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THE COMPETITIVE ADVANTAGE OF INTERCONNECTED FIRMS: AN EXTENSION OF THE RESOURCE-BASED VIEW

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I extend the resource-based view to incorporate the network resources of interconnected firms. My model distinguishes shared resources from nonshared resources; identifies new types of rent; and illustrates how firm-, relation-, and partner-specific factors determine the contribution of network resources to the rents extracted from alliance networks. After reassessing the heterogeneity, imperfect mobility, imitability, and substitutability conditions, I conclude that the nature of relationships may matter more than the nature of resources in networked environments.

The sources of economic rents and the quest for competitive advantage have received considerable attention in the strategic management literature. In traditional perspectives on competitive advantage, such as the resource-based view (RBV; Barney, 1991; Dierickx & Cool, 1989; Wernerfelt, 1984), scholars have envisioned firms as independent entities. Consequently, these perspectives have provided only a partial account of firm performance in view of the accumulated evidence of the proliferation and significance of interfirm alliances in recent years. Unfortunately, in the rapidly evolving alliance literature, researchers have developed their own agenda by focusing on phenomenon-driven research and by drawing from various theories, such as the RBV, transaction cost economics, learning and knowledge management, game theory, and social network theories (Osborn & Hagedoorn, 1997). The emphasis on alliance formation and alliance performance in this literature has left a theoretical gap between traditional theories of the firm and observations concerning the strategic behavior and performance of interconnected firms.

Here I seek to bridge this gap by extending one prominent strategic management theory—namely, the RBV—in order to offer a systematic theoretical analysis of the competitive advantage of firms participating in alliances. First, I discuss the theoretical implications of alliance proliferation for theories of the firm. I follow this with an examination of the limitations of the RBV in addressing the competitive advantage of interconnected firms, noting that the focus on resources that are owned or controlled by the firm undermines the essential contribution of the resources of alliance partners. According to recent empirical work (Afuah, 2000; Lee, Lee, & Pennings, 2001; McEvily & Zaheer, 1999; Rothaermel, 2001; Saxton, 1997; Singh & Mitchell, 1996; Stuart, Hoang, & Hybels, 1999; Stuart, 2000), alliance partners play a significant role in shaping the resource-based competitive advantage of the firm. Therefore, in this study I follow the relational view (Dyer & Singh, 1998) by examining the applicability of RBV assumptions in networked environments. I integrate and extend the relational view and social network theories, contrasting the formulation of the traditional RBV with a reformulated version of the RBV that takes into account the impact of network resources. The notion of network resources was introduced by Gulati (1999), who examined how resources that are embedded in the firm's alliance network shape alliance formation decisions. Network resources are external resources embedded in the firm's alliance network that provide strategic opportunities and affect firm behavior and value. In this study I consider the broader implications of network resources for

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the competitive advantage of interconnected firms.

The contribution of this study rests in the extension of the RBV and the ability to move beyond a traditional perspective that precludes an accurate evaluation of a firm's competitive advantage in networked environments. Instead of applying traditional RBV research in an attempt to provide a theoretical explanation of the phenomenon of alliance networks, I revisit the theoretical underpinning of the RBV by considering the implications of alliance networks. I reveal how an interconnected firm can extract value from resources that are not fully owned or controlled by its internal organization. I then develop a model that allows for the estimation of various types of rent that a firm generates by relying on resources distributed across its network of alliances. By integrating and elaborating previous studies, firm-specific, relation-specific, and partner-specific factors that determine the capacity to appropriate rents can be identified. The paper concludes with a discussion that positions the current study within the broad RBV research agenda and that calls for the integration of social network theories and RBV research.

THE THEORETICAL IMPLICATIONS OF THE PROLIFERATION OF ALLIANCE NETWORKS

Since the early 1980s, scholars have been observing the proliferation and increasing importance of interfirm alliances (Gulati, 1998; Gulati, Nohria, & Zaheer, 2000; Hagedoorn, 1993, 1995). An interfirm alliance (henceforth termed *alliance*) is a voluntary arrangement among firms that exchange or share resources and that engage in the codevelopment or provision of products, services, or technologies (Gulati, 1998). Alliances can take different forms, including joint ventures, franchising, long-term marketing and licensing contracts, reciprocal trade agreements, R&D partnerships, and affiliation in research consortia.

Because of the proliferation of alliance formation, the study of alliance networks has gained popularity, and researchers have noted the benefits of considering the role that these networks play in affecting the performance of member firms (Gulati et al., 2000). Until recently, however, most alliance studies have focused on different questions, such as those involving the motivation for alliance formation, the identity of firms participating in alliances, the selection of partners, the management of alliances, the determinants of the governance structure or mode of alliance, learning and dynamics in alliances, and the performance of alliances (Gulati, 1998). This body of literature has evolved almost independently from traditional theories of the firm, which focus on competitive strategy, and thus make different assumptions than theories that do not consider cooperative strategies as an anomaly.

The gap between mainstream theories of the firm and the emerging literature on alliances leaves open the question of competitive advantage in networked environments. Theories such as the RBV (Barney, 1991; Wernerfelt, 1984) cannot, in and of themselves, explain how firms gain competitive advantage in an environment where firms maintain frequent and multiple collaborative relationships with alliance partners. The alliance literature has provided tools for evaluating value creation and appropriation at the dyad or network level, but the integrated contribution of internal and external sources of competitive advantage to firm performance deserves more attention. In this study I confront this theoretical challenge by analyzing the limitations of the RBV in explaining competitive advantage in networked environments and by offering adjustments that allow for a more precise treatment in such environments.[1]

[1] This study focuses on extending the RBV, but other mainstream theories of the firm deserve similar attention. For example, the industrial organization framework (Porter, 1980) views competition rather than cooperation as the dominant state of the world. It is further concerned with overall industry forces rather than with specific actions of individual industry players and regards alliances mainly as collusive arrangements. These limitations are partially addressed by Brandenburger and Nalebuff (1996), who consider the role of complementors. Similarly, transaction cost economics (Williamson, 1975) offers a narrow view of alliances as hybrid organizations and emphasizes contractual rather than relational aspects. Subsequent research extends this theory by shifting from cost minimization to joint value creation and suggesting interfirm trust as an alternative to formal safeguards that mitigate opportunistic behavior (Dyer & Singh, 1998; Zajac & Olsen, 1993). The fundamental concepts of bargaining power, opportunistic behavior, and contractual agreements are incorporated in the proposed extension of the RBV.

THE APPLICABILITY OF THE RBV FOR INTERCONNECTED FIRMS

Assessment of the RBV

In recent years the RBV has become one of the most influential frameworks in the strategic management literature. Rooted in the early contribution of Penrose (1959), the RBV adopted an inward-looking view, conceptualizing firms as heterogeneous entities consisting of bundles of idiosyncratic resources. Rumelt (1984) and Wernerfelt (1984) advanced the RBV by arguing that the internal development of resources, the nature of those resources, and different methods of employing resources are related to profitability. Hence, firms can develop isolating mechanisms or resource-position barriers that secure economic rents. Dierickx and Cool (1989) provided a more dynamic perspective, arguing that it is not the flow of resources but, rather, the accumulated stock of resources that matters, and that only those resources that are nontradable, inimitable, and nonsubstitutable are essential for competitive advantage, typically measured in terms of above-normal rents.

By tying the nature of resources to competitive advantage, the RBV suggests that resources enable the generation of Ricardian rents and quasi-rents (Conner, 1991; Peteraf, 1993). To explicate this phenomenon, Barney (1991) has offered an enhanced framework identifying four characteristics of resources essential for gaining sustainable competitive advantage—namely, value, rarity, imperfect imitability, and imperfect substitutability. Similarly, Peteraf (1993) has elucidated the link between resources and economic rents by identifying four conditions for sustainable competitive advantage—namely, resource heterogeneity, ex post limits to competition, imperfect resource mobility, and ex ante limits to competition. These studies do not focus on appropriability problems and latently assume that the appropriability of rents requires ownership, or at least complete control of the rent-generating resources. Despite its limitations (Barney, 2001b; Priem & Butler, 2001), the RBV has established a strong foothold in the strategic management literature.

