Global Strategy Journal
Global Strat. J., **1**: 67–85 (2011)
Published online in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1111/j.2042-5805.2011.00001.x

HOW TIGHT AN EMBRACE? CHOOSING THE OPTIMAL DEGREE OF PARTNER INTERACTION IN ALLIANCES BASED ON RISK, TECHNOLOGY CHARACTERISTICS, AND AGREEMENT PROVISIONS

FAROK J. CONTRACTOR,[1]* JAMES A. WOODLEY,[2] and ANKE PIEPENBRINK[1]
[1] *Rutgers University, Rutgers Business School, Newark, New Jersey, U.S.A.*
[2] *Ramapo College, Anisfield School of Business, Mahwah, New Jersey, U.S.A.*

This study examines a key question one asks when negotiating an alliance: 'how tight or loose a relationship do we wish to have with our partner?' Interaction with one's partner is necessary in order to coordinate operations, effectively transfer tacit knowledge, monitor for opportunism, maximize joint synergistic value, and make sure that an appropriate share of the net benefit created by the alliance is appropriated by the technology provider. However, too tight an 'embrace' or too high a degree of interaction between the allies can increase coordination costs and increase the chance of unintended technology leakage. The sample, comprising 95 international alliances involving technology transfers, is grouped into four clusters with rising levels of interaction between allies. The optimal degree of interaction between the partners is explained by variables drawn from (1) technology characteristics and future technology policy, (2) coordination costs and risks, (3) agreement provisions, and (4) firm and sector characteristics that existed during the negotiation of the alliance. Using a proportional odds model, variables in the 'coordination costs and risks' and 'agreement provisions' categories found the most support in the results. Copyright © 2011 Strategic Management Society.

INTRODUCTION

An alliance is an interorganizational embrace between two or more organizations that remain distinct, except that they cooperate for a specific joint purpose. Each partner's strategic goals amount to (1) maximizing the joint net value or net benefits resulting from the cooperation (Zajac and Olsen, 1993; Colombo, 2003), (2) appropriation of a goodly *share* of the net benefits created (Gulati and Singh, 1998), (3) minimizing each partner's own costs and risk. 'Appropriation' of the benefits from an alliance can take several forms. It can involve financial gains such as profits and equity growth on the shares held in an equity-based joint venture (JV) or royalties earned on technology licenses. Alliance benefits could also accrue from earning profit mark-ups on outsourced components or products bought or sold (i.e., traded) between the allies in supply chain partnerships (Wathne and Heide, 2004; Kaufman, Wood, and Theyel, 2000; Jeffries and Reed, 2000). Alternatively, the benefit each partner derives from an alliance may be nonfinancial, but no less important, such as learning valuable process techniques or other

Keywords: international strategic alliance; technology alliance; partner relations; agreement provisions
*Correspondence to: Farok J. Contractor, Rutgers University, Rutgers Business School, 1 Washington Park, Newark, NJ 07102, U.S.A. E-mail: farok@andromeda.rutgers.edu

knowledge from the alliance organization or other partner. However, each ally incurs transaction costs (TC), such as unrecoverable investments and partner opportunism, such as shirking, violating agreements, withholding information and future competition, from their former ally—all of which are, by now, venerable concepts in the TC literature.

The key strategic issue for each partner then is how to maximize joint net benefits and appropriate their share of the joint value created, while minimizing their own costs and risks (Hansen, Hoskisson, and Barney, 2008). In 'learning alliances' where creation and appropriation of knowledge are the dominant consideration, Kale, Singh, and Perlmutter (2000: 217) describe this as '. . . the balance between trying to learn and trying to protect.' For example, in sectors such as pharmaceuticals, telecommunications, chemicals, and computers, a key issue in interorganizational cooperation is how to extract knowledge and skills from partners while protecting one's own proprietary knowledge assets.

Taxonomies of alliance organization: structure or process?

If maximizing value creation and appropriation while minimizing cost and risk are the overarching goals, what is the best type or form of alliance? Scholars have tried to answer this question in structural terms or by positing different 'governance' types, contrasting contractual to 'hierarchical' (e.g., Carson, Madhok, and Wu, 2006; Hagedoorn and Hesen, 2007), or involving equity joint venture investments versus 'non-equity' alliance dichotomies (e.g., Oxley and Wada, 2009; Contractor and Woodley, 2009; Mellewigt and Das, 2010; Osborn and Baughn, 1990; Oxley, 1999). Others have introduced, as part of their classification, a third category of so-called 'minority equity investments,' by which they mean one or both partners buying some small equity share in the other (Gulati and Singh, 1998; Das and Teng, 1998; Bierly and Coombs, 2004).[1] Such structural variables have been used in these studies to examine the determinants of the governance type chosen by the parties at the time of alliance formation.

But structure is not an end in itself. When it comes to creating and appropriating value or new technology in an alliance, learning from one's partner, improving the efficiency with which knowledge is transferred, coordinating with one's ally, or moderating their opportunism, it is the process and intensity of interactions between the personnel of the two companies—more than the legal or contractual form—that matter. To learn, coordinate, transfer technology effectively, moderate behavior, trust, commit, forebear, and/or reciprocate, etc., are interorganizational behaviors and processes. The point of this article is that—while there are several studies on 'governance choices' cited above, as well as recent literature scrutinizing the details of agreement provisions (e.g., Reuer, Ariño, and Mellewigt, 2006), insufficient attention has been paid to a taxonomy of collaboration based on the *degree of interactions* between partner personnel.

Designing the optimal degree of interaction between alliance partners

Structure and process are, of course, loosely correlated. The 'alliance governance' literature, some of which was cited earlier, shows how parties negotiating alliances choose a structure with the degree of future interactions in mind. Gulati and Singh (1998) use the term 'degree of coordination.' However, interactions between partners go beyond just coordination needs, to include key issues like the joint development of future technologies, setting price and delivery terms (in supply chain alliances), or the location of investment in the event that the allies are from different nations.

At one extreme, with a simple patent right license agreement, there may not be much need for ongoing future interaction or involvement, especially if the licensee is fully capable and only awaits legal permission to use the licensor's patent rights. Supply chain alliances (where allies trade components and/or finish products through each other) involve a greater need for coordination (Wathne and Heide, 2004; Jeffries and Reed, 2000; Kaufman *et al*., 2000) as models and outsourced component designs change. In many supply chain partnerships, the assembler and component supplier will undertake a joint R&D effort, codesigning future technology changes. Finally, with an equity JV, the degree of interorganizational interaction is the greatest since personnel from each partner are deputed to the JV company, full time and on an indefinite basis.

[1] A better term for such arrangements would be 'cross-shareholding,' since minority joint ventures, strictly speaking, refer to the creation of a third (alliance) company in which the two principal investors have unequal shareholding, one being the majority holder, while the other is a minority equity holder in the JV company they create.

DOI: 10.1111/j.2042-5805.2011.00001.x

Incidentally, virtually all alliances have written agreements, whether long or short, especially when a third joint venture company is created (Reuer *et al*., 2006).[2] However, the term 'contractual alliance' is usually associated with relatively short-term, unilateral transfers of patents or technology in licensing agreements, where the bulk of the contract's obligations are fulfilled once the patent or technology has been transferred and learned by the recipient. There may be no need for a long-term relationship for such alliances. The term 'relational contracting' is used when the partners need to develop a longer-term relationship and interact more frequently, for example in supply chain agreements (Kaufman *et al*., 2000; Wathne and Heide, 2004). This is because in supply chain partnerships, the product design, unit price, delivery quantity, and delivery frequency change over time and are, hence, less determinate for the future. This requires a higher degree of interaction, coordination, and ongoing negotiation between the allies regarding many buying-selling or supply chain issues—incidentally, this is one of the very few studies that tracks the degree of supply chain interaction between allies and incorporates it into the dependent variable.

In general, the more complex the alliance, the greater the need for 'relational capital' (Kale *et al*., 2000), which requires further and deeper interaction between the partners. Finally, when the future is least determinate and the capture of benefits or allocation of costs over the partners least certain—or when unknown future technology is involved—the best way to align the interests of the allies may be to involve them in creating an equity joint venture. In JVs, the benefits and costs are more likely to be incurred proportional to the shareholding of each ally in the JV company.

However, this article goes beyond governance form. We argue that governance structure is not an end in itself, but should be selected, in part, to facilitate the intended interorganizational interaction intensity and the involvement or commitment of each ally to the alliance. The degree of partner interaction is, in fact, a background theme for many frequently discussed topics in the field, such as governance choices, control, trust, commitment, and learning through alliances. It is important to an understanding of alliance design and outcomes. And yet, partner interaction has somehow remained an under-researched issue.

When negotiating and designing an alliance agreement, a key question is how closely we wish to interact or be involved with our ally. This article will address this issue from several perspectives. For example, consider possible influences of technology characteristics on partner interactions. In transferring technology to one's partner, there are potential concerns about opportunism or unintended technology transfer that later weaken the firm's overall competitive position. But, there needs to be a sufficient degree of interaction between the personnel of the two companies in order to effectively teach the other alliance partner—especially when technology is complex (Teece, 1977) and the transfer is to occur across national or cultural boundaries. More frequent and more broad-based interaction between the partners facilitates greater and faster transfer of technology.

