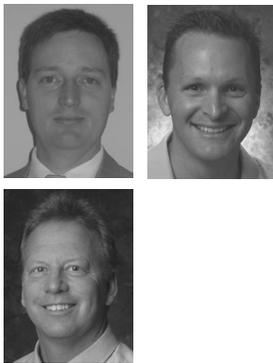


Investigating the role of knowledge in alliance performance

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Abstract

Purpose – The purpose of this paper is to show that following from the premise that knowledge comprises the fundamental source of competitive advantage, this study provides results of a meta-analysis that examines whether and how alliance performance is influenced by the role knowledge plays in a strategic alliance.

Design/methodology/approach – Meta-analysis is employed as the driving methodology in this study. The meta-analysis approach permits the literature on interfirm knowledge management to be reviewed and synthesized such that the role of knowledge in the alliance, environmental risk, and alliance performance can be thoroughly and validly investigated.

Findings – The findings suggest that the level of risk associated with the environment in which the alliance partners join forces does not moderate the relationship between the various “roles” of knowledge and alliance performance, whereas the magnitude and type of interfirm cohesiveness enjoyed or endured by the alliance participants does materially impact alliance performance. These performance differences suggest that – when the subject is alliance performance – knowledge management strategies matter more than environmental factors.

Research implications/limitations – The environmental uncertainty construct proved the biggest surprise, given conventional views that alliances should prove more effective in turbulent environments. However, implications are limited by observations that suggest the current alliance literature lacks well-developed and corroborated knowledge and performance constructs. This, in turn, implies researchers should systematically assess the validity of extant knowledge and performance measures.

Practical implications – The observed positive relationship between increased levels of knowledge interchange, alliance cohesion, and alliance performance is a materially practical implication. This was especially true within industries that are inherently more dependent on vertical supplier or buyer relationships, such as manufacturing and services. Active interfirm knowledge management appears to contribute more to alliance performance than environmental factors.

Originality/value – This paper describes the first study to meta-analyze the role and influence of knowledge constructs within the alliance literature. As such, the results empirically confirm some presumed conventional wisdoms while calling others into question.

Keywords Strategic alliances, Knowledge creation, Knowledge management, Knowledge sharing

Paper type Research paper

Alliances are big business. Firms primarily seek strategic alliances as a means of achieving competitive advantage (Dyer and Singh, 1998). Alliance competitive advantage roots itself in firm-level knowledge resources (Barney, 1991). Alliance formation has been described as the exchange of access to resources, skills, and, most importantly, knowledge (Varadarajan and Cunningham, 1995). Firms with \$2 billion or more in revenues developed an average of 138 alliances between 1996 and 1999 (Schifrin, 2001a). But there is one major problem with alliances: up to 75 percent fail (Liker and Choi, 2004). Senior managers clearly grasp the potential benefits of alliances; but history suggests management often does not understand what makes alliances succeed.

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The importance of senior decision makers' influence on alliance success cannot be overstated. Senior decision makers within the firm carry out the search for resources, skills, or information, making alliances socially embedded institutions (Rindfleisch and Moorman, 2003). The embedded nature of alliances has been described as driven by the search for knowledge in an effort to reduce uncertainty (Gulati, 1998). Research suggests performance benefits tend to accrue more readily to those firms that are best able to share knowledge between organizations (Inkpen and Tsang, 2005).

This study is grounded in the social embeddedness perspective. Social embeddedness suggests a search for knowledge underlies the reason why firms enter alliances in the first place. Indeed, numerous studies refer to the primary trigger of alliance formation as the quest to generate, acquire, or use knowledge (Moorman, 1995; Rindfleisch and Moorman, 2001; Moorman and Miner, 1997; Simonin, 1999; Nielsen, 2003; Grant and Baden-Fuller, 2004). The continuous quest for knowledge makes alliances catalysts for re-distributing asymmetric skills and resources between firms (Day, 2006; Hamel, 1991).

Little to no consensus exists regarding the nature of knowledge's relationship to the successful performance of strategic alliances (Teece, 1998). Yet the relevant literature has grown to the point where a meta-analysis aimed at evaluating the performance implications of the various roles of knowledge and their moderators in alliance research should prove fruitful. Given the ever-expanding quantity of domestic and international alliances in a flattening global economy, the strategic managerial implications that should emerge from such research may prove substantial.