The RBV and the Role of Network Resources

Recently, the RBV has been applied to the study of alliances, covering such issues as the rationale for alliance formation, governance structure, and performance (e.g., Das & Teng, 2000; Eisenhardt & Schoonhoven, 1996). These studies retain the fundamental assumptions of the traditional RBV, conforming to principles that may be inconsistent with the nature of interconnected firms. In particular, because of the argument in favor of strategic asset idiosyncrasy and resource immobility, the RBV still holds that resources that confer competitive advantage must be confined by the firm's boundaries.

Despite the diverse definitions used by different scholars, the RBV's assumption of ownership and control is embedded in most resource definitions. For instance, Wernerfelt defines resources as "tangible and intangible assets which are *tied semi-permanently to the firm*" (1984: 172; emphasis added). Barney classifies resources as "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. *controlled by the firm* that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (1991: 101; emphasis added). Finally, Amit and Schoemaker define resources as "stocks of available factors that are *owned or controlled by the firm*" (1993: 35; emphasis added). This proprietary assumption is not limited to resource definitions but, rather, concerns the core idea that firms secure rents by imposing resource-position barriers that protect their proprietary resources.

The proprietary assumption may have resulted from the popularity of competitive strategy (as opposed to cooperative strategy) at the time the RBV was first formulated. The RBV (Rumelt, 1984; Wernerfelt, 1984) followed the industry analysis framework (Porter, 1980), which conceptualized all incumbents, entrants, substitutors, suppliers, and customers as entities seeking to compete away a firm's rents, therefore needing to be deterred by entry barriers and mobility barriers. In particular, proponents of the RBV developed their own conception of resource-position barriers (Wernerfelt, 1984) designed to protect a firm's resources from imitation and substitution (Barney, 1991). Therefore, in conventional RBV studies, scholars have assumed that value-creating resources are owned and controlled by the focal firm (Amit & Schoemaker, 1993; Barney, 1991). Furthermore, researchers have assumed that the only type of

association between extrafirm resources and firm-level performance is competitive in nature. As Conner (1991) has concluded, firm performance results from simultaneous interactions among the firm's resources, the resources of its competitors, and the public policy environment. Assumed away is a cooperative type of interaction, in which the superior resources of counterpart firms can actually contribute to the focal firm's performance.

The proprietary assumption of the RBV does not pose a limitation to the extent that the competitive environment is populated by independent firms. However, in recent years, evidence has accumulated suggesting that resources of alliance partners transferred via direct interfirm interactions have a considerable impact on firm performance. These resources can be referred to as *network resources* that extend the opportunity set of the firm (Gulati, 1999).

In support of this claim, Saxton (1997) found that firms benefited from their alliance partners' reputation. Stuart et al. (1999) found that the IPO performance of new ventures was affected by the technological and commercial prominence of their alliance partners. Singh and Mitchell (1996) learned that firms in the hospital software systems industry failed when their partners went out of business or formed other alliances. Similarly, Afuah (2000) demonstrated that exogenous technological changes that produced an adverse effect on the capabilities of suppliers in the computer workstation industry influenced the competitive advantage of their customers. In addition, Lee et al. (2001) found that linkages to venture capital firms predicted performance of Korean technological start-ups. Rothaermel (2001) showed that incumbents in the biopharmaceutical industry achieved higher performance when leveraging the complementary resources of new technology providers. Finally, Stuart (2000) found that the technological capabilities of partners contributed to the sales growth and innovation rates of semiconductor firms. Together, these studies suggest that the resources of alliance partners influence the competitive advantage of the interconnected firm.

Hence, proponents of the RBV may have been correct when arguing that valuable resources are nontradable and imperfectly mobile, but they failed to acknowledge the direct sharing of resources and the indirect transferability of benefits associated with these resources. The fundamental assumption of the RBV, according to which firms must own or at least fully control the resources that confer competitive advantage, turns out to be incorrect. Ownership or control of resources is not a necessary condition for competitive advantage. A weaker condition of resource accessibility, which establishes the right to utilize and employ resources or enjoy their associated benefits, may suffice. This idea is akin to the Penrose's (1959) suggestion that it is the services that resources provide, not resources themselves, that generate value for the firm.

The proprietary assumption of the RBV prevents an accurate evaluation of a firm's competitive advantage. Following the rationale of the RBV, a firm should be valued based only on the contributions of its internal resources. Yet empirical studies examining the market value of firms entering alliances, especially joint ventures, detect abnormal stock market returns in response to alliance announcements (Balakrishnan & Koza, 1993; Chan, Kensinger, Keown, & Martin, 1997; Das, Sen, & Sengupta, 1998; Koh & Venkatraman, 1991; Reuer & Koza, 2000). These results suggest that firm valuation should be based not only on the resources of the firm in question but also on the resource endowments of its alliance partners. Despite the mounting evidence of the contribution of alliance partners to the competitive advantage of firms, most of the reviewed studies are epiphenomenal and provide no overarching theoretical framework to explain this important relationship between network resources and firm performance.

Theoretical Approaches for Evaluating the Contribution of Alliance Networks

Before shifting to theory building, it is vital to acknowledge the contributions and limitations of alternative approaches to the study of the impact of alliance partners on a firm's competitive advantage. In particular, the relational view and social network theories have provided valuable insights (Gulati, 1998). The relational view (Dyer & Singh, 1998) complements the RBV by arguing that critical resources may span firm boundaries and that firms earn not only Ricardian rents and quasi-rents but also relational rents, which are jointly generated with alliance partners. Such relational rents derive from spe-

cific assets firms dedicate to alliance relationships and from complementarities between their resources and the resources of their partners.

The establishment of an effective alliance governance structure and the evolution of interfirm routines that facilitate the sharing of knowledge and information within the boundaries of the alliance also play a role in generating relational rents. Hence, the relational view draws not only from the RBV but also from transaction cost economics. It elaborates on the mechanisms of joint value creation, since, by definition, relational rents accrue at the alliance level and cannot provide private benefits. Unlike studies that acknowledge the role of both private and common benefits (Hamel, 1991; Khanna, Gulati, & Nohria, 1998), the relational view emphasizes common benefits that alliance partners cannot generate independently.

A second stream of research, rooted in social network theories, recently has been applied to the study of interfirm relationships and performance. In addition to relational aspects, network theories emphasize structural variables and cover a wide range of theoretical perspectives that focus on the analysis of enduring patterns of relationships among interacting social actors (Wasserman & Faust, 1994). Such relationships are not an inherent characteristic of any individual actor, so the fundamental unit of analysis becomes the network, which consists of the collection of actors and their connecting ties.

Social network studies originated in the sociology literature exploring social groups, cliques, structural balance, social cohesion, roles, positions, status, dominance, conformity, social exchange, reciprocity, influence, and other forms of relationships among individuals. These theories gained mathematical appeal with the development of structural measures such as network density and centrality (Wasserman & Faust, 1994). Important contributions in the social network literature include the distinction between weak and strong ties (Granovetter, 1973); the related measure of embeddedness (Granovetter, 1985; Uzzi, 1996); the notion of structural holes (Burt, 1992); centrality measures of network positions, closeness, and status (Bonacich, 1987; Freeman, 1979; Ibarra, 1993; Podolny, 1993); network density and social capital measures (Burt, 1992, 1997; Coleman, 1988, 1990); measures of cohesion (Coleman, Katz, & Menzel, 1957); and structural equivalence (Burt, 1987).