When the need to share information and the need to protect the firm against opportunism and future competitive threat are in opposition, setting the 'right' frequency, depth, and scope of interaction can be particularly challenging for managers. Figure 1 outlines this and other variables which we hypothesize will influence the degree of interaction between partners. These are categorized into four groups: (1) technology characteristics and intent, (2) coordination costs and risks, (3) agreement provisions, and (4) firm and sector characteristics.

The next section develops hypotheses. Interestingly, despite more than two decades of alliance studies, the literature provides opposing views on the effect of some variables on governance choices and the expected degree of interaction between partners. In such cases, we do not shy away from discussing both view and counter-view, although one of the two is finally stated as the formal hypothesis. In other cases, there are very few, or no, antecedent studies in the literature on significant variables (such as territorial exclusivity, the number of alternative alliance partners available at the time of negotiation, or degree of standardization and commercialization of the product), although practitioners have long averred that these very much influence alliance agreements. Despite the fact that almost all alliances are covered by a formal contract, Reuer and Ariño (2007: 326), observe that '. . . research has largely

[2] It is relatively recently that empirical studies have begun to pay attention to provisions in the alliance agreement to see how these affect outcomes and behavior. This article includes some key agreement variables.

DOI: 10.1111/j.2042-5805.2011.00001.x

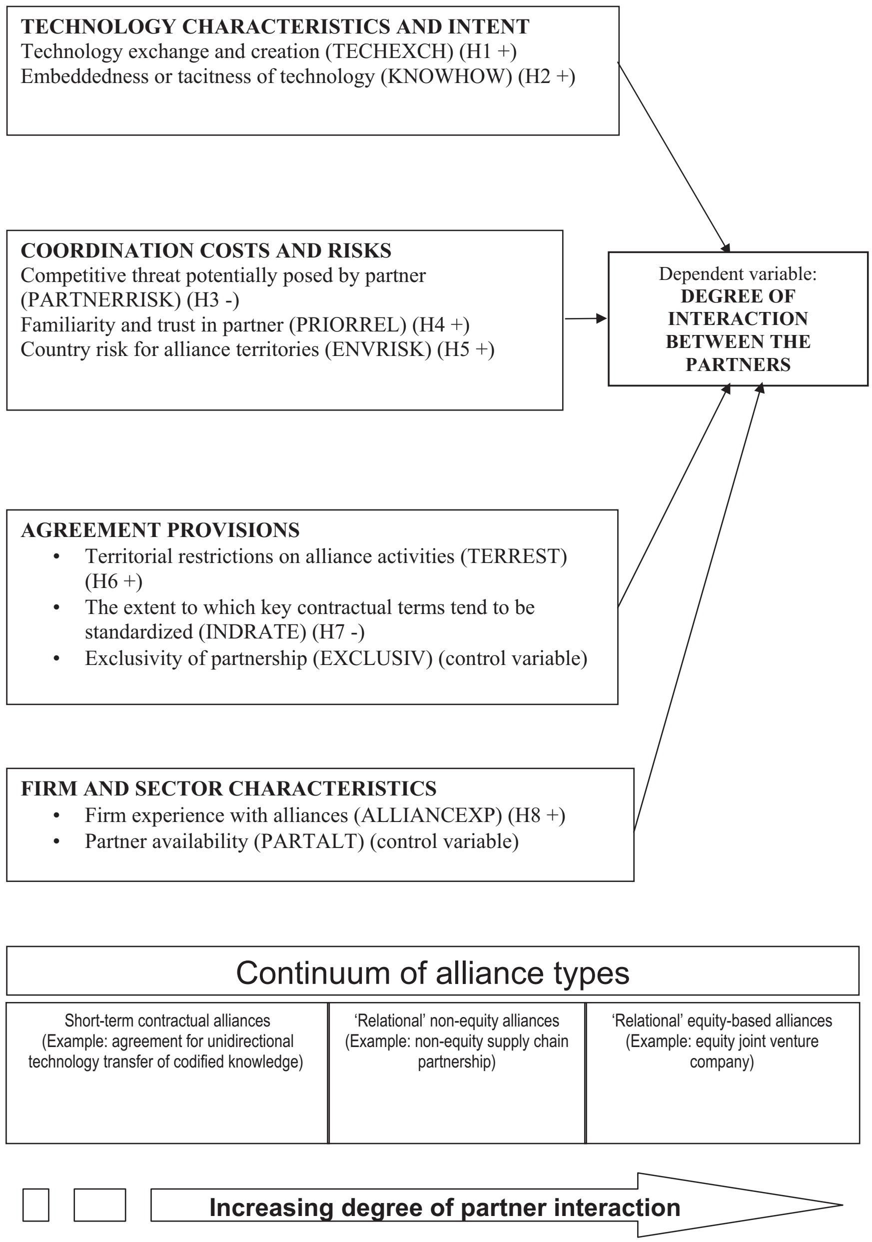

Figure 1. Model summary (with hypothesized signs for coefficients)

ignored alliance contracting . . .' and that differences in contract provisions '. . . are not captured by the equity/non-equity dichotomy so commonly used in empirical research . . .' We still have quite a bit to learn about the design of alliances during the agreement negotiation process, as well as the influence of some contextual variables, such as the availability of other potentially suitable partners, that may influence the negotiation process.

HYPOTHESES

Technology transfers and exchanges

In this article, we distinguish between three types of technology relationships, with a rising level of expected partner interaction for each. The first is where there is a specific technology or intellectual property that is identified and that one ally wishes to

Global Strat. J., **1**: 67–85 (2011)
DOI: 10.1111/j.2042-5805.2011.00001.x

receive from the other. The intensity of interaction or involvement would likely taper off after the specific technology asset is transferred from one party to the other. The second case is where a unidirectional technology transfer from one partner to the other is expected to continue for a medium or long duration, well into the future. In the third case, technology exchanges are expected to be bidirectional, as both partner firms expect to continue to learn from each other, sometimes with the objective of creating new technology. Colombo (2003) suggests that bidirectional, as opposed to unidirectional, technology transfers are more likely to involve greater controls, hierarchy, and joint work teams, as well as a greater degree of interpartner interaction. Future bilateral knowledge transfers are also likely to entail greater ambiguity (Carson *et al*., 2006) and require a closer alliance governance type (Contractor and Woodley, 2009) since they entail the creation of new knowledge. In 'highly interdependent activities', such as bilateral knowledge exchanges or joint R&D, 'coordination is difficult because . . . the overlapping division of labor calls for mutual adjustments, which precludes the use of standard rules' (Krishnan, Martin, and Noorderhaven, 2006: 896). Joint R&D programs have a greater likelihood of being equity JV types of alliances, according to Pangarkar and Klein (2001). Equity joint ventures facilitate a deeper intensity of interaction between the partners than more distant licensing agreements tend to do. More hierarchical alliance structures are associated with greater 'anticipated interdependence' and an 'expected technology component,' according to Gulati and Singh (1998). With the same thought, Oxley and Wada (2009) indicate that joint ventures provide a richer organizational milieu for interactive joint development work when there is a future '*technology building*' intent.

Going from (1) short-term or one-time unidirectional technology transfer from one ally to the other, to (2) anticipated long-term unidirectional technology transfer involving more ambiguous future technology, and finally to (3) anticipated future bidirectional exchanges and joint knowledge creation, there is rising *ex ante* uncertainty—at the time of negotiating the alliance—about the valuation of the technology to be created and how alliance benefits, costs, and each partner's obligations would be distributed in the future. This leads to contract incompleteness and greater uncertainty—uncertainty that the partners will need to coordinate in the future to resolve (Argyres and Mayer, 2007). At the same time, with joint R&D or less certain future bilateral technology transfers comes the expectation of closer interaction between the allies. Hence,

> *Hypothesis 1 (H1): In a technology alliance, increases in the expected duration and bidirectionality with which technology transfer and exchange take place between the partners, will increase the degree of interaction between the partners.*

Technology characteristics: codified knowledge vs. 'know-how'

Codified knowledge (whether formally registered as intellectual property or not) possessed by one firm is easier for the other firm to observe and value when negotiating an alliance. On the other hand, the value, extent, transfer difficulty, and absorption effectiveness of 'know-how,' or tacit knowledge, is more difficult to measure *ex ante* at the time of negotiation (Sampson, 2004). In a cross-section of alliances, the proportions of tacit versus codified knowledge will vary. As tacit knowledge becomes a more important component of the knowledge needed to make an alliance work, the partners are likely to need to interact more frequently and deeply (Kogut and Zander, 1992). The transfer of know-how is not simply a matter of handing over a patent right or the right to use a trademark for a certain country. Know-how requires joint experience and social interactions between the engineers and managers of the partner firms. A larger know-how (or tacit) component in the technology bundle increases the need for coordination (Park and Russo, 1996) and interaction to reduce potential misunderstandings about partner contributions (Oxley, 1999). Relational-based alliances are more effective in facilitating tacit knowledge transfers (Lee and Cavusgil, 2006), and relational based alliances require interactions between the partners to develop and maintain them. Hence, the hypothesis:

> *Hypothesis 2 (H2): As the ratio of tacit to codified knowledge increases, the partners are more likely to select an increased degree of interaction.*

Potential competitive threat from a partner

In technology transfer or joint technology development alliances, there is the clear possibility that an

DOI: 10.1111/j.2042-5805.2011.00001.x

ally, having absorbed sufficient knowledge, may turn into a competitor. From the point of view of a company possessing knowledge it wishes to share with a prospective ally, is a high interaction or low interaction arrangement preferable?

