competence are suggested to shape its ability to apply the assimilated knowledge.