SOCIAL CAPITAL, STRATEGIC RELATEDNESS AND THE FORMATION OF INTRAORGANIZATIONAL LINKAGES

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This paper investigates the evolutionary dynamics of network formation by analyzing how organizational units create new interunit linkages for resource exchange. Using sociometric techniques and event history analysis, this study predicts the rate at which new interunit linkages are created between a newly formed unit and all the existing units in a large multinational organization. Two important constructs: social capital, derived from the literature on social structure and network formation, and strategic relatedness, derived from research on diversification and the resource-based view of the firm, are used to explain the rate of new linkage creation. Results show that the interaction between social capital and strategic relatedness significantly affects the formation of intraorganizational linkages. Copyright © 2000 John Wiley & Sons, Ltd.

A fundamental challenge for multiunit organizations is to leverage resources and knowledge developed by their diverse organizational units. Such resources or knowledge is an important source of organizational success, but is often sticky and difficult to spread (Von Hippel, 1994; Szulanski, 1996). Because of tacitness of knowledge (e.g., Winter, 1987) as well as causal ambiguity (e.g., Lippmann and Rumelt, 1982), organizational units have to cope with many kinds of difficulties to gain from exchanging resources with other units inside organizations. Resource exchange among organizational units occurs in a shared social context in which intraorganizational (or interunit) linkages are created. The creation of such linkages provides a foundation for a firm to leverage its internal resources and knowledge. As many scholars have argued, networks of intraorganizational linkages are effective for sourcing and transferring knowledge that leads to competitive advantage (e.g., Ghoshal and Bartlett, 1990; Nahapiet and Ghoshal, 1998; Nohria and Garcia-Pont, 1991; Hansen, 1999; Podolny, 1998; Powell, 1990).

While great effort has been devoted to the study of firm-specific resources and knowledge, there is less systematic understanding of the dynamic process of interunit resource exchange or knowledge sharing. Previous research has taken a static view by focusing on stable patterns of exchange among organizational units. Such a static view ignores the process of a firm's internal network formation that can influence the development of organizational capability over time. Indeed, many important research questions require exploration of the dynamic properties of network linkages within organizations: How do intraorganizational linkages evolve over time? Why can some organizational units quickly create an interunit linkage for resource exchange (or knowledge transfer) while others take longer to do so?

The aim of this research is to address these

questions in the context of a large, complex multiunit organization. As several scholars have argued, the structure of a multiunit organization can be conceptualized as a network arrangement consisting of a set of relational ties linking together dispersed organizational units (e.g., Miles and Snow, 1986; Nohria and Eccles, 1992; Nohria and Ghoshal, 1997). Based on this conceptualization, interactions (including communication and resource flows) among different units of an organization can be analyzed using a network perspective. An organization or a network, however, does not always contain the same set of participating actors. New actors may join and existing actors may leave. Interesting network patterns thus emerge when existing actors start interacting with new actors.

In this study, I investigated the creation of new interunit linkages in a multinational food-manufacturing company. I observed interactions among all the business units within the company for a recent 24-month period beginning in 1996, when a new business unit was established in the company. I analyzed the timing of which new interunit linkages are created between the new unit and all the existing units in the company and identified a set of structural, relational, and strategic factors that affected the rate of new linkage creation. The results of this study inform both the social network perspective and the resource-based view of intrafirm linkages, and suggest avenues for future research in this emerging area of inquiry.

THEORY AND HYPOTHESES

Intraorganizational linkages for resource exchange

Inside a multiunit organization, different units can establish linkages among themselves to exchange resources and transfer knowledge. Through such linkages, organizational units can access other units' knowledge and learn from each other. Intraorganizational or interunit resource exchange is an attractive alternative to market exchange because different units of an organization usually share similar values and common corporate languages that can facilitate communication in the exchange process. Many studies have shown that intraorganizational linkages enable an organization to achieve economies of scope and have a crucial bearing on the organization's competitive

advantage (e.g., Hill and Hoskisson, 1987; Gupta and Govindarajan, 1991). Also, research on diversification has suggested that there are synergistic benefits for resource exchange or knowledge sharing among related units within the same organization (e.g., Rumelt, 1974). Through generation of new applications from existing resources or knowledge, intraorganizational linkages allow individual units to create value for their organization (e.g., Tsai and Ghoshal, 1998).