The literature provides two contradictory answers to this question. From the transaction cost literature comes the concept of tempering and moderating partner opportunism by requiring both allies to make credible commitments and deeper investments in the alliance: in short, a mutual hostage situation where the investments made by the allies are not easily reversible (Williamson, 1983). One measure of commitment is the degree to which the partners depute managers and engineers to the alliance task. This assignment of managers and engineers is lowest in unidirectional licensing (especially if the technology is codified or patented). Commitment of personnel and interactions with the partner increase when there is a supply chain or ongoing trading relationship between the partners. Interactions between the personnel of the alliance companies are likely to be most intense in the case of equity JVs, where interactions tend to take place on a daily basis between the personnel from the two partners harnessed together into the management of the JV firm. When financial commitment and personnel interactions are at high levels and when they are not easily reversible, this is said to create a mutual hostage situation. According to this hypothesis, when the potential competitive threat from a prospective partner is the greatest, it is best to involve them and tie them up in deeper interaction types of alliances (Mitchell, Dussauge, and Garrette, 2002). If so, one would find the most intense levels of interorganizational interactions in alliance forms such as JVs when the competitive threat of one partner is the greatest (Mellewigt and Das, 2010).

The exact opposite hypothesis is also found in the literature. This posits that when a partner is considered dangerous (in terms of their potential competitive threat), it is best to keep them at a distance and minimize interactions for fear that they may learn too well from such interactions (Hamel, 1991). A different but congruent version of the second opposite hypothesis may be seen in O'Dwyer and O'Flynn (2005), who found that firms are more comfortable sharing proprietary knowledge with other firms when they believe the potential recipient of that knowledge is *not* eager or able to compete with them. The weaker the partner's learning capacity (1) the greater is the need to teach them (e.g., deeper interactions are required with them), and (2) the less afraid is the knowledge-providing partner that their ally will become a competitive threat. This teaching/learning perspective is also supported in Sampson (2004).

Hence, the opposite hypothesis is that a firm will be more willing to increase their interactions when a partner constitutes a lower competitive threat because of the partner's lower absorptive capacity and their greater need for teaching—or by the same token, the firm will wish to limit its interactions with a partner that seems likely to become a strong competitor in the future. Formally, we state the next hypothesis below.

Hypothesis 3 (H3): The greater the competitive threat posed by a particular alliance partner, the more likely it becomes that a firm will seek to limit the degree of interactions with that partner.

The influence of trust and prior ties on the degree of partner interaction

Ring and Van de Ven (1992, 1994) suggested that as partners develop trust in each other through repeated alliances, their degree of interaction may increase because both partners become less concerned about opportunism and more concerned with maximizing the value that can be realized by comingling their respective resources. Over time, with sequential alliances, trust improves and allies develop deeper interactions (Faems *et al*., 2008). On the other hand, Gulati (1995) and Gulati and Nickerson (2008) suggest that as partners accumulate experience working together, repeat their ties, and increase their level of trust in one another, they will tend to use hierarchical alliances less frequently and more frequently adopt contractual agreements (such as licensing), which reduce interactions between the partners (Contractor and Ra, 2002). In addition, with developing trust and repeated ties, there would be a decreasing need to monitor partner behavior. This is another instance where the literature points in opposite directions regarding the effects of prior relations on the intensity of interaction between alliance partners. However, we propose to test the following hypothesis:

Hypothesis 4 (H4): When alliance partners negotiating an additional alliance between them have prior relations, they are likely to choose an increased degree of interally interaction.

DOI: 10.1111/j.2042-5805.2011.00001.x

Environmental or alliance country risk

From the perspective of a company that wishes to share its technology with a prospective ally, how does their assessment of alliance country risk affect their intended degree of interaction with their partner? Earlier we described risk in terms of partner risk—a prospective partner's proclivity to engage in opportunism, having absorbed their partner's knowledge. Here we are focusing on business or environment risk in the alliance territories and the laws of the nations in which the alliance will operate. Higher environmental volatility makes it more likely that hierarchical alliances would be preferred, according to Carson *et al*. (2006).

Speaking of intellectual property (IP) protection as one aspect of country risk, Oxley's (1999) study concluded that firms adopt more hierarchical modes (i.e., higher degrees of interaction between partners) when IP protection is weak. A closer and more interactive alliance relationship, involving trade of a key component or product, or one involving an equity joint venture, also enables the IP owner to more closely monitor and watch the behavior of their partner in a higher risk country with a weaker IP regime.

Gulati and Singh (1998) make the same hypothesis, but from the perspective of appropriation. In general, a deeper relationship and involvement in the alliance increases the chances of success, as well as a technology-providing partner's ability to extract an appropriate share of that success (Contractor and Ra, 2002). According to Gulati and Singh (1998), when appropriability regimes are weak, there is a greater likelihood of forming equity based alliances. The benefits of 'relational-based' alliances are greater with higher environmental turbulence (Lee and Cavusgil, 2006).

Making the opposite argument, Casciaro (2003) proposed that when strategic or environmental uncertainty is high, non-equity or more distant alliance modes involving less interaction between the partner may be preferred for two reasons: they (1) reduce the negative consequences of failure; and (2) contractual alliances, which tend to be short term, also provide strategic flexibility and keep future options more open. This is consistent with the view of alliances as real options (McGrath, 1997) within which lower interaction alliance modes such as licensing provide far greater strategic flexibility than high interaction modes such as equity joint ventures, which are less reversible. Of the two possible hypotheses mentioned earlier, we will test for the first argument, which is that . . .

Hypothesis 5 (H5): Higher alliance country or environmental risk increase the likelihood of an alliance that features a higher degree of partner interaction.

The article next examines three variables that are frequently included in alliance contracts, but that have been seldom tested: geographical territory restrictions, exclusivity provisions, and industry standards.

Agreement restrictions on the geographic areas served by the alliance

Many cross-border alliance agreements have clauses specifying or limiting the territory in which the alliance may operate and sell. How does the presence or absence of territorial limits affect the type of alliance created?

The practitioner literature provides a plethora of examples where one of the alliance partners got a nasty surprise because the territorial scope of an international agreement was not specified and the other partner later claimed additional territories the former had intended to reserve for their own operations. The academic literature has little to say on this specific issue of territory demarcation and area restrictions in the agreement. Carson *et al*. (2006) distinguish between volatility and ambiguity in alliance arrangements. Volatility is more akin to exogenous or environmental risk, whereas ambiguity has more to do with internal decisions within the alliance. They propose that when ambiguity is high (e.g., if the territorial scope of an international agreement can be contested in the future), 'formal' agreements (which could include territorial clauses) would be preferred over 'relational' alliance modes. In a more distant, low interaction alliance such as an arm's length license agreement, it is easier to insist during negotiations on territorial limits than in the case of higher interaction modes such as strategic supply chain or trading arrangements and joint ventures where the focus is on building a harmonious relationship. In short, relational controls (on the scope of the alliance territory, restraining the territorial expansion proclivities of the local ally) can substitute for formal agreement provisions limiting the territory of the alliance. If this is indeed the case, it would suggest a negative correlation between the

DOI: 10.1111/j.2042-5805.2011.00001.x

presence of territorial restrictions written into the agreement and the closeness of interaction between the partners.

However, the counter argument is that when the level and depth of interaction between partners is expected to be high, these are 'higher-stakes' alliances than just technology licensing, and involve greater strategic and long-term consequences (e.g., in supply chain arrangements and equity joint ventures). When the stakes are higher (e.g., the consequences of the partner wishing to expand their territory in the future after dissolving the alliance) and when the nonrecoverable or dedicated investment is greater (e.g., in terms of dependence on a foreign supplier, or in the investment made in the equity of a joint venture), this increases the need and the likelihood of writing limiting clauses into the alliance agreement—whereby the territorial ambitions of a prospective foreign partner can be circumscribed. We adopt the latter line of reasoning and state the hypothesis as:

Hypothesis 6 (H6): The presence of territorial restrictions written into an alliance agreement increases the likelihood of a greater degree of interaction between the partners.