Two research objectives drive this study. To begin with, this study seeks to demonstrate whether and how alliance performance is influenced by the role knowledge plays in a strategic alliance. In addition, this study seeks to develop theoretically and managerially actionable insights into the nature and role of critical knowledge-related factors that may moderate the successful application of knowledge by firms collaborating within strategic alliances.

Achieving these objectives should contribute to the systematic examination of the interorganizational rent-generating process. If firms garner performance benefits by transferring knowledge from other firms (Inkpen and Tsang, 2005), these findings should shed light on an important aspect of the idiosyncratic firm linkages that generate competitive advantage (Dyer and Singh, 1998). Additionally, this meta-analysis illuminates the importance of *cohesion* – a new construct proposed as a simpler way of accounting for relational and governmental aspects of alliances.

Knowledge as the fundamental source of competitive advantage

Business literature may be re-orienting itself around a new dominant logic, one highly congruent with the tenets of alliance literature, where knowledge is the source of competitive advantage (Vargo and Lusch, 2004a; Inkpen and Tsang, 2005; Grant and Baden-Fuller, 2004; McEvily and Chakravarthy, 2002; Kogut, 2000). Recently, scholars have debated a new dominant logic for sustained competitive advantage based with knowledge at the core of the ability to capitalize on market opportunities.

Known as Service-Dominant (S-D) Logic (Vargo and Lusch, 2004b), this new dominant logic posits that knowledge, and the knowledge processes surrounding products and product management, are key sources of competitive advantage (Lusch and Vargo, 2006; Vargo and Lusch, 2004a). Market-based knowledge and core competency intertwine to form the basis

of competitive advantage. Further, “knowledge as the basis for competitive advantage can be extended to the entire supply chain” (Vargo and Lusch, 2004b, p. 9). It is through knowledge that firms, allied with partners, bring value to consumers.

Background of alliance research

Alliances range across a wide range of collaborative activities. These include supplier-buyer partnerships, joint marketing efforts, shared new product development, shared manufacturing arrangements, common distribution agreements, and franchising (Grant and Baden-Fuller, 2004). Firms entering alliance relationships have made deliberate decisions to accept greater dependency in certain functional areas in exchange for greater access to resources viewed as important by them in other functional areas. An alliance exchange relationship itself is “trussed” together by the partnering firms’ shared expectation, usually explicitly stated, that each will work together in pursuit of a goal that, if not completely isomorphic, is at least acceptable to each partner. Presumably, alliance formation and execution are driven by an understanding and acceptance of such information. The fact that “knowledge” plays a prominent role in all these processes is obvious.

The alliance knowledge literature draws extensively from three theoretical schools. One is the resource-based view of the firm (Barney, 1991). Prahalad and Hamel’s (1990) competence-based view also plays an important role. Finally, Grant’s (1996) knowledge-based theory of the firm is also drawn upon widely. These and other theories provided the basis for the conceptual model tested in this meta-analysis (see Figure 1).

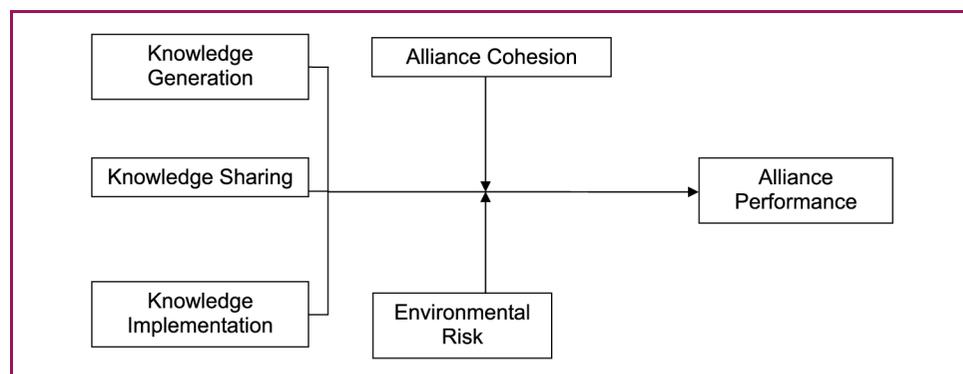
Methodology

Meta-analysis functions as a survey of studies, using study-level results to seek general types of relationships (Kerlinger and Lee, 2000). Though its roots go back at least as far as agricultural studies in the 1930s, meta-analysis has since rapidly promulgated through the social sciences as a means of performing a literature review capable of discerning regular patterns responsible for divergent findings (Bangert-Drowns, 1986).