In this study, I focus on intraorganizational linkages for resource exchange that involve transfer and sharing of resources or knowledge among organizational units. In particular, I investigate how such linkages are created between a newly formed unit and all the exiting units in an organization. The existing units are interested in exchanging resources with the new unit because the new unit represents the emergence of new ideas and new market opportunities. By collaborating with the new unit, the existing units can access new market information and expand their business domains. Also, the existing units can gain new expertise from the new unit and enhance their capabilities to adapt to a new environment. The new unit is also interested in exchanging resources because it can learn from the routines and best practices developed by the existing units. The new unit may also gain legitimacy by collaborating with the existing units and enhance its performance by leveraging the existing knowledge in the organization.

Path dependence and creation in intraorganizational networks

Although organizational units can benefit from new interunit linkages, creating such new linkages is not easy. Several scholars have argued that social relations are 'path dependent' in the sense that prior linkages determine the formation of future linkages (e.g., Gulati, 1995; Levinthal and Fichman, 1988; Walker, Kogut, and Shan, 1997). Because of the lack of information about the competencies and reliabilities of potential partners, developing a relationship with a new actor takes time and involves uncertainty. Once two actors 'have developed specific routines for managing an interface with each other' (Gulati, 1995: 626), they tend to rely exclusively on such routines and ignore opportunities for initiating relationships with new partners. As Cook has argued,

firm attachments or commitments often develop between exchange partners due to the investment made and the costs involved in establishing and maintaining the relationship. The attachment or commitment serves to prolong the exchange and tends to limit the mobility of exchange partners. (Cook, 1977: 68)

In the interorganizational context, Levinthal and Fichman (1988) investigated the dynamics of auditor–client relationships and found positive duration dependence in these relationships. In addition, Van de Ven and Walker (1984) explored the role of coordination and found that initial relationships significantly affected their subsequent development. Relation-specific capital such as trust and tacit understanding develops over time. The potential gains associated with such relation-specific capital are likely to direct people's attention to existing relationships rather than new ones.

If maintaining existing linkages is a dominant force in network formation, social networks, in general, seem to be inert. However, at the individual actor level, different networking opportunities exist and some actors are better than others at capturing these opportunities. In a study of intraorganizational networks, Tsai (1998) showed that different organizational units possess different levels of 'strategic linking capability' which determines their effectiveness in using interunit linkages for exchanging resources and transferring knowledge. The idea of strategic linking capability highlights the differences among individual actors in the process of network formation through creation of new interunit linkages. Organizational units that are capable of creating new interunit linkages are likely to access new resources or knowledge that is embedded in other units. Simply maintaining a stable pattern of existing relationships cannot meet all the different needs in a world of increasing competition and changing technology. Collaborating with new partners and creating new relationships are necessary for acquiring critical resources and getting external support. The sooner an actor can create a new relationship, the earlier it can obtain the required resources and support.

To understand how organizational units can quickly create new interunit linkages, I examined two important concepts: *social capital*, derived from the literature on social structure and network formation, and *strategic relatedness*, derived from

research on diversification strategy and the resource-based view of the firm. Social capital describes the social context that facilitates or constrains individual actors' selection of exchange partners (e.g., Bourdieu and Wacquant, 1992; Burt, 1992; Coleman, 1990). Strategic relatedness characterizes the extent to which two organizational units are strategically similar[1] and pinpoints the opportunity for sharing strategic resources between the two units (e.g., Prahalad and Bettis, 1986; Rumelt, 1974; Teece *et al.*, 1994). These two concepts, social capital and strategic relatedness, provide complementary explanations for the creation of new interunit linkages.

Social capital and creation of new interunit linkage

Social capital represents the relational resources attainable by individual actors through networks of social relationships (e.g., Baker, 1990; Bourdieu and Wacquant, 1992; Coleman, 1990; Portes, 1998; Portes and Sensenbrenner, 1993; Putnam, 1995). Social capital is a powerful concept for understanding the emergence, growth, and functioning of network linkages. As Walker *et al.* (1997) have maintained, social capital influences network formation that proceeds through the establishment of new relationships. By providing a shared context for social interactions, social capital facilitates the creation of new linkages in the organizational setting.