Standardization of technology and agreement provisions

As a process or product becomes more commercialized and standardized over time and as it becomes more diffused across different firms in an industry, there is less ambiguity about the knowledge involved and lower uncertainty over the price or market value of similar technology (Mowery, Oxley, and Silverman, 1996; Carson *et al*., 2006). For idiosyncratic or newer technology, there may be little consensus about its value or price. However, in the case of more commercialized or older technology, some idea (if not consensus) emerges within an industry about how much a prospective technology recipient should pay the technology-supplying ally (Contractor, 1980). A greater degree of standardization and diffusion of knowledge also means that the expected contributions of the partners become easier to clarify in advance (when negotiating the alliance), and contract terms will tend to become more convergent across different agreements in the sector. With technology standardization, it is easier to have a clear division of responsibilities between the partners in the agreement, as well as a decreased need for interaction between the partners (Hagedoorn and Hesen, 2007). Hence,

Hypothesis 7 (H7): Greater contract standardization will reduce the likelihood of an alliance with a high degree of interaction between the partners.

Alliance experience

Our final hypothesis relates to accumulated alliance experience and seeks to determine whether companies tend to negotiate different types of alliances as they gain more and more experience at collaborating and designing alliances.[3] Here we refer to accumulated experience (in negotiating and managing alliance relationships) in the technology-providing firm. Greater alliance experience makes a firm better at managing alliance relationships and interacting with their partner, in general. Hagedoorn (2006) summarizes the sparse literature examining this question. In reviewing studies by Ring and Van de Ven (1992), Park and Ungson (1997), Anand and Khanna (2000), and a few others, the limited consensus appears to be that past experience with partnering '. . . increases the survival of existing partnerships' and '. . . can assist in establishing new partnerships' (Hagedoorn, 2006: 673).

But this does not quite answer the question posed earlier—about how a firm's general alliance experience correlates with the intensity of interaction with the partner and the type of alliance that is preferred. The weak inference from the studies mentioned earlier is that accumulated experience increases confidence and the ability to appropriate value from an alliance (Hansen *et al*., 2008) and, to that extent, it may lead to a greater ability and willingness to undertake higher investment and higher interaction alliance types—in governance terms, preferring equity joint ventures over relational alliances (such as supply chain arrangements) and preferring relational alliances over purely contractual types.

Hypothesis 8 (H8): As firms' accumulated experience as participants in cross-border alliances increases, the degree of interaction they prefer with their alliance partners will also be likely to increase.

[3] Note that this is not the same as repeated ties between the *same* alliance partners, as studied by Gulati (1995). Rather, this concerns the technology provider's *overall* experience at designing alliances and collaborating with other firms.

DOI: 10.1111/j.2042-5805.2011.00001.x

CONTROL VARIABLES

As controls, we introduce an additional contract variable, namely exclusivity provisions in the alliance agreement, and an additional contextual variable, the availability of alternate partners at the time of negotiations. There is no extant empirical evidence on how these variables affect the intensity of partner interaction.

Exclusivity

How does the frequency and depth of interaction between partners change when there is a single (exclusive) alliance versus multiple partnerships for the same knowledge or technology? Sengupta (1995: 33) mentions in passing that '. . . relationship-specific investment calls for more exclusivity . . . ,' but other than this brief reference, this issue has received little attention in the literature, despite the fact that exclusivity provisions are a common occurrence in alliance agreements (Bessy, Brousseau, and Saussier, 2002). Using a different dependent variable (whose focus was on governance type rather than interaction intensity), Contractor and Woodley (2009) found no significance for their exclusivity variable. Two observations are pertinent. First, deciding upon a single global partner for a particular technology may imply an ambitious agenda for that alliance. With up to the entire world open as a field of operation, there is a great deal of potential upside to such an exclusive alliance. The higher benefits that can accrue from a single exclusive global alliance helps justify greater investment and greater willingness to bear the higher coordination costs associated with high levels of partner interaction (Sengupta, 1995). Second, when a technology provider works with only one partner, they have fewer outside distractions from other allies (within the same technology area). A singular focus would seem to argue for a greater ability, and willingness, on the part of the firm to commit resources to an alliance and interact more regularly and more deeply with that partner. According to Elfenbein and Lerner (2009), exclusivity provisions give partners greater assurance when anticipating alliances involving higher interaction, and lock-in and hold-up risks. Hence, the expectation is that exclusive partnerships with respect to a particular technology will be positively correlated with deeper and more frequent interactions between the partners.

The number of alternate potential partners available at the time of negotiation

Firms with many choices for alliance partners are likely to have a more varied pool of partner characteristics from which to choose, when compared to firms that have few or only one viable choice for a partner. If greater choice helps them pick a partner better suited to their particular needs, then the next question becomes the kind of partner characteristics they are likely to seek out. In an effort to economize on coordination and other interaction-related costs, technology providers may tend to select technology-recipient partners that require less assistance from the technology provider and can operate more independently over the long term, without substantial ongoing help from the technology provider. If so, *ceteris paribus*, as the number of potential partners available to a technology provider firm increases, the intensity of partner interaction seems likely to decrease.

From this discussion, we see that the question of 'how tight an embrace' between partners is best, is not amenable to a simple answer. In the empirical analysis that follows, we will examine the extent to which the preferred or optimal level of interorganizational interaction, or involvement, depends on technology characteristics, coordination costs, risk perceptions, and agreement provisions.

Methods

Sample and data collection

The sample consists of U.S.-based partners supplying manufacturing technology to foreign alliance partners under various arrangements including licensing agreements, supply chain relationships, and/or an equity joint venture. We excluded alliances focused solely on joint R&D and alliances focused solely on marketing. Technology that had already been commercialized or was close to that goal was the focus of the data collection efforts. A six-page questionnaire went through three rounds of pretesting and revisions before the final version was sent to the U.S. technology-provider partners. The 'respondents' to our questionnaire were executives, engineers, or other personnel who had been intimately involved in the negotiations that led to the formation of the alliance.

Out of 141 responses, many were eliminated because the respondents did not choose an international alliance or, despite our instructions, did not

DOI: 10.1111/j.2042-5805.2011.00001.x

respond with a manufacturing technology alliance. Finally, because of the conservative approach of 'listwise' deletion of cases with missing values, the ultimate sample size was reduced to 95 for all statistical analyses in this article.

There are a variety of alliance types, ranging from pure licensing deals to supply chain relationships and equity joint ventures. All alliances in the sample, including those with supply chain relationships and joint ventures, have licensing agreements between the parties. However, it is important to recognize that, in the case of equity joint ventures, the licensing portion of the alliance link is likely to be minor and subordinate to the equity investment.[4] Some joint venture companies also trade (buy or sell components or finished products) with one or both of their own principals, earning profit markups on each trade. Such multiple or hybrid arrangements are common in practice. Checks for internal consistency inserted into the questionnaire showed that respondent accuracy was consistent in more than 98.1 percent of all cases.[5]

Construction of the dependent variable: a surrogate for the degree of partner interaction

How does the degree or intensity of interactions between the partners change over different types of alliances? All alliances entail a relationship where the intensity of interactions between the personnel of the partner companies is a function of their common task or strategy (Kale *et al*., 2000). The legal structure or form of an alliance is not an end in itself, but rather one means to foster and manage a desirable degree of interaction between the personnel of the two companies. Gulati and Singh (1998: 785) created three categories rank ordered by an increasing '. . . need for ongoing task coordination and joint decision making . . .' Carson *et al*. (2006) distinguish between 'formal' contracting (as in the case of, say, semi-arm's length technology licensing), 'relational' alliances, and 'hierarchy,' by which they mean equity investment. Hagedoorn and Hesen's (2007) conceptual paper proposed three ordered categories: (1) licensing based on what they call 'classical' contracting; (2) non-equity 'relational' contracting—where a contract may exist but the key characteristic is continuous friendly renegotiation and flexibility exhibited by both partners. (This is required in outsourcing, supply chain or trading arrangements, where model designs, unit prices, and order quantities change over time. In such a case, contracts cannot outline all future contingencies). Finally, (3) equity-based relationships where, by definition, the managers and engineers of the two principals, deputed to together run the joint venture, rub shoulders on a daily or frequent basis. We posit that in equity joint ventures (JVs)—especially where the shareholding is roughly equal or near 50/50 and both partners feel they have an equal stake in the alliance—entail the greatest degree of interaction between the partners. But, when equity shares in a JV are unbalanced, the minority partner plays a more passive role and is less likely to depute personnel to help run the JV or as actively interact with the majority partner, since their stake in the venture is proportionately less. Lyles and Salk (1996: 7) found support for this idea and stated that '. . . there will be higher levels of knowledge acquisition in 50/50 two-partner IJVs than in IJVs with other forms of ownership.' While they were referring to the knowledge each JV partner drew from their respective parents and then were willing to share with their alliance partner, there is a clear implication that more intense interactions occur within 50/50 equity joint ventures.