Social network theories have been applied to the study of interorganizational relationships, identifying these relationships as a significant element in organizational environments (DiMaggio & Powell, 1983; Grandori & Soda, 1995; Nohria, 1992). This rapidly growing body of literature criticizes theories that seek to explain firm strategies and performance solely on the basis of unilateral profit-seeking behavior in a resource-based or competition-oriented environment (Granovetter, 1985; Gulati, 1995; Nohria, 1992). Instead, social network researchers analyze interfirm relationship structures and examine the impact of network-level cooperation, communication, learning, and imitation on a firm's actions and performance.

Incorporating social network approaches in the study of firm performance, scholars have focused on the firm's ego network, which encompasses the focal firm (termed *ego*), its set of partners (*alters*), and their connecting ties (Wasserman & Faust, 1994). For example, Ahuja (2000) examined the effects of direct ties, indirect ties, and structural holes on innovation output. By counting the number of alliance partners and measuring structural equivalence, patent counts, and relative scope, Baum, Calabrese, and Silverman (2000) demonstrated that the composition of alliance networks explains differences in the performance of start-up firms. In addition, other studies have explored the effect of network centrality, network density, and clique structure on network effectiveness in terms of client outcomes (Provan & Milward, 1995; Provan & Sebastian, 1998). More recent studies have also shown that the number of ties to venture capital firms is associated with the sales growth of start-up firms (Lee et al., 2001) and that strong ties differ from weak ties in terms of their effect on firm performance (Rowley, Behrens, & Krackhardt, 2000).

Social network research has provided important contributions to the study of interconnected firms. Nonetheless, many of these studies have focused on outcomes only at the dyadic or the network level, have utilized performance measures other than economic rents, or have oversimplified the contribution of network resources by predominantly considering structural measures that hardly reflect the heterogeneity in resource endowments of specific alliance partners.

The relational view and social network theories offer important insights that I incorporate here in extending the RBV and advancing a comprehensive theoretical framework that explains how interconnected firms combine network resources and internal resource endowments to achieve competitive advantage. The development of this theory requires a major adjustment of the RBV that must be undertaken in order to relax the proprietary assumption of the traditional perspective. Whereas the basic unit of analysis remains the resource and the unit of accrual remains the firm, the theory developed here acknowledges the contributions from resources distributed across the ego network to the competitive advantage of the focal firm.

REFORMULATION OF THE RBV

Formulation of the Traditional RBV

For the purposes of this study, I follow Barney's (1991) formulation of the RBV, which refers to the broad definition of resources as all types of assets, organizational processes, knowledge, capabilities, and other potential sources of competitive advantage that are owned or controlled by the focal firm. Barney (1991) identifies two preconditions for competitive advantage: resource heterogeneity and imperfect mobility. Resource heterogeneity requires that not all firms possess the same amount and kinds of resources; imperfect mobility entails resources that are nontradable or less valuable to users other than the firm that owns them (Peteraf, 1993). Generally, the firm is said to possess a set of resources that can produce a positive, neutral, or negative impact on its overall competitive advantage. This impact depends on two characteristics of each resource: its value and its rarity (Barney, 1991). In addition, the firm's competitive advantage is influenced by interactions, combinations, and complementarities across internal resources of the firm (Amit & Schoemaker, 1993). The competitive advantage of the firm can be understood as a function of the combined value and rarity of all firm resources and resource interactions.[2]

[2] The parameterizing of the value and rarity constructs has become a basis for fertile discussion and is summarized elsewhere (Barney, 2001a).

Reformulation of the RBV for an Interconnected Firm

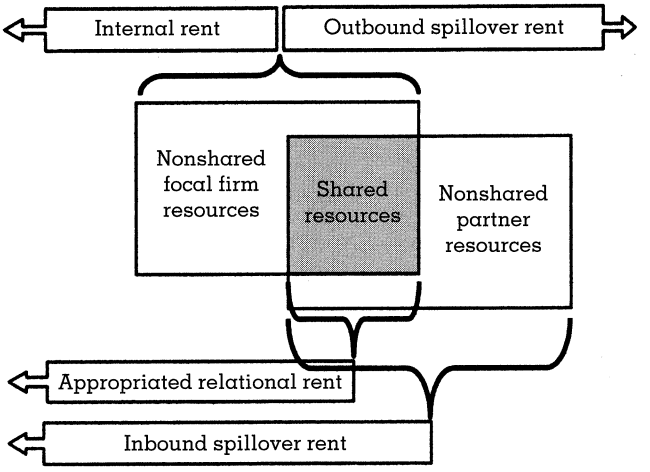
Before reformulating the RBV, it is necessary to examine whether the resource heterogeneity and imperfect mobility conditions still hold in networked environments. The heterogeneity condition is tied to the conceptualization of firms as independent entities. This condition remains critical, although alliances may contribute to resource homogeneity by facilitating asset flows among interconnected firms. Generally, alliances do not enhance competitive advantage by contributing to resource heterogeneity. However, under conditions of pure resource homogeneity, alliances will be formed solely for collusive purposes, rather than to gain access to complementary resources. Mergers and acquisitions may be even more effective than alliances for such purposes.

The imperfect mobility condition is also relevant for interconnected firms. Under perfect mobility, resources can be traded and accessed without forming alliances. However, alliances can serve as the means for mobilizing resources that have traditionally been considered immobile. Even when resources cannot be mobilized, alliances enable the transfer of benefits associated with such resources and, thus, weaken the imperfect mobility condition.

I develop the theoretical model by formulating the competitive advantage of an interconnected firm participating in a single dyadic alliance, then discussing the formulation for the case of multipartner alliance networks in which the partners are either independent or interdependent, and finally suggesting that these two generic forms of multipartner networks can be generalized to any ego network structure. The mathematical formalization in the Appendix is employed to enhance the clarity of the arguments, enable their generalization to the ego network level, and facilitate empirical validation of the theory.

Consider a focal firm and its alliance partner. Relaxing the proprietary assumption of the RBV allows for the resources of the partner to affect the competitive advantage of the focal firm. When an alliance is formed, each participating firm endows a subset of its resources to the alliance with the expectation of generating common benefits from the shared resources of both firms. Therefore, each firm possesses a subset of

FIGURE 1
Composition of Rents Extracted by the Focal Firm in an Alliance[a]



[a] This figure depicts the composition of rents from the perspective of the focal firm. Internal rent can be extracted from the focal firm's own shared and nonshared resources. Appropriated relational rent can be extracted only from the shared resources of both partners. Inbound spillover rent applies to the partner's shared and nonshared resources, whereas outbound spillover rent applies to the focal firm's own resources. Unlike other rent types, outbound spillover rent results from the transfer of benefits from the focal firm to the partner and is, thus, in the opposite direction.

shared resources and a subset of nonshared resources that, together, form its complete set of resources.[3]

Different degrees of convergence may exist between the resources of the focal firm and the resources of its partner. When the intersection of shared resource sets, which includes similar resources that both the firm and its partner own, is substantial, we can identify the alliance as a *pooling alliance,* in which partners pool their resources to achieve a greater scale and enhanced competitive position in their industry. In contrast, when this intersection is diminutive, the alliance can be described as a *complementary alliance,* in which firms seek to achieve synergies by employing distinct resources that are difficult to accumulate in combination by any given firm.

The resource-based competitive advantage of a focal firm participating in an alliance can be partitioned into four elements corresponding to four different types of rent: (1) internal rent, (2) appropriated relational rent, (3) inbound spillover rent, and (4) outbound spillover rent. Figure 1 depicts the composition of rents that the focal firm extracts from the shared and nonshared resources of a dyadic alliance. The following discussion elaborates on each type of rent.

Internal rent. The term *internal rent* refers to the combination of Ricardian rents and quasi-rents derived from the internal resources of the focal firm (Peteraf, 1993). Ricardian rents result from scarcity of resources, which limits their supply in the short run, whereas quasi-rents encompass the added value that a firm can extract from its specialized resources relative to the value that other firms can extract from similar resources.