Based on a comprehensive review of previous research on social capital, Nahapiet and Ghoshal (1998) and Tsai and Ghoshal (1998) have considered social capital as a broadly defined multidimensional construct that can contribute in many ways to the creation of new value for an organization. According to these authors, social capital includes a structural component, which manifests itself in attributes of an actor's network position, and a relational component, which encompasses trustworthiness and trusting relationships among network actors. In this study, I focus on these two components of social capital and examine how they influence the creation of new interunit linkages.

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[1] In this study, I consider two organizational units are strategically similar when they value the same kinds of strategic assets.

The structural dimension of social capital: prior network centrality

According to Tsai and Ghoshal (1998), an actor's location in a social network captures the structural dimension of social capital. An individual actor that is centrally located in a network may possess unique advantages in getting access to certain resources or actors. As Ibarra (1993) has argued, a high network centrality implies a high position in a status hierarchy and a high degree of access over valued resources. Holding a central network position is an important element of social capital that facilitates an individual actor's occupational attainment (e.g., Lin, Ensel, and Vaughn, 1981; Marsden and Hurlbert, 1988), career mobility (e.g., Podolny and Baron, 1997), power (e.g., Brass, 1992), and external resource acquisition (e.g., Tsai, 1998). In the interorganizational setting, research has suggested that prior social relationships facilitate the establishment and governance of future relationships (e.g., Gulati, 1995). In the intraorganizational setting, an organizational unit that is centrally located in the interunit network is likely to have a privileged access to critical resources because of its locational advantages. Such a central unit is likely to use its existing contacts to approach other units quickly. In addition, such a unit is highly visible and is a major channel of information for other units. Because of its high potential communication activity, a central unit is capable of dealing with complex interunit relationships and is likely to become an attractive partner to other units. It is reasonable to expect that such a central unit is able to attract other units to establish new interunit linkages quickly. Accordingly:

> *Hypothesis 1. An organizational unit's prior network centrality will be positively related to the rate of new linkage creation.*

The relational dimension of social capital: trustworthiness

Many scholars have articulated that trustworthiness is an important aspect of social capital (e.g., Coleman 1990; Fukuyama, 1995; Putnam, 1995). An actor's trustworthiness signals to other parties (including both those that have interacted with the actor in the past and those that have not) its willingness to forego short-term outcomes obtain-able through opportunistic behaviors (Chiles and McMackin, 1996: 87). Several recent studies have challenged the traditional opportunism-based theories of the firm and have emphasized the role of trustworthiness in governing social and economic exchange (e.g., Conner and Prahalad, 1996; Ghoshal and Moran, 1996). Trustworthiness not only constrains opportunistic behaviors but also reduces the costs of finding an exchange partner (e.g., Chiles and McMackin, 1996; Granovetter, 1985). As Uzzi has noted, trustworthiness 'facilitated the exchange of resources and information that are crucial for high performance but are difficult to value and transfer via market ties' (Uzzi, 1996: 678).

The potential benefits of creating intraorganizational strategic linkages can be achieved only if trustworthiness exists among organizational units. Inside a multinational or multiunit organization, a high degree of trustworthiness is particularly important as it can achieve global integration in 'the differentiated network' structure in which dispersed organizational units are linked to each other by independent relationships (Nohria and Ghoshal, 1997). Trustworthiness allows the exchange of idiosyncratic resources and fine-grained information, and shapes the patterns of interunit strategic linkages. An organizational unit's reputation for trustworthiness is mainly determined by other units' perceptions and evaluations of the unit's integrity and reliability in interunit exchange. Such a reputation for trustworthiness is an important factor that will influence a unit's preferences in selecting its exchange partners, as a unit will be more willing to exchange resources with the units that it perceives as trustworthy. Put differently, a trustworthy unit is an attractive exchange partner and other units are likely to establish new linkages with such a unit. As Fukuyama has argued, trustworthiness is a useful kind of social capital that increases 'the capacity to form new associations' (Fukuyama, 1995: 27). Accordingly:

> *Hypothesis 2. An organizational unit's trustworthiness will be positively related to the rate of new linkage creation.*

Strategic relatedness and creation of new interunit linkage

The strategy of related diversification enables

firms to exploit economies of scope through common strategic assets among different business units (Peteraf, 1993; Teece *et al.*, 1994). Because certain resources are neither tradable nor imitable through external market mechanisms, internal resource sharing among related units becomes an important source of an organization's competitive advantage (Dierickx and Cool, 1989; Kogut and Zander, 1992). In this study, I emphasize relatedness at the strategic rather than the operational level. Many previous studies have measured relatedness based on similarity of SIC code (e.g., Palepu, 1985). Such SIC-based measures are likely to exclude instances where two business units are strategically related. In particular, many conglomerate firms that are typically treated as unrelated diversification may in fact exhibit a degree of strategic similarity across their business units that makes them related in a cognitive sense (e.g., Markides and Williamson, 1996; Prahalad and Bettis, 1986). By emphasizing strategic similarity among organizational units, the concept of strategic relatedness may capture the motivation for organizational units to exchange strategic resources even though these units do not share the same SIC code.

A high degree of strategic relatedness between two organizational units implies that they have prior related knowledge that allows effective utilization of new knowledge (Cohen and Levinthal, 1990). Hence, strategic relatedness is an important factor that affects an organizational unit's decision to forge a new interunit linkage. As Inkpen has noted, 'New knowledge in an area we are familiar with is generally easier to acquire than knowledge about an unfamiliar area. Unrelated knowledge will be difficult to acquire and may, in fact, have limited value because of a lack of common language for understanding the knowledge' (Inkpen, 1998: 76).

It is difficult to create a linkage for resource exchange between two unrelated units because of the lack of shared language and common interests which are important for the effectiveness of their communications. When two units are strategically related, their common interests may motivate them to exchange information and resources in a way that both parties can benefit. Other things being equal, the higher the strategic relatedness between two organizational units, the higher their incentive to exchange or share their resources through an interunit strategic linkage. To the

extent that two organizational units are strategically related, this facilitates their ability to gain access to each other. Hence:

Hypothesis 3. An organizational unit's strategic relatedness will be positively related to the rate of new linkage creation.

Strategic relatedness may strengthen the effect of social capital on the creation of new interunit linkages. With strategic relatedness, organizational units may become increasingly aware of differences in centrality and trustworthiness when choosing an exchange partner. An organizational unit with high network centrality may create new linkages more quickly with strategically related units because strategic relatedness stimulates their interests in exchanging resources. Also, a trustworthy unit may create new linkages more quickly with strategically related units because trust reduces appropriation concerns and facilitates cooperation between related units. Put differently, social capital is likely to have a stronger impact on the rate of new linkage creation when there is a high level of strategic relatedness between two units. As Gulati and Gargiulo (1999) have suggested, the interaction between social structure and strategic interdependence significantly affects alliance formation. The impact of social capital on the creation of new linkages is likely to be contingent on the extent to which two units are strategically related. It is reasonable to expect a positive interaction between social capital and strategic relatedness on the rate of new linkage creation. Hence:

Hypothesis 4a. An organizational unit's prior network centrality is more positively associated with the rate of new linkage creation when there is a high level of strategic relatedness.

Hypothesis 4b. An organizational unit's trustworthiness is more positively associated with the rate of new linkage creation when there is a high level of strategic relatedness.

METHODS

Data collection and research site

The research was conducted in a large multinational company. The company was founded in

1967 by a group of business elite that shared the same interests in the food-manufacturing industry. During the past three decades, the company has continuously expanded new businesses and gradually become a diversified conglomerate. By 1996, the company had annual sales around U.S. $4 billion and total assets of U.S. $3.8 billion. It consisted of 36 business units and had a wide range of products including edible oil, beverages, fast foods, and dairy products. The interactions among the business units were basically voluntary and the organizational structure in the company was a typical multiunit form in which each unit dealt with conceptually distinct businesses and was self-contained with its own functional hierarchy. There were no formal requirements in the company for the business units to exchange resources or knowledge with certain other units. Each business unit was financially independent and had full discretion about choosing its business partners inside the company or outside.