Meta-analysis seeks common findings from across a variety of settings, thus shifting focus from robustness to generalizability. It is appropriate for resolving conflicting findings as well as assessing the relative importance of different independent variables (Lipsey and Wilson, 2001).

For the purposes of this research endeavor, meta-analysis is viewed as a slightly less subjective literature review, applying quantitative methods to an essentially qualitative endeavor, a view supported by the fact that meta-analysis “. . . is truly an analysis of the results of statistical analysis” (Hedges and Olkin, 1985, p. 13), and does not directly analyze the data themselves. Results of this (or any other) meta-analysis therefore assess the state of literary consensus rather than directly assessing the data. When and where a literature exhibits conflicting empirical results, meta-analysis is the method of choice for finding consensus.

Figure 1 Proposed model



Background to the research

Alliances play a key role in re-distributing asymmetric skills and resources between firms (Hamel, 1991). Some research suggests performance benefits tend to accrue more readily to firms that are best able to access knowledge between organizations (Inkpen and Tsang, 2005; Grant and Baden-Fuller, 2004). Other research underscores the benefits of knowledge-based competitive advantages, often in connection with the competitive advantages accrued through causal ambiguity (McEvily and Chakravarthy, 2002; Reed and DeFillipi, 1990; Zander and Kogut, 1995; Simonin, 1999) or firms seeking to concentrate on their core competence (Prahalad and Hamel, 1990). However, empirical support in the literature for the knowledge-performance link in alliances remains limited.

Among extant examples of the performance-enhancing benefits of interfirm knowledge transfers, a few stand out. In the logistics literature, information processing has been cited as critical to efficiency and effectiveness (Bowersox *et al.*, 2000). In the management literature, Hult *et al.* (2004) proposed a model relating achieved memory, knowledge acquisition, information distribution and shared meaning to cycle time. Each of these four constructs offers a different perspective on the role of knowledge in relation to business improvement.

Achieved memory provides a guide to other information processes in an organization, a background or frame of reference for collective action. Knowledge acquisition activities convert experience and other gathered knowledge, often focused on certain areas, in order to direct firm resources more judiciously (Huber, 1991). Information distribution activities benefit from both formal and informal communication procedures and communication media to transmit needed information and speed interactions (Kohli and Jaworski, 1990; Narver and Slater, 1990). In all these cases, the interplay of the role of knowledge, environmental risk, and the interorganizational relationship forms determine alliance performance. Based on a literature review and the meta-analysis findings, the following insights describe this interplay.

Theoretic background of the roles of knowledge

Knowledge generation

Drawing upon the information acquisition views of Rindfleisch and Moorman (2001), our view of knowledge generation focuses on the acquisition of information that pertains directly to the development of new products or services. The prevailing literature generally supports the premise that intra-firm knowledge generation contributes to firm growth and success (Andrews and Smith, 1996; Sethi *et al.*, 2001; Kohli and Jaworski, 1993). Research has supported knowledge generation's effectiveness at developing new products in the inter-firm context (Rindfleisch and Moorman, 2001; Sivadas and Dwyer, 2000; Im and Workman, 2004).

Alliances provide a primary vehicle for interfirm interactions that lead to innovation generation (Roy *et al.*, 2004; Nielsen, 2005). Alliances have been called "... the most important source of new ideas and information that result in performance-enhancing technology and innovations" (Dyer and Singh, 1998, p. 665). Unfortunately, requirements for successful innovativeness include flexibility and departures from planned objectives, factors that may destabilize alliances (Sivadas and Dwyer, 2000). This may partially explain the high failure rate for alliances.