The traditional RBV focuses on internal rents; however, when considering an interconnected firm, we need to incorporate not only the contribution of intrafirm resource complementarities

[3] As mentioned earlier, alliances can take different forms. When a joint venture is formed, the distinction between shared and nonshared resources is clear-cut because the new corporate entity is established only on the basis of shared resources. For other forms of alliances, such as joint marketing or R&D agreements, the distinction between shared resources and nonshared resources may be relatively ambiguous, but each firm should have a clear conception of which resources it is willing to share. The model developed in this study is sufficiently robust to apply to joint ventures as well as to other forms of alliances in which no separate corporate entity is formed.

but also that of interfirm resource complementarities. A firm can leverage the value of its own resources by accessing complementary resources of an alliance partner. For instance, Stuart et al. (1999) have demonstrated that the reputation of start-up firms' prominent alliance partners reflects on their own reputation, resulting in enhanced IPO performance. Unlike relational rents, which rely on interfirm complementarities in creating common benefits to alliance partners, internal rents are private benefits enjoyed exclusively by the focal firm. Hence, in the example of endorsing organizations (Stuart et al., 1999), the prominent alliance partner can actually suffer from reputational loss when endorsing an unsuccessful start-up firm. Thus, alliances can produce not only positive synergies but also negative implications for the value of the focal firm's own resources. Hence, the value of a particular internal resource depends on all other internal resources, as well as on network resources.

> *Proposition 1: Internal rent derived from the focal firm's own resources will depend on positive and negative complementarities with the shared and nonshared resources of its alliance partners.*

Appropriated relational rent. Dyer and Singh (1998) have defined relational rent as a common benefit that accrues to alliance partners through combination, exchange, and codevelopment of idiosyncratic resources. This type of rent cannot be generated individually by either alliance partner and is therefore overlooked in the traditional RBV.

Relational rents are extracted from relation-specific assets, knowledge-sharing routines, complementary resources, and effective governance mechanisms. They can be extracted only from resources that are intentionally committed and jointly possessed by the alliance partners, and, thus, they involve the shared resources of the focal firm and its partner. The contribution of relational rents to alliance outcomes depends on the total value of these shared resources. Although the relational view (Dyer & Singh, 1998) does not specify the proportion of relational rents appropriated by each participant in an alliance, unless predetermined, ex post relational rents are rarely distributed equally between the partners. For instance, Dyer (1996) found that asset-specific relationships between automobile assemblers and their suppliers led to a greater increase in the profitability of the former.

Several factors determine the proportion of relational rents appropriated by the focal firm, as discussed below.

Relative absorptive capacity. Firms often enter alliances with the expectation of learning new knowledge and acquiring external rent-generating resources. Distinctive learning capabilities of the firm and its partners explain the distribution of rents in such alliances (Dussauge, Garrette, & Mitchell, 2000; Hamel, 1991; Kumar & Nti, 1998). Absorptive capacity is an important learning capability that measures a firm's ability to identify, evaluate, assimilate, and exploit external knowledge (Cohen & Levinthal, 1990). Firms differ in terms of their absorptive capacity owing to idiosyncratic resource stocks, path dependencies, and heterogeneous communication channels. Prior studies have shown that a firm's absorptive capacity accounts for the actual learning from partners and eventually contributes to firm performance (Lane, Salk, & Lyles, 2001). Therefore, the better the absorptive capacity of the focal firm relative to that of its alliance partner, the higher the proportion of relational rents appropriated by the focal firm will be.

Relative scale and scope of resources. Relational rents accrue because of interfirm resource complementarities (Dyer & Singh, 1998), and, therefore, they are greater for complementary alliances than for pooling alliances, in which partners possess similar types of resources. The degree of overlap in shared resources of partners varies across alliances. Consider a hypothetical case where the shared resources of the focal firm are a subset of the shared resources of its partner. In this case, the resources that the focal firm can share are internally available to the partner, regardless of the alliance. Thus, the partner's potential benefit from the jointly generated rent is limited relative to that of the focal firm.

Similarly, the relative scale of alliance partners' resources affects the potential for appropriation. A larger resource set of the partner can provide greater potential benefits to the focal firm insofar as resources are idiosyncratic, which is the case under the resource heterogeneity assumption (Barney, 1991). In support of

this relative scale argument, empirical studies have shown that small firms with limited resources benefit more than their affluent established partners, even when controlling for firm age (Stuart, 2000). Ceteris paribus, the smaller the scale and scope of the focal firm's shared resources relative to those of its partner, the higher the proportion of relational rents appropriated by the focal firm will be.[4]

Contractual agreement. Most alliances involve the signing of formal contractual agreements at the time of alliance formation. Such contractual agreements specify the payoff structure of the alliance and proprietary information rights, as well as review, arbitration, and termination clauses. These contracts provide formal safeguards and determine the distribution of common benefits ex ante. A favorable contract may provide a firm with exclusive access to network resources, specify a relatively large share of returns on joint activities, protect the firm's internal resources from misappropriation by defining the scope of shared resources, and offer legal remedies that secure the firm's investments in the alliance.

Relative opportunistic behavior. Since contracts are incomplete and cannot specify all future developments (Williamson, 1975), researchers have emphasized the important role that informal safeguards and trust-building initiatives play in deterring potential opportunistic behavior of alliance partners (Dyer & Singh, 1998; Mody, 1993). Still, after a contract is signed, opportunistic behavior of a partner can result in extraction of a disproportionate share of rents by that party (Gulati, Khanna, & Nohria, 1994; Parkhe, 1993).

Salient opportunistic behavior in alliances may involve a tendency to cheat or defect from mutual agreements, unilaterally reduce investments in joint activities, and pursue self-interested objectives that maximize short-term private benefits at the expense of partners' common benefits. Hence, the more opportunistic a firm is relative to its alliance partner, the higher the proportion of relational rents appropriated by that firm will be. However, the more opportunistic the firms participating in the alliance are, the smaller the potential relational rents ex ante will be, since firms that recognize potential opportunistic behavior of partners tend to limit the scope of collaboration and knowledge transfer, which are critical for the creation of relational rent (Dyer & Singh, 1998; Parkhe, 1993). The contractual safeguards and opportunistic behavior arguments underscore the need to incorporate transaction cost economics logic (Teece, 1986; Williamson, 1975) in order to evaluate resource-based rent appropriation in alliance networks.

Relative bargaining power. Firms rely on their bargaining power at the stage of alliance formation and contract formulation. Yet, because of the incompleteness of contracts and dynamics that affect the relative bargaining power of partners during the course of the alliance, relative bargaining power plays a continuous role in determining the potential for rent appropriation. For instance, Hamel (1991) has argued that relative bargaining power complements relative learning skills in determining rent appropriation in alliances. Inkpen and Beamish (1997) have demonstrated that alliance partners accumulate knowledge and skills that result in shifts in their relative bargaining power over time. Finally, Khanna et al. (1998) have posited that an alliance partner's share of common benefits generated through an alliance depends on that partner's relative bargaining power. Hence, the stronger the bargaining power of the focal firm relative to its alliance partners, the higher the proportion of relational rents appropriated by the firm will be.

Since all of the aforementioned factors are relation specific, their combined impact on the appropriated relational rent can be described as follows.

> *Proposition 2: At the time of alliance formation, the more favorable the contractual agreement, the smaller the relative scale and scope of resources, the more attenuated the relative opportunistic behavior, and the stronger the bargaining power of the focal firm*

[4] A reviewer noted that Teece (1986) offers another argument that ties complementary resources to appropriated rent. Teece focuses on rent accrued because of technological innovation efforts (i.e., Schumpeterian rent) and suggests that the extent to which contracting for complementary resources enhances the capacity to appropriate rents depends on the appropriability regime—that is, the nature of the technology and the effectiveness of property rights protection. Teece's argument complements extended RBV propositions that consider relational rents rather than Schumpeterian rents and for which environmental factors remain exogenous.

relative to its alliance partners, the greater the firm's ex ante appropriated relational rent will be.