In September 1996, a new business unit was established within the company. The new unit specialized in manufacturing and selling healthy food products, which represented an emerging high-profit segment in the food industry. The new business opportunities associated with the new unit attracted a lot of attention within the company and stimulated many existing units to collaborate with the new unit. To examine the interunit linkages within the company, I collected questionnaire data on the interactions among the 36 units before the new unit had been officially established. I then investigated how the new unit interacted with other units for 2 years. All questionnaire data were collected on site at two points in time. The first questionnaire was administrated in 1996 when there were only 36 units in the company; the second was in 1998, when there were 37 units in the company. After consulting with the corporate headquarters of the company, I asked the director of each business unit to respond to my questionnaires. These directors were also interviewed after they filled in the questionnaire (in both 1996 and 1998). During the interviews, I clarified unclear questions and ensured that respondents had provided complete information in the questionnaire. Respondents were assured that their individual responses were confidential and would be used for research purposes only. In addition to questionnaire surveys, corporate internal records were also used to sup-

plement my data analysis.

Operationalization of variables

New linkage creation

To investigate the creation of interunit linkages for resource exchange, I asked respondents (the directors of the original 36 business units) in my second questionnaire survey to indicate when their units started exchanging resources with the newly formed unit. I distinguished between two types of resource exchange: tangible and intangible. Tangible exchange involves transfer or sharing of tangible resources such as special input materials or specific product components. Intangible exchange involves transfer or sharing intangible resources such as technical skills or knowhow. Respondents reported the initial dates for each type of exchange in my second questionnaire survey (in 1998). To verify the responses, I provided a different questionnaire to the new unit asking when it started exchanging resources with all the other units. Consistence was found after I double-checked all the responses during my follow-up interviews.

Based on the information provided by the respondents, I calculated, for each unit, the duration (the amount of time that passed until the creation of its first linkage with the newly formed unit) in months. Since the second questionnaire was administrated 24 months after the new unit was formed, I coded the data ranging from 1 to 24. Duration that had no ending date (no linkage had yet occurred) was treated as right-censored data.

To transform the above data for my subsequent analysis and hypothesis testing, I used event history techniques,[2] which allowed me to incorporate right-censored data (e.g., Allison, 1984; Tuma and Hannan, 1984). The event of interest here is the creation of a new strategic linkage between an existing unit and the new unit. By definition, occurrence of an event assumes a preceding time interval that represents its nonoccurrence (Yamaguchi, 1991). More specifically, a certain time period or duration of nonoccurrence must

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[2] The event history techniques have been applied to analyze the longevity of interorganizational relationships. See, for example, Levinthal and Fichman (1988) and Miner, Amburgey, and Stearns (1990).

exist. In this study, the duration was the time elapsed before an existing unit established a linkage with the new unit (as described in the above paragraph) and the rate of new linkage creation can be written as

$$h(t) = \lim \frac{P(t+\Delta t > T \geq t \mid T \geq t)}{\Delta t}$$

where $P(t + \Delta t > T \geq t \mid T \geq t)$ indicates the probability that the event occurs during the time $(t, t + \Delta t)$ given that the event did not occur prior to time t. In this study, the hazard rate can be interpreted as the instantaneous probability that an existing unit will create a linkage with the new unit, given that it has yet to do so.

Prior network centrality

In my first questionnaire survey (in 1996), I asked respondents to report the units with which they communicated frequently. I provided a list of all the business units of the company in the questionnaire so that the respondents could simply select the units that applied. Using data collected from this questionnaire item, I constructed an adjacency matrix of interunit communication among the 36 business units. I then symmetrized the matrix to focus on bilateral communications and calculated the degree centrality index for each business unit. I chose the degree centrality index because, as Freeman (1979) has argued, it is relatively the most suitable centrality measure for capturing an individual actor's visibility, information access, and potential communication activity.