Nevertheless, empirical studies of alliances in industries where successful performance depends more heavily on innovation indicate that members of alliances that do survive outperform firms that lack innovative partners (Stuart, 2000). Furthermore, the more complex and tacit the knowledge required for the innovation, the greater the advantage of the alliance relationship (McEvily and Chakravarthy, 2002).

Knowledge sharing

Variously described as knowledge transfer or interfirm learning, knowledge sharing requires information systems that support sharing (Kohli and Jaworski, 1993), resources,

competencies, personnel and other knowledge resources already possessed by at least one alliance member but not by at least one other (Baker and Sinkula, 1999). Knowledge sharing refers to the extent to which know-how and critical information are accessible between organizations (Appleyard, 1996).

Knowledge sharing reflects the process of merely accessing knowledge versus internalizing it from across the collaborative membrane that exists between organizations in an alliance (Hamel, 1991). Knowledge sharing is present in many instances of organizational learning, which is a form of knowledge generation (Roper and Crone, 2003; Appleyard, 1996). However, knowledge sharing forms a distinct inter-firm process, the essence of which consists of information sharing. As a process, knowledge sharing represents the antithesis of knowledge generation (Rindfleisch and Moorman, 2001).

An example of a horizontal knowledge sharing alliance is SEMATECH. SEMATECH is a group of semiconductor manufacturing firms that team up for the purposes of setting standards and tracking industry trends. Firms involved in knowledge sharing alliances generally consist of horizontal alliances seeking to reduce environmental uncertainty (Bucklin and Sengupta, 1993). Dyer and Singh's conceptualization of information sharing is a near proxy for this study's concept of knowledge sharing (Dyer and Singh, 1998).

Uses of knowledge sharing also include sharing complementary knowledge resources that may lead to competitive advantage or sharing of information on supplier and customer markets. Research has linked the sharing of knowledge at the organization level with higher short-term financial benefit (Moorman and Miner, 1997). Toyota offers an oft-cited example of the power of a strong knowledge sharing network (Dyer and Nobeoka, 2000). Some research has posited that knowledge sharing comprises the primary advantage that firms can secure through entering alliances (Grant and Baden-Fuller, 2004).

Knowledge implementation

Knowledge implementation occurs when generating or sharing knowledge becomes too difficult, expensive or time-consuming. The implicit and explicit costs associated with generating and sharing knowledge prompt one alliance partner's desire to permit a trusted partner to perform certain tasks (Kogut and Zander, 1992). This often happens when a firm elects to divest responsibility for performance of a non-core competence (Prahalad and Hamel, 1990).

A common example of knowledge implementation involves the use of logistics alliances to alleviate the need to generate competencies in transporting and tracking products from factory to customer. Knowledge sharing with a logistics partner can be expensive given that sharing information on package contents, origins, destinations, truck license number, air cargo flight numbers, shipping costs, hazardous material routing and the like requires that expensive information systems be developed. Many companies ally themselves closely with a logistics firm to avoid having to invest in expensive skills and resources themselves. Instead, they secure expert logistics partners who can function efficiently as "plug and play" logistics modules.

This arrangement works particularly well when both partners are relatively self-sufficient in their knowledge requirements. In such an arrangement, each firm adds value through the utilization of its specialized knowledge or capability. Many modern products and services emerge from complex combinations and consolidations of many skills and technologies, making it economically less tenable for a single company to create and maintain specialized knowledge in all of them.

Bringing together specialized knowledge, knowledge implementation alliances tend to rely on integrating systems to win over customers. For example, no single firm, not even Starbucks, could ever produce a successful latte in solitude. Now multiply the degree of complexity associated with a latte's production complexity by perhaps a million, and one begins to fathom the incredible role that knowledge implementation must play in the manufacture and maintenance of a joint strike fighter or space shuttle.

Knowledge implementation alliances are often evaluated in the supply chain literature. There, such alliances are purported to benefit their members by improving execution or consolidating common production expertise in order to garner the benefits of risk pooling and reduced investment in additional production capacity (Roper and Crone, 2003). These types of alliances generally seek improved efficiencies rather than new knowledge. They seek such efficiencies absent any intention of gaining another firm's knowledge. Instead, the alliance partners continue to compartmentalize knowledge in the alliance.