Proposition 3: After an alliance is formed, the stronger the relative absorptive capacity, the more salient the relative opportunistic behavior, and the stronger the bargaining power of the focal firm relative to its alliance partners, the greater the firm's ex post appropriated relational rent will be.

Inbound spillover rent. So far, I have considered the competitive advantage that is based on private benefits that are derived from a firm's own resources and on common benefits that are derived from the shared resources of alliance partners. Yet another type of private benefit is exclusively derived from network resources and pertains to unintended gains owing to both shared and nonshared resources of the alliance partners. This inbound spillover rent is usually associated with horizontal alliances among coopetitors that collaborate strategically.

Hamel (1991) discusses such collaborations in which firms seek to internalize the resources of their alliance partners and, thus, ultimately improve their competitive position vis-à-vis these partners. When both the firm and its alliance partner pursue such objectives, the parties are said to engage in learning races; however, when only one party holds latent objectives, such as targeting the core assets of its partner, it is said to be acting opportunistically (Kale, Singh, & Perlmutter, 2000). Hennart, Roehl, and Zietlow (1999) call such cases, where one party exploits the alliance for its private benefit, "Trojan Horses." Such learning races and "Trojan Horses" result in an unintended leakage of rents, with no synergetic value creation.

In the case of inbound spillover rent, the competitive advantage of the focal firm depends on several factors. Firm-specific factors determine the capacity of the firm to extract rents from the shared resources of the partner in an involuntary way for unintended purposes. Both firm-specific and partner-specific factors determine the potential for appropriating spillover rents from the nonshared resources of the partner. Because alliances grant the firm access to the shared resources of partners, the leakage of knowledge associated with such resources is difficult to prevent ex ante using contractual instruments. Coevolving trust and conflict resolution mechanisms can limit such leakage (Kale et al., 2000); however, the bulk of the appropriation potential hinges on the good faith of the focal firm. Hence, firm-specific factors, including opportunistic behavior, bargaining power, and the absorptive capacity of the focal firm, affect its ability to extract spillover rents from the partner's shared resources. This theme echoes prior studies analyzing the impact of strategic behavior and absorptive capacity on knowledge leakage in alliances (Kumar & Nti, 1998; Mowery, Oxley, & Silverman, 1996).

Proposition 4: The more salient the focal firm's opportunistic behavior and the stronger its bargaining power and absorptive capacity, the greater the inbound spillover rent the firm will derive from both the shared and nonshared resources of its alliance partners.

When considering spillover rents derived from nonshared resources, we assume that alliances provide opportunities that range beyond their immediate scope. Hence, the appropriation factors that represent the focal firm's motivation and capacity to identify and exploit such opportunities are also applicable to the partner's nonshared resources. However, partners acknowledging the risk of such unintended appropriation and its adverse consequences for their long-term competitive standing will invest in preventing resource leakage.

Firms protect their nonshared resources by using isolating mechanisms, such as causal ambiguity, firm-specific specialized assets, patents, trademarks, and other forms of legal and technological mechanisms designed to protect proprietary resources (Rumelt, 1984; Wernerfelt, 1984). According to Peteraf (1993), isolating mechanisms protect the firm from imitation and secure its rent streams. Specifically, these isolating mechanisms prevent the outbound diffusion of rents by limiting the imitability, substitutability, and transferability of strategic resources (Barney, 1991).

While the relational view (Dyer & Singh, 1998) acknowledges the role of isolating mechanisms that the firm and its alliance partners jointly employ to protect their shared resources from the external environment, the partners can individually develop other isolating mechanisms

that protect their nonshared resources from inbound spillover that benefits the focal firm. These partner-specific isolating mechanisms can vary across different resources but, for the sake of simplicity, can be consolidated.

Proposition 5: The stronger the isolating mechanisms used by the focal firm's alliance partners, the smaller the inbound spillover rent the firm will derive from the nonshared resources of its alliance partners.

Integrating Propositions 4 and 5, the competitive advantage derived from the inbound spillover rent can be considered a combination of the benefits associated with the leakage of an alliance partner's shared resources and nonshared resources.

Outbound spillover rent. Much as the resources of the alliance partners are subject to spillover rent appropriation, the resources of the focal firm are subject to unintended leakage that benefits the alliance partners. Hence, a symmetrical argument can be developed for the impact of outbound spillover rent, which diminishes the competitive advantage of the focal firm, as described in Propositions 6 and 7.

Proposition 6: The more salient the opportunistic behavior of the focal firm's alliance partners and the stronger their bargaining power and absorptive capacity, the greater the firm's loss of outbound spillover rent derived from both its shared and nonshared resources will be.

Proposition 7: The stronger the isolating mechanisms used by the focal firm, the smaller the loss of outbound spillover rent derived from its nonshared resources will be.

Following the general convention in RBV research, according to which industry structure effects are embedded in the static value of resources (Barney, 2001a), the overall impact of network resources on the interconnected firm's competitive advantage can be conceptualized as the combination of the four rent components—namely, internal rent, appropriated relational rent, inbound spillover rent, and outbound spillover rent. This formulation suggests that the competitive advantage of an interconnected firm, based on the combination of internal resources and network resources, is either greater or smaller than the competitive advantage of the same firm if evaluated only on the basis of its internal resources. Firm-specific, partner-specific, and relation-specific factors play a role in determining the type and magnitude of rents extracted from both the internal resources of the focal firm and the network resources of alliance partners (see the Appendix for generalization to the ego network level). Finally, the distinction between types of rent allows for the elaboration of traditional RBV propositions to the case of interconnected firms. For instance, based on the above reformulation of the RBV, I propose the following.

Proposition 8: Use of stronger isolating mechanisms by the focal firm will enhance its competitive advantage by inducing internal rent and reducing outbound spillover rent.

Proposition 9: Use of stronger isolating mechanisms by the focal firm's alliance partners will impair the competitive advantage of the firm by reducing internal rent and inbound spillover rent.

Proposition 10: The greater the overall relational rent shared by the focal firm and its alliance partners, the higher the potential for accrual of inbound and outbound spillover rents will be.

DISCUSSION

The proposed model overcomes a limitation of the traditional RBV, which has focused on resources that are owned or controlled by a single firm. This model incorporates the notion of network resources that play a role not only in the evolution of alliance networks (Gulati, 1999) but also in shaping the competitive advantage of interconnected firms. In addition, the model extends prior research on joint value creation in dyadic alliances (Dyer & Singh, 1998; Zajac & Olsen, 1993) by considering unilateral accumulation of spillover rents that produce private benefits. It also proposes that the mechanisms of value creation differ for shared and nonshared resources and that the value of internal

resources is affected by complementarities that span firm boundaries.

Overall, participation in alliances can either benefit or impair a firm's quest for rents. By extending the RBV, this study sheds light on the competitive advantage of interconnected firms and advances an ego network perspective. In the following sections I discuss the applicability of RBV propositions to interconnected firms, the prospects for the integration of the RBV and social network theories, and directions for future research.

Toward a Complete RBV of the Interconnected Firm

This study has focused on resource-based competitive advantage gained by interconnected firms. Barney's (1991) original framework, however, also analyzes the conditions for sustainability of competitive advantage. Do the imperfect imitability, imperfect substitutability, and organizational appropriability conditions still hold in networked environments?