Trustworthiness

As Barney and Hansen (1994) have asserted, trust is an attribute of a relationship and trustworthiness is an attribute of an individual actor. Tsai and Ghoshal (1998) have also suggested that an actor's trustworthiness can be measured by its locational properties in a network of trusting relationships. Based on these authors' conceptualization, I surveyed interunit trusting networks before I operationalized trustworthiness at the business unit level. Interunit trusting networks were examined by asking two questions: (1) 'Suppose your unit is looking for business partners inside your organization for a joint project. Which units are you confident that they will

do what you require (what you believe they should do) even without writing a contract to clearly specify their obligations?'; (2) 'Which units can provide your unit with reliable information or service?'

The 1996 survey data were used here for the trustworthiness measure, because my objective was to examine how a unit's trustworthiness affected its subsequent (1996–98) networking activities. The data consisted of responses gathered from the above two questions. Based on the responses, I created two sociomatrices (adjacency matrices) and calculated 'indegree' for each unit in each matrix. Indegree was used as a measure of trustworthiness here, as it counted the number of nominations that a unit received in the interunit trusting network. The higher the indegree a unit had, the more trustworthy the unit was. I then standardized the indegree measure for each of the two interunit trusting networks. Cronbach's coefficient alpha for the two indegree measures (derived from the two matrices of trusting relations) was 0.89.

Strategic relatedness

Following Verdin and Williamson (1994) and Markides and Williamson (1996), I operationalized strategic relatedness based on five broad categories of strategic assets: (1) customer assets, such as brand recognition and customer loyalty; (2) channel assets, such as channel access and pipeline stock; (3) input assets, such as quality of suppliers and financial capacity; (4) process assets, such as proprietary technology; and (5) market knowledge, such as accumulated information on demand or market responses. Respondents were asked to rate the importance of these assets to their units' operations (using a scale of high, low, or moderate).

I then compared the responses across all the units. I considered two units to be strategically related if they highlighted the importance of the same category (or categories) of strategic assets. As Prahalad and Bettis (1986: 490) have argued, strategically similar businesses within a firm can be managed using a 'dominant logic' that is 'the way in which managers conceptualize the business and make critical resource allocation decisions—be it in technologies, product development, distribution, advertising, or in human resource management'. The dominant logic is

stored in managers' mindset. When managers of two different units have a similar mindset that emphasizes similar strategic assets, the two units are strategically related. To measure the extent to which two units emphasized similar strategic assets, I created a variable counting the number of categories for which two units had the same responses. The variable was coded from 0 (which means two units had nothing in common in terms of their responses to the above category) to 5 (which means two units had exactly the same responses to the above five categories). For example, unit A considered customer assets, channel assets, and market knowledge were important; unit B considered input assets, process assets, and market knowledge were important. Since units A and B had only one response in common (which is market knowledge), I coded 1 to indicate the extent of the strategic relatedness between units A and B. In this study, strategic relatedness was used to explain the creation of new interunit linkages with the newly formed organizational unit. So, for each of the 36 original units in the company, I calculated the degree of its strategic relatedness with the newly formed unit based on my 1998 survey data.

Control variables

Several control variables were included in this study. First, unit size may affect the rate of new linkage creation because size is an important consideration for a unit to select its exchange partners. As Burgers, Hill, and Kim (1993) have argued, large companies are likely to enter alliances with small companies. To control for the possible size effect, I used the logarithms of unit sales as an indicator of unit size in my analysis. In addition, geographic locations may also affect the networking activities among organizational units. Two units operating in the same geographic area are more likely to create a linkage between them. To account for this alternative explanation, I included a dummy variable (geographic proximity) coding 1 if an exiting unit and the new unit had major business operations in the same country, and 0 otherwise. Moreover, I expected that the internal transfer of employees across different units within the company might also affect the creation of new interunit linkage. In this specific sample, a few employees of the new unit were transferred from other units. These

employees may become key contacts for the new unit to reach their previous working unit. Hence, I included a variable counting the number of employees being transferred from each of the existing units to the new unit.