Knowledge implementation relies on the different abilities that are created when the differing capabilities of alliance member firms are strategically blended (Kogut and Zander, 1992). Component capabilities at the firm level make possible the emergence of architectural capabilities at the interfirm level (Henderson and Cockburn, 1994). This means that when designing an alliance, the mix and match of firms contributing their competences result in different alliance capabilities. Apple allied with Intel produces a much different mix of capabilities (and products) than Apple allied with IBM, but neither Apple nor Intel depends on each other for knowledge related to their core competences. Knowledge implementation facilitates improved economies of scale and competence at the firm level while leveraging the broader capabilities throughout the alliance.

Environmental risk

Studies on the impact of a firm's environment on its performance abound. One important cause of environmental risk is the rate of technological turnover (Bucklin and Sengupta, 1993). Market uncertainty is another source of environmental risk (Dahlstrom *et al.*, 1996). The extent of competition and market development stage constitute other specific environmental risk factors (Gulati, 1998). Regulatory environments impose other important factors that increase or decrease environmental risk by creating more or less supportive legal conditions (Li and Atuahene-Gima, 2002).

Environment contingencies, particularly of the unexpected sort, also inspire managerial responses, including the development of complex knowledge structures to combat risk (McNamara *et al.*, 2002). Empirical studies suggest alliances perform better in turbulent than in stable environments (Bucklin and Sengupta, 1993). Alliances provide a means of spreading risk and rapidly assimilating capabilities required to deal effectively with uncertainty. However, environmental risk may also diminish potential opportunities. This leads to a complex interaction between the benefits of knowledge garnered through alliance relationships and the ability to realize performance enhancements.

Alliance cohesion

In the alliance knowledge literature, Hamel described the concepts of "internalizing" as opposed to merely "accessing" knowledge (Hamel, 1991). Ostensibly, a collaborative membrane exists that functions as a filter between organizations in alliances. This collaborative membrane supposedly also influences the type of knowledge that flows between the organizations comprising an alliance, as well as the direction in which that information flows. The collaborative membrane purportedly defines the parameters of the collaborative exchange relationship that exists between alliance members. In the context of the model introduced below this collaborative membrane purportedly determines the cohesion of an alliance network. Cohesion results from one of two approaches to interorganizational interaction: collaboration and modularization.

Kahn's (1996) work on integration suggests "collaboration" denotes continuous interaction, usually of an informal nature, without a clearly defined structure. Collaborative efforts attempt to achieve collective goals by sharing resources and a common vision. In highly unstable environments, collaboration offers advantages for organizations by buffering volatility, which, in turn, enhances the opportunity to learn-by-doing (Sorenson, 2003).

Modularization, by contrast, entails an architecture of discrete organizational nodes or clusters held together by standards of member performance and conformance to design rules (Langlois, 2002). Such arrangements tend to lower transaction costs while preserving the separate identities of the firms involved (Kahn, 1996). Ethiraj and Levinthal (2004)

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revealed that modularity results in improved speed and efficiency through redundant parallel operations by several network members. Idle time is reduced, prompting more completed work in the same amount of time compared to situations where the same operations are all conducted by one firm.

Products of limited diversity with independent markets for each of the modules (such as computer memory) tend to benefit greatly from the recombination possibilities of modularity. Operations requiring more complex interactions, such as testing and integrating new product innovations, bring to light the difficulties of optimizing highly interdependent processes in a modular network (Ethiraj and Levinthal, 2004). Products involving highly complex interdependencies of design and manufacture, or heterogeneity in available design choices (such as a microprocessor), tend to benefit more from integration.

The moderating effect of cohesion should interact differently with distinctive forms of knowledge. However, modularity and integration should each work well in the appropriate environment.

Alliance performance

Alliance performance measures vary with the purpose of the alliance. Studies of alliance new product innovations usually measure new product success or knowledge transfer (Sivadas and Dwyer, 2000; Rindfleisch and Moorman, 2001). Other studies measure some aspect of the alliance itself, such as duration or partner trust (Geringer and Herbert, 1991; Yan and Zeng, 1999). Still others have focused on performance metrics such as market share or profits (Singh and Mitchell, 2005; Geringer and Herbert, 1991). Lastly, some studies measure an overall assessment of alliance satisfaction (Lin and Germain, 1998; Dahlstrom *et al.*, 1996).