The main focus of this study is to statistically examine possible influences on the degree of interaction between alliance partners. The dependent variable INTERACT was constructed from data on each case regarding (1) Equity Shares, if applicable (in the case of a contractual alliance, the equity share is zero), and (2) the Intensity of the Supply Chain Relationship Between the Allies. In situations where there was no trade (buying/selling) between the allies, an underlying variable, TRADE, was coded as zero. In cases where there was unidirectional or one-way trade between partners, TRADE was coded as one (see Figure 2). The sourcing of components or sale of finished product involves many joint decisions by the allies about technical designs, raw material costs, the transfer price for the component traded between them, and delivery schedules. Since product designs change over time, this entails repeated interactions and renegotiations. In some cases, the parties share development costs for the next new model. Hence, supply chain alliances entail a degree of partner interaction that exceeds simple technology licensing. In cases where the allies had both buying *and* selling between them, i.e., a two-way supply chain relation-

[4] Such auxiliary licensing contracts are commonly undertaken for international tax reasons.

[5] By asking for the same information, but in a different manner, in another part of the questionnaire, one can cross-check responses to help gauge respondent care and accuracy in answering questions.

DOI: 10.1111/j.2042-5805.2011.00001.x

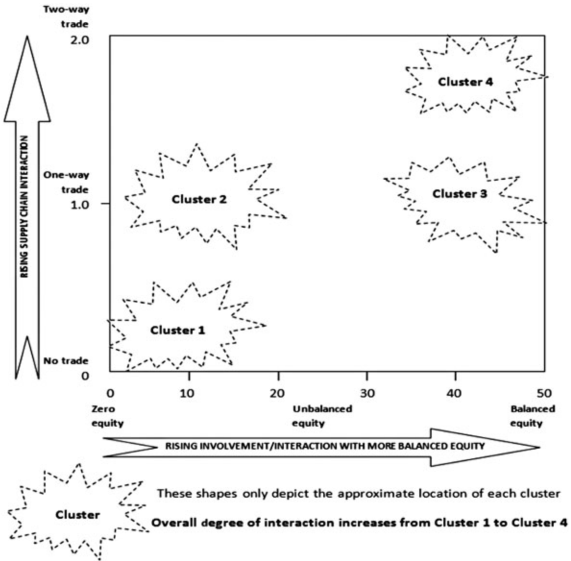

Figure 2. The dependent variable INTERACT
Note: Greater intensity of supply chain interaction (vertical axis) and more balanced equity (horizontal axis) together lead to an *overall* rising intensity of partner interaction going from Cluster 1, to Cluster 2, to Cluster 3, to Cluster 4.

ship, TRADE was coded as two. In this situation, the degree of partner interaction would be even higher.

Our article proposes a rank ordering of the overall degree of interpartner interaction based on increasing supply chain trade (buying/selling) between the allies, as well as equity share, as shown in Figure 2. The dependent variable INTERACT is a composite of supply chain intensity and 'level of equity' (or the absence of equity), based on a clustering of cases into four ordered categories.[6] The horizontal axis of Figure 2 represents rising levels of equity investment (starting with zero or no equity, i.e., a purely contractual alliance) to a maximum value of 50 (which depicts a perfectly balanced 50/50 equity JV). On the left side of the horizontal axis, with zero equity investment, a technology provider only licenses out the rights to use its intellectual property to another firm, with routine arm's length monitoring of payments and the licensee's adherence to contract terms. When know-how or tacit knowledge is licensed, some degree of initial training may be provided to the licensee. But, in any case, licensing entails less interaction than equity joint venture alliances. In the middle of the horizontal axis are unbalanced equity JVs—where the equity share of one of the JV partners is significantly greater than the other partner's share (e.g., a 30/70 equity JV). The degree of interpartner interaction or involvement is lower when there is no equity investment (and only licensing), higher when there is an unbalanced equity JV, and highest when the JV equity shares are balanced or 50/50—since a 50/50 equal equity stake provides each partner with the greatest incentive for participation and shared control, in day-to-day management of the alliance.

This enabled us to construct a two-dimensional map (as seen in Figure 2) where a rising degree of interally interaction is envisaged on both vertical and horizontal axes. We mapped each alliance case within the two axes (Equity and Trade) in Figure 2 to see if there were natural groupings or clusters. For this, we used the 'partitioning around medoids' (PAM) method, which identifies representative data points that minimize the sum of dissimilarities of the remaining data points to its closest medoid (Kaufman and Rousseeuw, 1990). It is a more robust version of 'k-means' clustering. The clusters are initialized with randomly chosen medoids from the data, and the remaining data points are assigned to the closest medoid. In the next iteration, medoids are swapped with nonmedoid points and a better solution—i.e., a smaller sum of dissimilarities emerges—until the cluster solution converges and so on, until repeated iterations of the clustering routine produce the same cluster solution. Using the well-known 'k-means algorithm' produces similar results, but they are less stable than the PAM clusters.[7] We used the PAM routine in the clustering package based on Maechler *et al*. (2005) and R Development Core Team (2009).

The results of the clustering technique produced four clusters or categories with sufficient distinction between clusters and enough alliance cases in each category for data analysis.[8] Going from Cluster 1 to Cluster 4 in Figure 2, there is an *overall* increase in the degree of interaction between allies. Thus, each

[6] Some would argue that, ideally, the degree of interaction between allies should be observed in a field setting. But this is virtually impossible for 100+ international alliances, each spanning several to many years. Hence, a researcher is forced to use surrogate measures for the degree of interpartner interaction.

[7] Unlike a centroid, which is generally not a data point, a medoid is one of the cases in each cluster.

[8] We undertook a robustness analysis regarding the number of clusters and also tested our proportional odds model for a three- and five- cluster solution. Regression with a three-, four-, and five-cluster dependent variable results in very similar regression coefficients and significance levels. We choose the four-cluster solution, as the five cluster solution creates a small cluster of only eight observations.

DOI: 10.1111/j.2042-5805.2011.00001.x

Table 1. Measurement scales for variables

Variable	Type	Measurement scale
INTERACT (dependent)	Ordinal (cluster derived)	(=1), lowest degree of interaction between partners. (=4), highest degree of interaction between partners.
TECHEXCH (H1)	Ordinal	(=0), no obligations to transfer technology between the partners after the initial transfer of technology. (=1), Obligation to also transfer future technology to partner. (=2), both partners obligated to reciprocally transfer technology to each other, or codevelop new knowledge in the future, after the initial transfer.
KNOWHOW (H2)	Percentage	Percentage of technology bundle value accounted for by know-how or tacit knowledge, as opposed to registered intellectual property. For example, (=0), means that registered intellectual property was the principal component of the technology transfer. Alternatively, (=100), means that know-how accounted for all the knowledge-related value contributed.
HIGHOPP	Binary	(Note: This is not a direct explanatory variable, but is used below.) (=0), expected costs of opportunism by the partner are zero. (=1), expected costs of opportunism by the partner are greater than zero.
PARTNERRISK (H3)	Binary	(=1) when HIGHOPP =1 and partner's absorptive capacity is rated as equal or greater to that of the respondent firm. (=0) otherwise.
PRIORREL (H4)	Binary	(=0), there was no alliance between the partners in the past. (=1), there was one or more alliances between the partners in the past.
ENVRISK (H5)	Binary	(=0), alliance country risk is roughly equal to, or lower than, the U.S. (=1), country risk is higher for alliance territories than in the U.S.
TERREST (H6)	Binary	(=0), no territorial restrictions on where the alliance could operate, or where the firm's partner could use the acquired technology. (=1), there were territorial restrictions on where the alliance could operate, or where the firms' partner could use the acquired technology.
INDRATE (H7)	Binary	(=0), there are no industry standards or norms about technology price (such as typical payments or royalty rates for the technology in question). (=1), there are industry standards or norms about technology price.
ALLIANCEXP (H8)	Continuous, natural log	Natural log of the number of years since the first cross-border alliance was formed by the respondent's firm in this sample.
EXCLUSIV (control variable)	Binary	(=0), more than one agreement entered into by the respondent's firm for the technology in question. (=1), exclusivity—this is the only agreement entered into by the respondent's firm for the technology in question, worldwide.
PARTALT (control variable)	Continuous	(=0), no other reasonable alternative partners were available at the time of negotiation, *or as an example*, (=9), if 9 other viable alternative alliance partners were available.

alliance case assumes one of four values of INTERACT = 1, 2, 3, or 4, with rising levels of overall interaction going from 1 to 4.

Construction of the explanatory variables

Variable definitions are shown in Table 1. A rising value for TECHEXCH indicates higher technology-based interactions between the allies, with TECHEXCH = 0 only covering the technology transferred at the initiation of the alliance. TECHEXCH assumes a value of 1 if future unidirectional transfer of technology is anticipated and a value of 2 if bidirectional transfers or codevelopment is anticipated. This follows the Colombo (2003) study.

KNOWHOW is the proportion of know-how or tacit knowledge (as opposed to registered

DOI: 10.1111/j.2042-5805.2011.00001.x

intellectual property rights such as copyrights and patents) in the technology bundle transferred to the partner. KNOWHOW = 0 means that registered intellectual property comprised the entire contribution made by the technology-providing firm, while KNOWHOW = 100 would mean that unregistered 'know-how' made up *all* of the knowledge contributed by the technology provider. Being a continuous variable, of course, the proportions can assume values between 0 and 100 percent.