Imperfect imitability means that no other firm will be able to obtain the valuable and rare resources of the focal firm (Barney, 1991). At the dyadic level, a firm and its partner can protect codeveloped and shared resources from external imitation by relying on isolating mechanisms, such as property rights protection and causal ambiguity (Dyer & Singh, 1998). Nevertheless, from the perspective of an individual firm participating in an alliance, causal ambiguity and social complexity become insufficient for preventing imitation by a partner when that partner acts as a co-opetitor. First, interfirm alliances provide partners with opportunities to access resource benefits without obtaining the resources themselves so that imitability per se is less relevant. Second, by interacting with the firm, partners become exposed to the path-dependent process of developing proprietary resources, which therefore become less causally ambiguous and socially complex from the partners' standpoint. Finally, by engaging in proactive learning, partners can internalize the resources of the firm (Hamel, 1991). Consequently, the inimitability of resources will depend less on the nature of resources and more on the nature of relationships between the firm and its partners. While factors such as contractual safeguards, absorptive capacity, and opportunistic behavior will determine the degree of imitation, interconnected firms will generally experience greater erosion of rents owing to imitation.

Imperfect substitutability means that no other firm will be able to offer alternative resources that support strategies that are equivalent to those used by the focal firm. Again, this condition becomes less relevant to the sustainability of competitive advantage in networked environments, because partners can gain access to desired resources through alliances, mitigating the need to substitute resources. One implication would be lower variation in the resources of interconnected firms.

Recently, Barney (2001b) argued that firms need to organize themselves in ways that allow them to exploit their competitive advantage. This internal organization principle is still valid for interconnected firms, but it requires not only organization of internal activities but also configuration of alliance network activities. For example, a firm may not need to develop complementary resources internally but should develop mechanisms that ensure appropriation of relational rent when accessing complementary resources of a partner.

This study has focused on extending Barney's (1991) RBV framework, but it is also consistent with other frameworks. For example, in addition to the heterogeneity, imperfect mobility, imperfect imitability, and imperfect substitutability conditions (ex post limits to competition), Peteraf's (1993) cornerstones model also considers some ex ante limits to competition. These limits entail market uncertainty about the value of resources, which allows certain firms to acquire resources in the absence of competition such that the value of acquired resources exceeds their acquisition costs. These limits become less relevant for interconnected firms that use alliances to reduce market uncertainty and stabilize the competitive environment (Eisenhardt & Schoonhoven, 1996; Hagedoorn, 1993; Pfeffer & Salancik, 1978). By forming alliances, interconnected firms that lack foresight or good fortune can gain access to resources without paying their full acquisition costs. Hence, relational aspects such as relative bargaining power play a more significant role than ex ante limits to competition in determining rent allocation in networked environments. The capacity of interconnected firms to gain and sustain competitive advantage will depend less on traditional RBV

conditions and more on their relational capability—that is, their capacity to form and maintain valuable interactive relationships with alliance partners.

Integration with Social Network Theories

The proposed extension of the RBV offers a bridge between the RBV and social network theories. The theoretical gap between the traditional RBV and social network theories is considerable, because the RBV focuses on the analysis of firms and their internal rent-generating resources (actor attributes), whereas social network theories emphasize the value of external ties. Most RBV studies do not analyze the impact of network structure on performance. The few studies that incorporate social network logic point to the divergent concerns in these two bodies of literature. These studies consider networks independently as factors that moderate the effects of resources on performance (Lee et al., 2001) or conceive of the network as a type of a valuable resource in and of itself (Kogut, 2000). The current study analyzes the competitive advantage of a focal firm in view of its given ego network of alliances. Consistent with social network perspectives, the alliance network defines a set of opportunities and constraints on the focal firm's rent accumulation behavior. Furthermore, the relational ties serve as channels for the transfer or flow of resources (Wasserman & Faust, 1994).

The extended RBV can offer additional contributions to social network perspectives. First, the consideration of such actor attributes as firm resources in social network theories is less common than the consideration of valued relations that define the strength or intensity of ties. For example, Granovetter's theory (1973) makes a distinction between weak and strong ties, with strength of relationships measured in terms of frequency, reciprocity, emotional intensity, and intimacy. In interorganizational network studies, researchers began considering actor attributes such as firm size, but these variables were used mainly for classifying firms into subsets (Wasserman & Galaskiewicz, 1984). The current study offers an application in which actor attributes play a dominant role in affecting firm behavior and performance.

Second, the proposed model considers interdependent partners and collaborative relationships among multiple partners. These multipartner alliances cannot be reduced to a collection of dyadic ties, and, therefore, they challenge conventional network theories. A promising avenue in this regard is the study of affiliation networks, which are two-mode networks that associate actors (firms) with an event (alliance) and consider subsets of actors rather than ties between pairs of actors (Breiger, 1974).

Third, a useful integration of the RBV and social network perspectives will allow for categorization of ego networks based on alter (partner) attributes rather than structural measures, such as structural equivalence of the alters (Lorrain & White, 1971). For example, it is possible to make a distinction between a *homogeneous ego network,* in which the resource sets of partners are similar, and a *heterogeneous ego network,* in which alliance partners own different resource sets. A homogeneous ego network enhances the capacity of the focal firm to appropriate rents based on accumulated experience with similar partners, more efficient governance mechanisms, and enhanced bargaining derived from reduced dependence on each partner. In contrast, the potential of a heterogeneous ego network rests in synergies enabled by complementary resources, reduced technological risk, increased potential for growth, and greater opportunities for innovation. This example demonstrates how firms can benefit from discretionally and strategically constructing their alliance networks.

Finally, social network theories can shed light on the evolution and configuration of alliance networks. The proposed model assumes a given network, yet the resource sets of current partners may pose constraints on the future development of the focal firm's alliance network. A resource-based approach considers the resource sets of alliance partners, rather than the identities of partners. Because firms with similar resources are often competitors occupying similar market positions, alliance partners who join the ego network of a focal firm will often act to preempt their competitors and lock them out of the network. In addition, the focal firm will extend its alliance network only to the extent that new partners offer added value or synergies. Such strategic behavior brings to mind issues of network brokering (Burt, 1992), positions, and roles (Mandel, 1983), and it highlights the path-dependent nature of alliance networks (Gulati,

1999). The interdependencies across alliances in which a firm participates, and the impact of the current structure of the ego network on future opportunities for value creation and appropriation, should be taken into account as the firm attempts to proactively manage its alliance network.

Limitations and Directions for Future Research

The RBV, which serves as the main theoretical perspective in this study, suffers from some limitations. Future research may incorporate social network theories, transaction cost economics, and dynamic perspectives in order to address these limitations.

The RBV has been criticized for underemphasizing the costs associated with the development and acquisition of resources. Whereas the current study addresses the important question of the origin and development of resources, the model does not formalize the notion of resource-based costs. Future research can incorporate the costs of extracting rents through alliance networks. In particular, such extension should acknowledge the increasing costs of managing complex networks that involve an increasing number of alliance partners (Burt, 1992). These organizational costs may offset the synergetic value ascribed to dense ego networks and, thus, require relational capabilities that are essential for managing complex alliance networks (Anand & Khanna, 2000; Dyer, Kale, & Singh, 2001). More generally, because the proposed model includes both structural and relational elements, future research may evaluate the impact of alliance network structure relative to that of relational aspects, such as trust building, knowledge sharing, bargaining power, and interfirm learning.

Further, the RBV provides a static perspective on rent generation. Attempts to overcome this limitation include the important distinction between asset stocks and asset flows (Dierickx & Cool, 1989) and the notion of dynamic capabilities, which elaborates on the processes of generating, integrating, and reconfiguring resources and capabilities (Teece, Pisano, & Shuen, 1997). Still, when considering various types of rent, different appropriation processes may require dissimilar spans of time. For instance, the benefits of complementarities that enhance the value of internal resources may be available at the outset, but relational rents are created gradually, as a consequence of continuous collaboration. The benefits associated with spillover rents may consume even more time, because firms need to bypass their partners' isolating mechanisms.