A study by Ariño assessed the validity of an assortment of alliance performance constructs. The strongest support was observed for the validity of outcome and process measures. The weakest validity findings were associated with financial measures and measures of some aspect of the alliance itself (Ariño, 2003). Outcome performance metrics focus on the degree to which alliance goals are accomplished. In contrast, process performance metrics assess the acceptability of the resultant interactions to the various alliance partners. This suggests the manner in which alliance performance is measured impacts the magnitude of results.

Meta-analysis results

Overall results of the meta-analysis provide evidence that cohesion and knowledge significantly influence alliance performance. Thus, the underlying thesis proposed in this study that the sharing, implementing, and generating of knowledge, as well as interfirm knowledge management strategies, should contribute positively and significantly to alliance performance is supported. However, environmental uncertainty exhibited only a small effect on alliance performance.

Alliances based on the generation and implementation roles of knowledge appear to harvest positive alliance performance, supporting extant literature purporting the existence of a link between inter-firm ability to transfer knowledge and performance (Almeida and Kogut, 1999; Inkpen and Tsang, 2005). Furthermore, knowledge “generation” and “implementation” activities generated similar alliance performance outcomes.

By contrast, meta-evidence did not reveal the presence of a positive relationship for alliances based on knowledge sharing and alliance performance. A wide spread of mean

effect size values observed for knowledge sharing suggests “sharing” may provide a less certain path to alliance success. The data indicate that, as the least intense form of knowledge exchange, knowledge sharing may merely represent the price of entry, and thus offers no competitive advantage.

Environment did not exhibit a significant mean effect size on alliance performance. Therefore, alliance environmental risk apparently does not moderate the relationship between the various “roles” of knowledge and alliance performance. Several discrete factors may account for this counter-intuitive finding and appear in the discussion. This supports extant literature that views alliances as a reaction to (and therefore endemic to) environmental uncertainty (Gulati, 1998).

With regard to cohesion, study samples categorized as collaborations returned the highest effect size. Modular alliance cohesion, in turn, forms returned a mediocre effect size. And alliances characterized by low levels of interaction returned a zero mean effect size. These results are consistent with S-D Logic and other knowledge management literature that posit interfirm returns in relation to the degree of interaction and collaboration that occurs.

Discussion

This study provided an exploratory foray into the domain of disparate studies, methods, findings, and statistics previously employed to assess key antecedents to alliance performance. It has yielded several useful insights, both theoretical and practical, regarding the status and implications of the literature on the role of knowledge on alliance performance.

Strategic management implications

Senior managers involved in or contemplating participation in strategic alliances may benefit from several of the practical insights derived above. For starters, alliances primarily based on sharing knowledge exhibited much lower alliance performance benefits than those primarily based on implementing and generating knowledge. This may reflect the impact of differential effects of commitment. Mere knowledge sharing requires much less commitment than adapting organization processes to implement or generate new knowledge.

The results also imply alliances that integrate knowledge-based processes may realize greater benefits within industries that are inherently more dependent on vertical supplier or buyer relationships, such as manufacturing and services. This further implies industry type may function as a proxy for alliance risk. Greater risk presumably drives the search for knowledge to collaboration up and down the value chain, whereas lower-risk, less competitive industries may “allow” management to feel more secure in horizontal knowledge-sharing arrangements.

In terms of managing alliances, outcome-oriented alliance performance measures – followed closely by process measures – appear to provide the greatest benefit in terms of alliance performance. Managers who measure alliance performance through financial knowledge or based upon longevity metrics appear less likely to observe improved alliance performance. This implication is consistent with market orientation theory. Market orientation theory asserts that focusing on outcomes and processes beneficial to customers will lead to the greatest long-run performance benefits for alliance partners (Kirca *et al.*, 2005).