Analysis

To statistically test my hypotheses, I estimated a proportional hazards model (Cox, 1972). The use of the Cox proportional hazards model suits the objectives of this study. By including a time-dependent unspecified term in the model, the method allows environmental changes to be treated as an arbitrary function of time. Also, it counts for problems associated with the censoring of units that have not yet created a linkage with the new unit, but may nevertheless do it later. The model is often described as partially parametric or semiparametric, because it does not impose any distributional assumptions on the data. However, it does assume that the hazard functions (i.e., the probability of creating a new interunit strategic linkage, conditional on time) at different levels of an independent variable are proportional to an unspecified baseline hazard function. Following Anderson (1982), I examined the graphs of the natural logarithms of cumulative baseline hazard functions to check the proportionality assumption. For each variable examined, the functions appeared to be approximately proportional to each other, indicating that the proportionality assumption was not violated. The proportional hazards regression model, prior to adding interactions, was:

$$h(t) = h(0) \exp$$
$$(\beta_1 X_{controls} + \beta_2 X_{prior\ network\ centrality} +$$
$$\beta_3 X_{trustworthiness} + \beta_4 X_{strategic\ relatedness})$$

where $h(t)$ is the hazard function (i.e., the rate of new linkage creation) at time t, $h(0)$ is the baseline hazard function, β_i are the estimated regression weights, and X_i are the explanatory variables.

RESULTS

Table 1 shows the mean values, standard deviations, and correlations among all the measured

Table 1. Means, standard deviations, and correlations

Variables	Mean	S.D.	X_1	X_2	X_3	X_4	X_5
X_1 Prior network centrality	0.32	0.25					
X_2 Trustworthiness	38.06	12.06	0.44**				
X_3 Strategic relatedness	1.67	1.29	−0.00	0.10			
X_4 Unit size	2.33	0.44	0.18	0.40*	0.11		
X_5 Geographic proximity	0.44	0.50	−0.11	0.05	−0.03	−0.08	
X_6 Employee transfer	0.56	1.11	0.42*	0.22	0.15	0.09	−0.05

$*p < 0.05$; $**p < 0.01$ (two-tailed test)

variables in this study. Figure 1 parts (a) and (b) show the product limit (Kaplan–Meier) estimate of the survival function for tangible and intangible resource exchange, respectively. This figure describes how the new unit was integrated into the company over time. As shown in Figure 1(a),

(a)

(b)

Figure 1. Product limit estimate of survival function. (a) Tangible resource exchange. (b) Intangible resource exchange

most new linkages for tangible resource exchange were created during the first year since the new unit was established. No new linkage for tangible resource exchange was created after month 15. In contrast, Figure 1(b) shows that a few linkages for intangible resource exchange were created after month 15.

Table 2 presents the results of the Cox regression analyses examining the rate of new linkage creation. Several models were estimated. Models 1, 2, and 3 predict the time to first interunit exchange without differentiating different types of resources being exchanged. Models 4 and 5 predict the time to first tangible exchange controlling for the occurrence of prior intangible exchange (using a binary variable coding 1 if an existing unit previously had an intangible exchange with the new unit before). Models 6 and 7 predict the time to the first intangible exchange controlling for the occurrence of prior tangible exchange (using a binary variable coding 1 if an existing unit previously had a tangible exchange with the new unit).