PARTNERRISK deals with how the technology-receiving ally is perceived by the technology supplier. We use a more nuanced construct for PARTNERRISK, which is set to a value of '1' only when the expected costs of partner opportunism were rated by the respondent as greater than zero *and* the partner's absorptive capacity was rated as being at least equal to that of the respondent's firm. Otherwise, PARTNERRISK takes a value of '0.' This measure is analogous to Nooteboom, Berger, and Noorderhaven (1997), who distinguished between (1) the *likelihood* of partner opportunism and (2) the *consequences* of the opportunism, if it occurs. This also reflects the findings of O'Dwyer and O'Flynn (2005) that high absorptive capacity by an alliance partner does not necessarily correlate with a desire to engage in opportunism and vice versa. In other words, PARTNERRISK assumes a value of '1' only when the technology provider perceives a credible competitive threat from their partner, i.e., when the technology-receiving partner has **both** the *capacity* **and** the likelihood or *intention* to harm the technology-provider firm.

After Gulati (1995), PRIORREL measures whether or not the alliance partners had a previous alliance, assuming a value of '1' if they had a previous alliance and '0' for no previous alliance.

ENVRISK is a binary measure of the country risk (constructed from (1) intellectual property protection, (2) political environment, and (3) audit and verification ability) in the alliance territories as assessed by the respondent's firm. This variable was constructed in two steps, combining the ratings for each of the criteria mentioned earlier for the nations that were part of the alliance. In cases where the sum of the risk measures was comparable or lower to the United States, ENVRISK was set to a value of '0.' If the risk measures total was higher than the U.S., ENVRISK was assigned a value of '1.' Hence ENVRISK has a value of '1' when the combined country risk rating was poorer (or worse) than the United States. The adjusted Cronbach's alpha score was 0.7801 for the three items used to construct ENVRISK.

TERREST measures whether or not there were territorial restrictions written into the agreement: TERREST coded at a value of '1' means there are territorial restrictions written into the alliance agreement, and a value of '0' means otherwise.

INDRATE measures whether or not there was an 'industry standard' price for the technology in question. For more standardized technologies, royalty rates tend to converge and become known (e.g., Smith and Parr, 2005; Contractor, 1981). Hence, INDRATE could also be considered a surrogate for the degree of technological convergence, design standardization, or maturity for a particular product type covered by the agreement. A value of '1' for INDRATE means that the respondent knew of an 'industry standard' price for the technology in question, while a value of '0' for INDRATE means there was no such industry standard.

ALLIANCEXP is the natural log of the number of years that have passed since the respondent's firm entered into its first foreign licensing agreement.

EXCLUSIV equals '1' if the technology provider was providing the technology in question only to their partner (the technology recipient) and to no other firm anywhere in the world. Otherwise, EXCLUSIV takes a value of '0.'

Finally, PARTALT is the number of alternative partners realistically available to the technology provider when it was selecting a potential technology recipient and negotiating the alliance.

Statistical method

We used a proportional odds (PO) model that assumes a variable Y with j categories of the ordered response, where

$$P(Y \geq j) = \exp(\alpha_j + \beta x) / (1 + \exp(\alpha_j + \beta x))$$

with j from 1 to 4 in our case, α_j is the cut-point of category j, and β is identical for each category.[9] For a given category j, the PO model reduces to a binary logistic regression model. The cumulative odds ratio

[9] In some notations, $P(Y \leq j)$ is used. The chosen formulation makes the sign of the coefficients consistent with binary logistic models.

DOI: 10.1111/j.2042-5805.2011.00001.x

$\exp[\beta(x_1 - x_2)]$ is constant across response categories for any two values of the independent variables. This ease of interpretation and parsimony makes the PO model preferred for ordered categorical data even when the PO assumption is not perfectly met (Agresti, 2002). We graphically tested for the PO assumption (Harrell, 2001) and find that it applies for most of our independent variables. The modeling is performed with the design package in R v2.10.0 (R Development Core Team, 2009).

DISCUSSION OF RESULTS

Table 2 presents a table of Spearman's Rho correlation coefficients between the independent variables.

Table 3 presents a summary of key results for the ordered dependent variable proportional odds model. With a pseudo R-squared value of 0.385 and with a likelihood ratio of 42.2 with 10 degrees of freedom (significant at 0.000), the validity of the overall model is robust.

The results support the expectations of six of the eight hypotheses as well as both control variables. The hypotheses regarding tacit and codified knowledge (H2) and partner risk were not supported, although the former has the expected sign. Detailed findings are discussed next.

Technology characteristics and intent

The findings for **TECHEXCH** are consistent with H1, with a positive coefficient and a significance level of close to 0.05. As future technology exchanges increase from none to unidirectional to bidirectional, interactions between partners become more frequent. This is consistent with results in Colombo (2003), Oxley and Wada (2009), Contractor and Woodley (2009), and Krishnan *et al*. (2006) that when future technology exchanges are expected to be intense, or codevelopment is envisaged, more interactive alliance modes are chosen. In terms of choosing an optimal level of intergroup interaction, this finding also reflects the views of Tallman (2003) that 'high bandwidth' means of communication, especially where engineers and managers of the alliance partner firms rub shoulders on a daily basis, are better for complex exchanges or transfers.

The result for **KNOWHOW** did not support H2. Although we have the expected positive coefficient, it is not significant.

Table 2. Spearman's Rho for all independent variables[a]

N = 95

	TECHEXCH	KNOWHOW	PARTNERRISK	PRIORREL	ENVRISK	TERREST	INDRATE	ALLIANCEXP	EXCLUSIV
KNOWHOW	0.101								
PARTNERRISK	−0.017	−.174							
PRIORREL	−0.036	−0.031	0.114						
ENVRISK	−0.075	0.200	−0.248*	0.010					
TERREST	−0.008	.0.100	−0.025	−0.143	0.068				
INDRATE	0.081	−0.191	0.115	−0.003	−0.168	0.010			
ALLIANCEXP	0.058	0.120	0.024	0.188	0.144	−0.176	0.019		
EXCLUSIV	−0.133	−0.118	0.130	−0.081	−0.248*	−0.072	−0.022	−0.192	
PARTALT	−0.003	0.082	−0.097	−0.088	0.059	−0.021	−0.113	−0.088	−0.061

*Correlation is significant at the 0.05 level (two-tailed).

[a] Spearman's Rho was chosen over Pearson correlations because of the number of binary variables, which do not follow a normal distribution.

DOI: 10.1111/j.2042-5805.2011.00001.x

Table 3. Results for proportional odds model

Dependent variable: INTERACT (N = 95)

	Proportional odds model	Expected sign	Hypothesis, supported?
Likelihood ratio χ^2	42.2 (0.000)***		
Pseudo R^2	38.5%		
y>=2	−1.666 (0.081)		
y>=3	−3.872 (0.000)		
y>=4	−5.804 (0.000)		
TECHEXCH	0.596 (0.056)*	+	H1—Yes
KNOWHOW	0.007 (0.264)	+	H2—No
PARTNERRISK	0.347 (0.400)	−	H3—No
PRIORREL	0.922 (0.043)**	+	H4—Yes
ENVRISK	0.887 (0.043)**	+	H5—Yes
TERREST	1.345 (0.003)***	+	H6—Yes
INDRATE	−0.979 (0.021)**	−	H7—Yes
ALLIANCEXP	0.505 (0.001)***	+	H8—Yes
EXCLUSIV	0.971 (0.030)**	+	
PARTALT	−0.166 (0.051)*	−	

(x.xxx) = absolute *p* value.
* = significant at around 0.05.
** = significant at better than 0.05.
*** = significant at better than 0.01.

Firm and sector characteristics

The findings for **ALLIANCEXP** support H8, with significance at the 0.001 level. As technology provider firms gain more general international alliance experience, they tend to choose higher interaction relationships with their foreign-based technology-recipient partners. These findings may be driven by multiple possible influences. It may indeed be greater skill and confidence that leads technology provider firms to opt for deeper and more frequent interactions with their foreign-based partners as they gain international experience. Greater international experience also likely correlates with a higher level of commitment to global markets, which could increase the willingness of firms to commit substantial resources to their cross-border alliances. Finally, Hansen *et al*. (2008) imply that greater general alliance experience is positively correlated with greater desire for value appropriation, which is enhanced by choosing high-interaction alliance modes.

The control variable **PARTALT** also has the anticipated negative sign, with a 0.051 *p* value. At the time of partner selection, as the number of potentially suitable alternative partners increases for the technology-provider firm, the more likely it is that they will choose a partner requiring less interaction. The purpose of entering into alliances is to maximize returns while minimizing the costs of entangling alliances. Having a greater choice of partners increases the likelihood of finding a capable ally that reduces or minimizes knowledge transfer and coordination costs. *Ceteris paribus*, having more partner choices fosters, at the margin, the selection of partners that allow for a lower degree of interally interaction.