Knowledge implementation and knowledge generation exercised essentially the same magnitude of effect on alliance performance. Implementing knowledge in an alliance setting implies continuous innovation of processes as the alliance members adapt intra-organizational processes to the alliance inter-organizational processes (Sarkar *et al.*, 2001). According to this line of reasoning, implementation of knowledge may essentially equate to knowledge generation, casting new light on the importance of intra-organizational adaptability and commitment to alliance performance.

The apparent equivalence of knowledge implementation and knowledge generation reinforces recent qualitative suggestions that the motivation of alliance members and value

expected from social interaction may lead to more successful collaborative endeavors than those relationships organized by financial value expectations (Golicic and Mentzer, 2005). The contribution that social relations may make to successful collaboration may emanate from a desire at the individual manager level to garner knowledge from outside organizations, particularly in organizations that are internally competitive (Menon, 2000).

Extant research reinforces the notion that the social aspect of interorganizational relationships is a key factor that may buttress the successful utilization of knowledge in a collaborative setting. Rindfleisch and Moorman (2001) found that emotional closeness facilitated knowledge transfer among actors – social networks formed by managers with similar responsibilities across firms will facilitate inter-organizational knowledge transfer, suggesting the importance of deliberately fostering social exchanges (dinners, golf outings, etc). This would pertain especially to horizontal (competitor) alliances whose customers suffer more acutely from lack of collaboration (Rindfleisch and Moorman, 2003). An organization's cultural and structural characteristics may, in fact, determine to a great degree how knowledge is utilized (Menon and Varadarajan, 1992). In any case, sharing of knowledge appears to offer a less certain route to alliance success.

The analysis associated with study specification underscores that the effects of an alliance take time to bear fruit. New product development and newly formed alliances did not exhibit significant mean effect sizes in their relationships between knowledge and alliance performance. But the lack of significance for longevity as a measure of alliance success also implies successful alliances do not necessarily last longer. The data clearly revealed that firms that were more committed to an on-going (i.e. lasting) alliance benefit more from the knowledge interchanges that take place.

Managers should also realize that in highly uncertain environments, alliances might mitigate but not necessarily prevent negative performance consequences. This may strike readers as simple common sense. But, given the non-significant performance improvement findings for newly formed and new product development alliances, decision makers considering alliances may best serve their own professional interests by viewing them as part of long-term strategies aimed at better serving customers rather than quick strike crisis management solutions. Those seeking immediate succor from changing competitive environments may be disappointed.

Research implications

The role of knowledge in alliances appears to differ drastically by industry type. In service sectors, a strong relationship existed between knowledge and alliance performance. In manufacturing sectors, a weaker but still important relationship was present.

Services and manufacturing firms each depend upon other members of their value chains to contribute to efficiency and efficacy. So these industry sector differences may result from the prevalence and importance of vertical alliances in these industries. However, with only four services and five manufacturing studies included in the meta-analysis, further research would be necessary to establish more fully their generalizability. Three of the four service industries interfaced directly with end customers (construction services, advertising and software agencies, and retail gas service stations) and were international or non-US in scope (Nygaard and Dahlstrom, 2002; Sarkar *et al.*, 2001; Helfert *et al.*, 2002), while the fourth studied the US warehousing service industry (Dahlstrom *et al.*, 1996).

The manufacturing studies covered a spectrum of companies and industries operating in both US and non-US contexts (Dussauge *et al.*, 2004). High tech industries were revealed to not benefit as much from knowledge in alliance relationships, despite the important benefits of learning and having established routines of innovation and production to high tech firm success (Macher and Mowery, 2003). This finding contradicts literature predicting that established standards such as those apparent in many high tech industries should lead to improved innovation – even in uncertain environments (Rindfleisch and Moorman, 2001).

The environmental uncertainty construct revealed the biggest surprise, especially in light of Bucklin and Sengupta's (1993) findings suggesting alliances are more effective in turbulent

environments. The lack of significance and low but negative effect size indicate that either research does not address the correct measures of environmental (knowledge) uncertainty, or perhaps that environmental uncertainty does not always correlate with alliance performance. For example, industries enjoying relatively low environmental risk, such as cement companies, still might leverage economy of scale advantages from alliances, but did not demonstrate the moderating effect of uncertainty on alliance performance. Alternatively, alliances may successfully mitigate uncertain environment knowledge enough to diminish a strong correlation with alliance performance.