It is also important to consider simultaneous rent generation and appropriation at the network level. By adopting an ego network perspective, the proposed model assumes that the resource sets of alliance partners reach a steady state at the outset. Thus, the model conceives of network resources as given constants, whereas the underlying logic of the model suggests that internal resources can be adapted in response to interactive learning and collaboration involving network resources. Future research may relax this constraint by adopting a dynamic approach that relies on multiperiod formulation rather than on a single phase of interaction. Such a dynamic approach would require a shift from an ego network perspective to a more global network perspective.

In addition, future research may be able to consider not only the impact of direct ties but also the influence of indirect ties on the competitive advantage of the interconnected firm. From the perspective advocated in this study, resource-based rents are transferable to some extent; thus, a second-order effect in which a firm can access the network resources of a partner of its alliance partner can further advance our understanding of alliance networks. A firm may use a sequential partnering strategy in which it allies with a partner that does not possess valuable resources but that provides access to other partners owning desirable resources. Social network theories offer a promising approach for pursuing this avenue, insofar as they acknowledge the role of indirect ties (Ahuja, 2000; Gulati et al., 2000).

Finally, the proposed model should be corroborated empirically. Previous studies have provided ample support for the contribution of alliance partners to firm performance, but they have not focused on a comprehensive investigation of the RBV. Future research should test the extended model and identify the contingencies associated with the various sources of competitive advantage. Such empirical investigation may not be trivial, because firms do not follow the outlined model in reporting their composition of rents and do not offer proxies for measur-

ing such factors as relative absorptive capacity or opportunistic behavior. Consequently, archival sources referring to firm performance and fundamental resources should be supplemented with field studies and questionnaire-based data to estimate constructs such as relative absorptive capacity, opportunistic behavior, and bargaining power (Inkpen & Beamish, 1997; Lane et al., 2001; Parkhe, 1993). Such operationalization will provide further insights into resource-based interactions in alliance networks.

The proposed model can be tested empirically in any environment where the RBV is applicable, which suggests quite a broad range of industries and strategic conditions (Barney, 2001a; Priem & Butler, 2001). In fact, the extension I propose here offers a more accurate account of resource-based competitive advantage than the traditional RBV in environments characterized by dense alliance networks. Still, the extended RBV provides marginal value in highly competitive environments where alliances are rare, or in Schumpeterian environments where the RBV is generally less applicable than more dynamic perspectives (Barney, 2001b; Eisenhardt & Martin, 2000). As with the traditional RBV, the extended model is less applicable in studies of strategy implementation or in industry-level analysis. To evaluate the usefulness of the proposed model, researchers should ask under what circumstances relational rents and spillover rents become more pronounced relative to the internal rents that have received the majority of attention in traditional RBV studies. Hopefully, this study provides a useful formulation that integrates, elaborates, and systematizes contemporary RBV research and advances understanding of competitive advantage in environments featuring extensive alliance networks.

APPENDIX
GENERALIZATION TO THE EGO NETWORK STRUCTURE

The previous formulation of the extended RBV referred to the resource-based competitive advantage of an interconnected firm participating in a dyadic alliance. This formulation can be extended to the general case of an interconnected firm embedded in any alliance network by acknowledging that any ego network structure can be decomposed to two generic forms of multipartner networks, for which the formulation follows a similar logic as outlined previously. The following mathematical notation is introduced in order to clarify the generalization to the ego network level.

In the case of a dyadic alliance, we can refer to the focal firm as firm i and to its alliance partner as firm j. The resources of firm i maintain $R_i = S_i \cup N_i$—that is, a union of sets representing its shared resources $S_i = [r_1, r_2, \ldots, r_s]$ and its nonshared resources $N_i = [r_{s+1}, r_{s+2}, \ldots r_n]$. Similarly, the resources of firm j can be divided into its shared resources $S_j = [r_1, r_2, \ldots r_l]$ and nonshared resources $N_j = [r_{l+1}, r_{l+2}, \ldots r_m]$. The function $V(R)$ will denote the combined effect of the value and rarity of resources. Following the discussion of the four types of rent, the competitive advantage based on internal rent (CA_1) can be expressed by the equation

$$CA_1 = \sum_{p=1}^{n} V_1(r_p|(R_i^{-p} \cup R_j))$$

in which R_i^{-p} is the resource set composed of all firm resources R_i except resource r_p. The competitive advantage based on appropriated relational rents (CA_2) can be expressed by the equation

$$CA_2 = c_{ij}V_2(S_i \cup S_j)$$

in which c_{ij} represents a relation-specific appropriation factor that encompasses the relative absorptive capacity, relative scale and scope of resources, contractual agreement, relative opportunistic behavior, and relative bargaining power of firm i vis-à-vis firm j. The competitive advantage accrued due to inbound spillover rents (CA_3) can be represented by the equation

$$CA_3 = \alpha_i V_3(S_j) + \frac{\alpha_i}{b_j} V_4(N_j)$$

in which α is a firm-specific appropriation factor encompassing the opportunistic behavior, bargaining power, and absorptive capacity of the focal firm, whereas b represents partner-specific isolating mechanisms. Finally, the impact of outbound spillover rent (CA_4), which diminishes the competitive advantage of the focal firm, can be described by the equation

$$CA_4 = -\alpha_j V_5(S_i) - \frac{\alpha_j}{b_i} V_6(N_i).$$

The resource-based competitive advantage of a focal firm participating in a dyadic alliance can therefore be described as $CA_i = CA_1 + CA_2 + CA_3 + CA_4$.

The general ego network structure, such as the one depicted in Figure 2c, can be decomposed to the basic constellations depicted in Figures 2a and 2b. From the perspective of firm i that allies with the two alliance partners, firm j and firm k, a distinction can be made between a multipartner network that involves independent dyadic alliances (Figure 2a) and a multipartner network that involves three or more interdependent firms (Figure 2b).[5]

Reformulation of the RBV for an Independent Multipartner Network

In a multipartner network involving independent dyadic alliances, the competitive advantage of the focal firm relies on the four types of rent as discussed earlier: (1) internal rent, (2) appropriated relational rent, (3) inbound spillover rent, and (4) outbound spillover rent. The internal rent component, based on the focal firm's own resources, now embeds complementarities across the resources of the two partners, thus taking the form

$$CA^*_1 = \sum_{p=1}^{n} V_1(r_p|(R_i^{-p} \cup R_j \cup R_k).$$

When analyzing the relational rent component, we need to distinguish between the resources that firm i shares with firm j (S_{ij}) and those shared with firm k (S_{ik}). In most cases, the resources shared with firm j are not identical to those shared with firm k (i.e., $S_{ij} \neq S_{ik}$). The same resource can be shared with both partners only to the extent that the resource is nonrivalrous in use (i.e., its value does not depreciate with use, regardless of the number of resource users). Because the two alliances are independent, the accumulated appropriated relational rent produces a competitive advantage of the form

$$CA^*_2 = c_{ij}V_2(S_{ij} \cup S_j) + c_{ik}V_2(S_{ik} \cup S_k) = \sum_{q\in\{j,k\}} c_{iq}V_2(S_{iq} \cup S_q).$$

Similarly, the inbound (or outbound) spillover rent can be computed based on an aggregation of the terms referring to dyadic alliances. Hence, the competitive advantage of the focal firm benefits from inbound spillover rent of the form

$$CA^*_3 = \alpha_i\left(\sum_{q\in\{j,k\}}\left(V_3(S_q) + \frac{1}{b_q}V_4(N_q)\right)\right)$$

whereas the outbound spillover rent produces

$$CA^*_4 = -\sum_{q\in\{j,k\}} \alpha_q\left(V_5(S_{iq}) + \frac{1}{b_i}V_6(N_i)\right).$$

Overall, the competitive advantage of a focal firm involved in two independent dyadic alliances takes the form $CA^*_i = CA^*_1 + CA^*_2 + CA^*_3 + CA^*_4$.