Agreement provisions

The findings for agreement provisions are consistent with expectations for three of the four hypotheses. First, the coefficient for whether or not there are industry standards or norms for the value of the technology (**INDRATE)** has the expected negative sign, with a 0.021 *p* value. When there are industry standards or norms, the partners are likely to have a lower degree of interaction. The reasons include reduced uncertainty associated with a greater degree of technology commercialization and product standardization. Standardization and diffusion of knowledge reduce uncertainty (Carson, Madhok, and Wu 2006), enable easier technology transfer, and lead to lower interaction alliances. In addition, with

DOI: 10.1111/j.2042-5805.2011.00001.x

standardization and greater technological convergence, there is less need to subsequently revisit numerous issues connected to running the alliance, after the initial negotiation phase is complete. Hence, a lower interaction alliance mode is adequate. Findings for the control variable **EXCLUSIV** are also consistent with expectations, with a positive coefficient and a 0.03 *p* value. In cases where there is only one worldwide agreement covering the technology in question, the technology-provider firm tends to interact more intensively or deeply with their partner. Possible reasons include (1) a greater degree of focus when the agreement is exclusive (i.e., the technology-provider firm works with only one partner worldwide), (2) greater potential returns from a globally exclusive alliance, and (3) exclusivity provisions giving greater incentives to invest in deeper interaction alliances when 'hold-up' and 'lock-in' fears are higher (Elfenbein and Lerner, 2009). As noted earlier, there is virtually no prior empirical information on the incidence and effects of exclusivity versus nonexclusivity in alliance relationships. Hence, our finding can be a spur for further research on what is a critical strategic decision for a technology-possessing company that wishes to formulate global alliance policy.

Findings for **TERREST** support H6, with a positive coefficient and a 0.003 *p* value. With territorial restrictions in the agreement, the partners interact on a more intense basis. This pattern is consistent with a risk-minimization objective for the technology provider.

Coordination costs and risks

The coefficient for **PARTNERRISK** was not significant and Hypothesis 3 is not supported. The finding for **PRIORREL** has the expected sign, with a 0.04 *p* value. Greater trust and confidence between the partners lead to stronger commitment to alliance success and more intense interally interactions to maximize alliance value. Finally, results for **ENVRISK** support H5, with a positive coefficient that is statistically significant at a 0.04 level. As country risk increases, technology providers prefer arrangements that include deeper and more frequent interactions with their local partner over alliance modes that are more arms length. That is to say, greater participation and involvement in the alliance may be seen as a means of controlling and monitoring partner behavior. The preliminary conclusion from our findings appears to be that deeper interaction alliance types are seen as risk-reducing methods in riskier countries.

CONCLUSIONS: CONTRIBUTIONS AND LIMITATIONS

Alliances have become an integral part of management. Kale and Singh (2009) discuss a study reporting that as much as 26 percent of the revenues of 80 percent of Fortune 1000 companies was derived from their alliances, as opposed to their internal operations. But alliances are also said to terminate more frequently. Negotiating and designing optimum alliance relationships is still an area where there are many unknowns and where considerable research is still needed. This study goes beyond 'structure' or governance mode and examines partner interactions. Interaction or greater involvement with one's partner is necessary in order to coordinate operations (which is especially important if the partners are linked in a supply chain), effectively transfer tacit knowledge, monitor for opportunism, maximize joint synergistic value, and make sure that an adequate share of the net benefit created by the alliance is appropriated by the technology provider.

However, too tight an 'embrace,' or too high a degree of interaction between the allies increases coordination costs and the chance of unintended technology leakage; thus, how to handle partner interactions is one of the key questions in managing alliance processes. This article proposes that the 'optimum' degree of interorganizational interaction is a function of (1) technology characteristics and future technology policy, (2) coordination costs and risks, (3) agreement provisions, and (4) firm and sector characteristics. Hypotheses were drawn from knowledge-based and resource-based views of the firm, as well as from transaction costs theory.

This article proposed a new dependent variable that captures interaction intensity between the allies, instead of the more commonly selected, simple dichotomy between non-equity and equity-based alliances, which focuses only on structure. A clustering technique, based on two dimensions, grouped 95 alliance cases into four clusters in accordance with a rising degree of interpartner interaction. This was validated by a proportional odds model with a pseudo R-square of 0.385, and a highly significant likelihood ratio. This study also introduced unusual

DOI: 10.1111/j.2042-5805.2011.00001.x

explanatory variables. Until recently, not much scholarly attention has been devoted to agreement provision details. On that subject, Reuer and Ariño (2007: 326) write that

> . . . research has largely ignored alliance contracting and, more importantly, . . . these differences are not captured by the equity/non-equity dichotomy so commonly used in empirical research . . .

The dearth of past research focus on contractual provisions, which exist in all alliances, is a puzzling and unfortunate occurrence. The likely reason is that the majority of empirical studies in the alliance field have been based on secondary data, which lacks necessary details about agreement provisions for each alliance. The data in this study were collected directly from companies involved in cross-border alliances, and it uses four agreement provisions and contextual variables as explanatory variables. It also introduces an apparently wholly new variable, namely the number of prospective partners available at the time of negotiation of each alliance, to see how that influences the design of the alliance formed with one of the prospective allies. The technology transfer variable (TECHEXCH) assesses not only the current technology, but also the future technology exchange *intentions* of the allies. Our 'competitive threat' variable introduced a distinction between the likelihood and the consequences of potential partner competition, operationalizing an idea in Nooteboom *et al*. (1997). This assesses not just the absorptive capacity of the partner (Cohen and Levinthal, 1990), but also the anticipated intentions of the partner to engage in opportunistic behavior, to construct a more nuanced measure for partner risk.[10]

The conclusions of the empirical analysis are that one time technology transfer alliances may well lead to a low degree of interaction between the partners, especially when the knowledge is codified or explicit, such as for a simple licensing agreement. However, if there is the anticipation of future technology exchanges, or if tacit knowledge predominates in the technology 'package,'[11] then greater interaction between the partners becomes desirable. Anticipated bidirectional technology transfers lead to a higher degree of interaction than future unidirectional technology transfers.

The country or environment risk variable was created from three underlying country scores, namely audit and verification ability in the foreign nation of the ally, the political climate, and the intellectual property regime. To mitigate perceived higher country risk, technology providers prefer higher interaction alliance types, likely with the underlying rationale that developing a deeper relationship with their partner and tying them up in operational and investment commitments, will ameliorate possible opportunistic proclivities.

On many hypotheses, it was discovered that past literature suggests opposing conclusions. We have described both schools of thought—hypothesis and counter-hypothesis—in such instances, before formally espousing one of the views for testing. Further research is needed for some of the study's findings on issues frequently influencing alliance agreements in practice. Contract clauses, common in alliance agreements, are influenced by industry standards and norms, the availability of alternate prospective alliance partners, and the exclusivity of the alliance. Yet, little is known about how negotiators actually implement these provisions. Our results showed that the existence of industry standards and norms (possibly reflecting a greater degree of standardization of the technology) suggested, *ceteris paribus*, a lower interaction alliance type is desired, as did the availability of multiple prospective alliance partners at the time of negotiation. However, results for our exclusivity variable indicated that exclusivity is accompanied with increased partner interaction. The fact that these variables were statistically significant is a good starting point, but more microlevel, qualitative investigation is needed to better explain the results.

Still, the gap between large-sample empiricism and detailed, qualitative case studies is a common lacuna in academic studies. By the same token, there is a gap to be bridged between cross-sectional and longitudinal approaches—especially when, in the case of some of the variables, the 'shadow of the future' is used to propose the hypotheses. For example, TECHEXCH is a three-point scale, rising from one time technology transfer immediately following the alliance formation to future unidirectional technology flows to anticipated bidirectional technology exchanges and joint R&D. Finally, this study, like virtually every other in the alliance field, draws its data from only one partner. Still, with 95

[10] This operationalization distributes the 95 cases over four subcategories, which may be the key reason for the coefficient falling just shy of the usual 0.05 p value cutoff for declaring statistical significance.
[11] The statistic for this variable was not significant, although the sign of the coefficient was as hypothesized.

DOI: 10.1111/j.2042-5805.2011.00001.x

international technology transfers in the sample, it was difficult enough to find executives in the U.S. firm who had participated in the actual negotiations that led to the formation of the alliance. It would have been far more difficult to also find his or her counterpart in the foreign country of the alliance partner. Nevertheless if statistically significant results are found, despite incomplete data, this suggests a considerable degree of validity.

Overall, this study gives several answers that help managers address a key challenge associated with negotiating alliance relationships: how tight an embrace or what issues should managers consider when determining the optimal degree of interaction with their firm's technology alliance partners?

REFERENCES

Agresti A. 2002. *Categorical Data Analysis*. Wiley-Interscience: New York.

Anand B, Khanna, T. 2000. The structure of licensing contracts. *Journal of Industrial Economics* **48**(1): 103–35.

Argyres N, Mayer KJ. 2007. Contract design as a firm capability: an integration of learning and transaction cost perspectives. *Academy of Management Review* **32**(4): 1060–1077.