The non-significant finding for sample perspective may result from the failure of many studies to control for the factor. Many studies may have overlooked an important dimension – namely, that the perceived performance of alliances may depend on the role of players in the exchange relationships. For example, alliances may prove more beneficial to suppliers, or when suppliers share risk with their buyers in a close dyad.

Consistent with the strength-of-ties literature (Rindfleisch and Moorman, 2001; Wuyts *et al.*, 2004), the type of alliance returned highly significant results for collaborative alliances, but weak results for the most represented alliance type in this meta-analysis, the joint venture. However, many studies do not consider alliance type when assessing the relationship between knowledge and alliance performance.

Research should explore the conceptual differences, if indeed any exist, between knowledge generation and implementation. Conceptually this makes sense. Merely sharing knowledge implies weaker alliance effects than do more integrated operations with alliance partners as implied by the partners' willingness to generate or implement knowledge. Regardless, sharing knowledge appears a less certain path to alliance success.

The importance of environmental antecedents of alliances, as well as the construct's potential effects on alliance performance, each represent important research topics that have, to date, been insufficiently explored. Obviously, the continuously dynamic nature of the macro-environment inherently complicates its study. But absent an understanding of the role and effects of the relevant market environment, theoretical explanations lose power.

In many industries, alliances are employed routinely as strategic devices intended to enable alliance participants to cope more effectively with environmental uncertainty. However, this meta-analysis revealed that only a weak negative effect existed between uncertainty and alliance performance. The possibility exists, of course, that alliances may successfully mitigate environmental (knowledge) uncertainty enough to diminish a strong correlation with alliance performance. Clearly, the question merits further consideration.

The influence of industry on knowledge's ability to contribute to alliance performance begs further investigation. For example, the non-significant findings for the high tech industry may result from alliance networks merely representing the price of entry to this industry. Or, the cause may follow from the modular nature of relationships that characterize much of the high tech industry, thus inhibiting the full realization of knowledge-driven alliance benefits. The finding of a significant model for the industry-alliance type interaction, in conjunction with inclusion of the environmental uncertainty variable, may imply that different alliance types work better (or worse) in different industries.

Yet another explanation may reside in the rapidly changing nature of high tech and similar industries – alliance relationships need to change too quickly for them to achieve their full potential, thus diminishing the benefits of knowledge gained through alliances in these

“ Knowledge implementation occurs when generating or sharing knowledge becomes too difficult, expensive or time-consuming. ”

industries. The fact that some large high tech firms such as Intel, Samsung and Texas Instruments maintain a large part of their capability in-house rather than through partnerships or outsourcing illustrates that alliances are hardly the sole strategy through which knowledge uncertainty might be addressed (Carbone, 2005).

Limitations and future research

In sum, this meta-analysis indicates the role of knowledge is an important indicator of alliance performance, and that cohesion and environmental uncertainty are important moderators of this relationship. Unfortunately, extant alliance literature lacks standardized measures and sufficient empirical research to conduct a truly thorough meta-analysis of these relationships. This deficit underscores the need to continue to work toward a consensus regarding possible antecedents and consequences of knowledge in alliances.

The lack of sufficient correlations to conduct more detailed weighted regression analyses of the study effects implies journals should publish or make accessible study data for replication by other researchers. Alliances impose a large burden on researchers in terms of the large numbers of players as well as the absolute variety of possible antecedents and consequences associated with alliance performance. The costs levied on researchers to gather this data augment the importance of sharing available data with other researchers.

The re-framing of alliances with the new construct of alliance cohesion captures the degree of trust and cooperation that results from the relational norms created through the interactions of alliance partners. Cohesion facilitates coordination and the sharing of information and other resources/market opportunities (Gargiulo and Benassi, 2000). Alliances depend on regular interaction and the consequent knowledge production to succeed. Alliance members that fail to interact regularly may lack the knowledge, ability or opportunity to enforce norms against another member (Coleman, 1988). Future research should elaborate/invest study on the knowledge-derived ties that bind alliances together under different environmental and industrial circumstances. Hamel's (1991) concept of a permeable membrane seems an appropriate starting point for a more organic view of interorganizational relations.

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