Reformulation of the RBV for an Interdependent Multipartner Network

A constellation of a multipartner network (e.g., a triad) may involve multiple interdependent partners that interact simultaneously in a single alliance. For example, in April 2000, CMGI formed a joint venture with Novell and Sun Microsystems, in which each party contributed technologies and financial resources for the joint development of an internet operating platform. The formulation for the competitive advantage of an interconnected firm participating in such multipartner network is slightly different from the one outlined for the network involving independent partners. The internal rent will be similar in form, because the capacity to benefit from interfirm resource complementarities is not susceptible to the alliance structure, as long as direct ties exist to provide the firm with access to network resources. Hence,

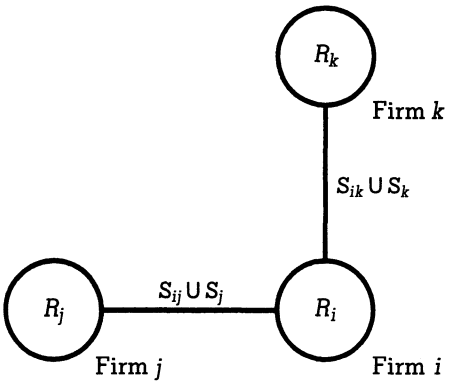
$$CA^{**}_1 = V_1(R_i|(R_j \cup R_k)).$$

The appropriated relational rent depends on a relation-specific factor (c_{ijk}) representing the rel-

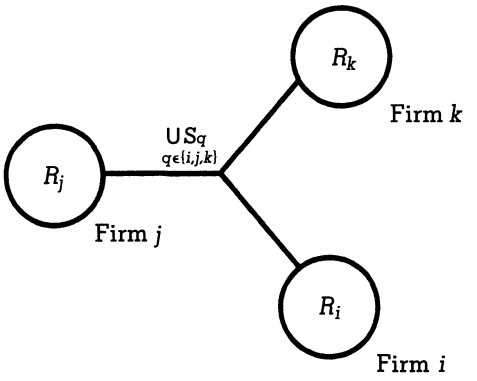
[5] The case where independent dyadic alliances are formed between each pair of firms in the multipartner structure can be reduced to the first case (Figure 2a), because the model adopts an ego network perspective that considers only direct ties. Second-order effects due to indirect ties such as those formed between two alliance partners are assumed away but could be considered as a natural extension of the model. In such an extension, to avoid circularity, it would be necessary to assume that the resource exchange between the two alliance partners reached a steady state before the interdependence with the focal firm could be analyzed.

FIGURE 2
Examples of Ego Network Structures

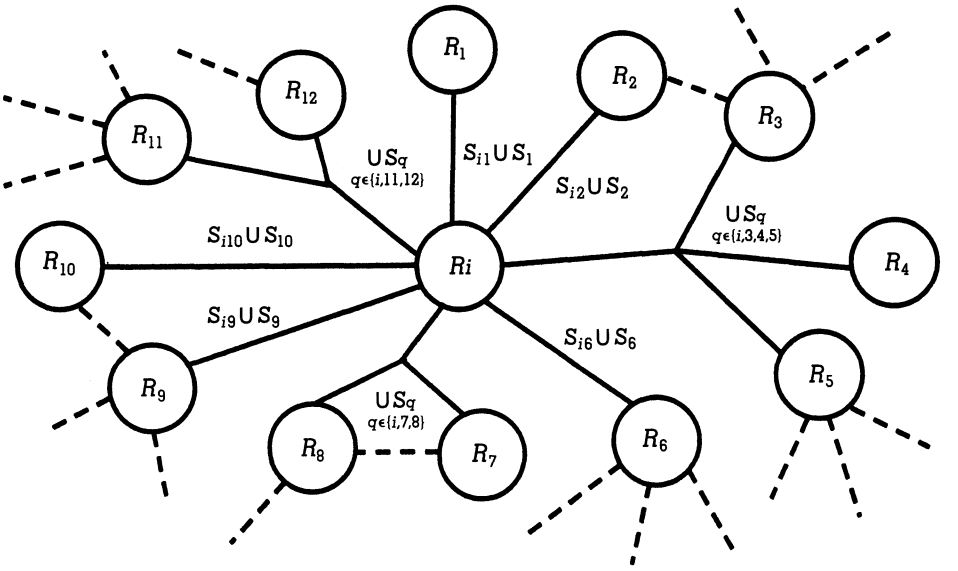
(a) Independent Dyadic Alliances



(b) An Alliance of Interdependent Firms



(c) A General Case of an Ego Network of Alliances



ative appropriation capacity of the focal firm, which differs across partners. Because the resource pool is shared by all partners, the shared resources of firm i maintain $S_{ij} = S_{ik} = S_{ijk}$ and can be simply denoted by S_i. The appropriated relational rent can be expressed by

$$CA^{**}{}_2 = c_{ijk} V_2\Big(\bigcup_{q\in\{i,j,k\}} S_q\Big).$$

Finally, when evaluating the effect of inbound (or outbound) spillover rents, we need to distinguish between shared resources that the focal firm treats as a source of combined network resources and nonshared resources that are possessed individually by each alliance partner and, thus, that generate an impact similar in form to the case of independent dyadic alliances. Therefore,

$$CA^{**}{}_3 = \alpha_i\left(V_3\Big(\bigcup_{q\in\{j,k\}} S_q\Big) + \sum_{q\in\{j,k\}} \frac{1}{b_q} V_4(N_q)\right)$$

and

$$CA^{**}{}_4 = -\sum_{q\in\{j,k\}} \alpha_q\left(V_5(S_i) + \frac{1}{b_i} V_6(N_i)\right).$$

The resource-based competitive advantage of a focal firm participating in a multipartner network of interdependent partners can therefore be indicated by

$$CA^{**}{}_i = CA^{**}{}_1 + CA^{**}{}_2 + CA^{**}{}_3 + CA^{**}{}_4.$$

Generalization to an Interconnected Firm with Any Ego Network Structure

Since any ego network structure (e.g., Figure 2c) can be decomposed to a collection of networks consisting of independent dyadic alliances and multipartner alliances involving interdependent partners, the formulation for these two generic multipartner networks can be generalized to any given ego network structure. Based on mathematical induction, firm i is assumed to have L_1 dyadic alliances, L_2 triadic alliances, L_3 quadratic alliances, and so forth. The term Q_{Mt} will denote the set of alliance partners participating in alliance t in which there are M participants besides firm i. For instance, in the case of the triadic alliance analyzed earlier (Figure 2b), $L_1 = 0, L_2 = 1, t = 1, M = 2$, and $Q_{Mt} = j,k$. Similarly, the two independent dyadic alliances (Figure 2a) can be characterized by $L_1 = 2, L_2 = 0, t \in (1,2), M = 1, Q_{11} = j$, and $Q_{12} = k$. In addition, the term Q will be used for the complete set of alliance partners so that

$$Q = \bigcup_{M}\bigcup_{t=1}^{L_M} Q_{Mt}.$$

It can be shown that in the general case, the competitive advantage of firm i is indicated by

$$\begin{aligned} CA_i = {} & V_1\Big(R_i \Big| \Big(\bigcup_{q\in Q} R_q\Big)\Big) \\ & + \sum_{M}\sum_{t=1}^{L_M} c_{iQ_{Mt}} V_2\Big(S_{iQ_{Mt}} \bigcup_{q\in Q_{Mt}} S_q\Big) \\ & + \alpha_i\left(\sum_{M}\sum_{t=1}^{L_M} V_3\Big(\bigcup_{q\in Q_{Mt}} S_q\Big) + \sum_{M}\sum_{t=1}^{L_M}\sum_{q\in Q_{Mt}} \frac{1}{b_q} V_4(N_q)\right) \\ & - \sum_{M}\sum_{t=1}^{L_M}\sum_{q\in Q_{Mt}} \alpha_q\left(V_5(S_{iQ_{Mt}}) + \frac{1}{b_i} V_6(N_i)\right). \end{aligned}$$

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