Bessy C, Brousseau E, Saussier S. 2002. The diversity of technology licensing agreements. Unpublished paper, Université de Paris.

Bierly P, Coombs J. 2004. Equity alliances, stages of product development, and alliance instability. *Journal of Engineering & Technology Management* **21**(3): 191–214.

Carson S, Madhok A, Wu T. 2006. Uncertainty, opportunism, and governance: the effects of volatility and ambiguity on formal and relational contracting. *Academy of Management Journal* **49**(5): 1058–1077.

Casciaro T. 2003. Determinants of governance structure in alliances: the role of strategic, task and partner uncertainties. *Industrial & Corporate Change* **12**(6): 1223–1251.

Cohen W, Levinthal D. 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly* **35**(1): 128–152.

Colombo MG. 2003. Alliance form: a test of the contractual and competence perspectives. *Strategic Management Journal* **24**(12): 1209–1229.

Contractor F. 1980. The profitability of technology licensing agreements by U.S. multinationals: a framework for analysis and an empirical study. *Journal of International Business Studies* **11**(2): 40–62.

Contractor F. 1981. *International Technology Licensing*. Lexington Books: Lexington, MA.

Contractor F, Ra W. 2002. How knowledge attributes influence alliance governance choices. *Journal of International Management* **8**: 11–27.

Contractor F, Woodley J. 2009. The influence of asymmetric bargaining power, mutual hostages, and task characteristics on the governance structure of cross-border technology alliances. *International Journal of Technology Management* **48**(3): 403–422.

Das T, Teng BS. 1998. Between trust and control: developing confidence in partner cooperation in alliances. *Academy of Management Review* **23**(3): 491–512.

Elfenbein D, Lerner J. 2009. Exclusivity, contingent control rights, and the design of Internet portal alliances. *Journal of Law, Economics and Organization*. Available at: http://jleo.oxfordjournals.org/content/early/2009/11/30/jleo.ewp035?keytype=ref&ijkey=zk00tFdtt4uKTw0 (accessed 30 November 2009).

Faems D, Janssens M, Madhok A, Van Looy B. 2008. Toward an integrative perspective on alliance governance: connecting contract design, trust dynamics, and contract application. *Academy of Management Journal* **51**(6): 1053–1078.

Gulati R. 1995. Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal* **38**: 85–112.

Gulati R, Nickerson J. 2008. Interorganizational trust, governance choice, and exchange performance. *Organizational Science* **19**(5): 688–708.

Gulati R, Singh H. 1998. The architecture of cooperation: managing coordination costs and appropriation concerns in strategic alliances. *Administrative Science Quarterly* **43**(4): 781–804.

Hagedoorn J. 2006. Understanding the cross-level embeddedness of interfirm partnership formation. *Academy of Management Review* **31**(3): 670–680.

Hagedoorn J, Hesen G. 2007. Contract law and the governance of interfirm technology partnerships: an analysis of different modes of partnering and their contractual implications. *Journal of Management Studies* **44**(3): 342–366.

Hamel G. 1991. Competition for competence and interpartner learning within international strategic alliances. *Strategic Management Journal*, Summer Special Issue **12**: 83–103.

Hansen M, Hoskisson R, Barney JB. 2008. Competitive advantage in alliance governance: resolving the opportunism minimization-gain maximization paradox. *Managerial & Decision Economics* **29**(2/3): 191–208.

Harrell F. 2001. *Regression Modeling Strategies: With Applications to Linear Models, Logistic Regression, and Survival Analysis*. Springer: New York.

Jeffries F, Reed R. 2000. Trust and adaptation in relational contracting. *Academy of Management Review* **25**(4): 873–882.

Kale P, Singh H. 2009. Managing strategic alliances: what do we know now, and where do we go from here? *Academy of Management Perspectives* **23**: 45–62.

DOI: 10.1111/j.2042-5805.2011.00001.x

Kale P, Singh H, Perlmutter H. 2000. Learning and protection of proprietary assets in strategic alliances: building relational capital. *Strategic Management Journal* **21**(3): 217–238.

Kaufman A, Wood C, Theyel G. 2000. Collaboration and technology linkages: a strategic supplier typology. *Strategic Management Journal* **21**(6): 649–663.

Kaufman L, Rousseeuw PJ. 1990. *Finding Groups in Data: An Introduction to Cluster Analysis*. Wiley: New York.

Kogut B, Zander U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science* **3**(3): 383–397.

Krishnan R, Martin X, Noorderhaven N. 2006. When does trust matter to alliance performance? *Academy of Management Journal* **49**(5): 894–917.

Lee Y, Cavusgil S. 2006. Enhancing alliance performance: the effects of contractual-based versus relational-based governance. *Journal of Business Research* **59**(8): 896–905.

Lyles M, Salk J. 1996. Knowledge acquisition from foreign parents in international joint ventures: an empirical examination in the Hungarian context. *Journal of International Business Studies* **27**(5): 877–903.

Maechler M, Rousseeuw P, Struyf A, Hubert M. 2005. *Cluster Analysis Basics and Extensions*. Available at: http://cran.r-project.org/web/packages/cluster/ (accessed 12 November 2010).

McGrath R. 1997. A real options logic for initiating technology positioning investments. *Academy of Management Review* **22**(4): 974–996.

Mellewigt T, Das T. 2010. Alliance structure choice in the telecommunications industry: between resource type and resource heterogeneity. *International Journal of Strategic Change Management* **2**(2/3): 128–144.

Mitchell W, Dussauge P, Garrette B. 2002. Alliances with competitors: how to combine and protect key resources. *Journal of Creativity & Innovation Management* **11**(3): 203–223.

Mowery D, Oxley J, Silverman B. 1996. Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal*, Winter Special Issue **17**: 77–91.

Nooteboom B, Berger H, Noorderhaven NG. 1997. Effects of trust and governance on relational risk. *Academy of Management Journal* **40**(2): 308–338.

O'Dwyer M, O'Flynn E. 2005. MNC-SME strategic alliances: a model framing knowledge value as the primary predictor of governance modal choice. *Journal of International Management* **11**(3): 397–416.

Osborn R, Baughn C. 1990. Forms of interorganizational governance for multinational alliances. *Academy of Management Journal* **33**: 503–519.

Oxley J. 1999. Institutional environment and the mechanisms of governance: the impact of intellectual property. *Journal of Economic Behavior & Organization* **38**(3): 283–309.

Oxley J, Wada T. 2009. Alliance structure and the scope of knowledge transfer: evidence from U.S.-Japan agreements. *Management Science* **55**(4): 635–649.

Pangarkar N, Klein S. 2001. The impacts of alliance purpose and partner similarity on alliance governance. *British Journal of Management* **12**(4): 341–353.

Park S, Russo M. 1996. When competition eclipses cooperation: an event history analysis of joint venture failure. *Management Science* **42**(6): 875–890.

Park S, Ungson G. 1997. The effect of national culture, organizational complementarity, and economic motivation on joint venture dissolution. *Academy of Management Journal* **40**: 279–307.

R Development Core Team. 2009. *R: A Language and Environment for Statistical Computing*. Available at: http://www.R-project.org (accessed 12 November 2010).

Reuer J, Ariño A. 2007. Strategic alliance contracts: dimensions and determinants of contractual complexity. *Strategic Management Journal* **28**(3): 313–330.

Reuer J, Ariño A, Mellewigt T. 2006. Entrepreneurial alliances as contractual forms. *Journal of Business Venturing* **21**(3): 306–325.

Ring P, Van De Ven A. 1992. Structuring cooperative relationships between organizations. *Strategic Management Journal* **13**(7): 483–498.

Ring P, Van De Ven A. 1994. Developmental processes of cooperative interorganizational relationships. *Academy of Management Review* **19**: 90–118.

Sampson R. 2004. Organizational choice in R&D alliances: knowledge-based and transaction cost perspectives. *Managerial & Decision Economics* **25**(6): 421–436.

Sengupta S. 1995. Some antecedents of exclusivity in bilateral interorganizational relationships. *Marketing Letters* **6**(1): 33–44.

Smith G, Parr R. 2005. *Intellectual Property: Valuation, Exploitation, and Infringement*. Wiley: New York.

Tallman S. 2003. The significance of Bruce Kogut's and Udo Zander's article, knowledge of the firm and the evolutionary theory of the multinational corporation. *Journal of International Business Studies* **34**(6): 495–497.

Teece D. 1977. Technology transfer by multinational firms: the resource cost of transferring technological know-how. *The Economic Journal* **87**: 242–261.

Wathne K, Heide J. 2004. Relationship governance in a supply chain network. *Journal of Marketing* **68**(1): 73–89.

Williamson O. 1983. Credible commitments: using hostages to support exchange. *American Economic Review* **73**(4): 519–530.

Zajac E, Olsen C. 1993. From transaction cost to transactional value analysis: implications for the study of interorganizational strategies. *Journal of Management Studies* **30**(1): 131–145.

DOI: 10.1111/j.2042-5805.2011.00001.x