As shown in Model 2, the coefficient for prior network centrality is positive and significant at the 0.01 level, suggesting that a unit with higher prior network centrality is likely to create a new interunit linkage more quickly. Thus Hypothesis 1 is supported. Model 2 also shows that the coefficient for trustworthiness is positive, as predicted. However, the result is only significant at the 0.10 level, indicating that a trustworthy unit is somewhat more likely to create a new linkage quickly. Thus Hypothesis 2 is only marginally supported here. In addition, the coefficient for strategic relatedness is positive and significant at the 0.01 level, suggesting that strategic relatedness increases the likelihood of new linkage creation. Therefore, Hypothesis 3 is supported.
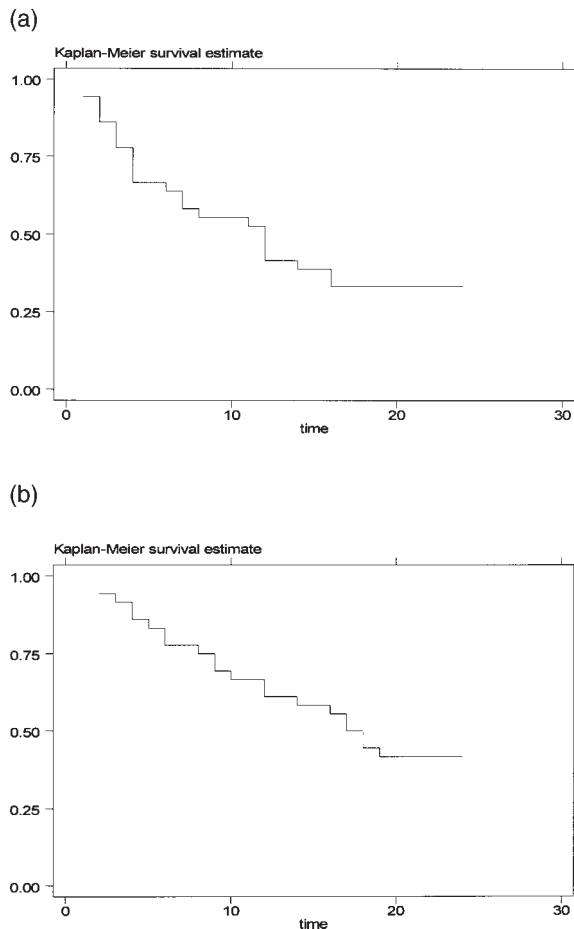
Table 2. Effects of social capital and strategic relatedness on new linkage creation

Variables	New linkage creation—not distinguish between tangible and intangible exchange			New linkage creation for tangible exchange		New linkage creation for intangible exchange	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Unit size	0.275 (0.455)	−0.552 (0.523)	−0.204 (0.533)	−0.379 (0.603)	0.223 (0.676)	−0.697 (0.612)	−0.641 (0.638)
Geographic proximity	0.173 (0.404)	0.496 (0.444)	0.807 (0.476)	0.346 (0.488)	0.659 (0.520)	−0.252 (0.473)	−0.334 (0.480)
Employee transfer	0.593* (0.237)	0.246 (0.256)	0.802* (0.327)	0.156 (0.274)	0.089 (.0371)	−0.105 (0.233)	−0.083 (0.278)
Prior tangible exchange				0.566 (0.719)	1.246 (0.848)		
Prior intangible exchange						−0.360 (0.695)	−0.635 (0.817)
Prior network centrality (H_1)		7.275** (1.785)	3.615 (2.525)	9.594** (2.245)	8.565** (3.073)	2.987* (1.465)	0.136+ (2.630)
Trustworthiness (H_2)		0.036+ (0.021)	0.069+ (0.038)	0.030 (0.022)	0.070+ (0.037)	0.491* (0.025)	0.128* (0.051)
Strategic relatedness (H_3)		1.411** (0.321)	1.827* (0.855)	1.773** (0.392)	2.969** (1.087)	0.498* (0.240)	1.766* (0.831)
Prior network centrality × strategic relatedness (H_{4a})			4.642** (1.589)		4.343** (1.615)		2.499+ (1.532)
Trustworthiness × strategic relatedness (H_{4b})			0.046* (0.023)		0.058* (0.026)		0.056* (0.024)
−2 log likelihood	157.539	114.279	103.114	96.110	85.530	114.016	107.661
Chi-square	7.647+	50.267**	68.075**	55.860**	69.992**	27.464**	32.889**

+ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$

Model 3 introduces the interaction term between prior network centrality and strategic relatedness. The result shows that the coefficient for this interaction term is positive and is statistically significant at the 0.01 level, indicating that the effect of prior network centrality on the rate of new linkage creation becomes more salient when there is a high level of strategic relatedness. Thus, Hypothesis 4a is supported. Model 3 also includes the interaction term between trustworthiness and strategic relatedness. As expected, the coefficient of the interaction term is positive and significant at the 0.05 level, suggesting that trustworthiness has a greater impact on the rate of new linkage creation when there is a high level of strategic relatedness. Hence, Hypothesis 4b is also supported.

Models 4 and 5 focus on interunit linkages for tangible exchange only. As shown in Table 2, prior network centrality and strategic relatedness are still significant predictors ($p < 0.01$) in Model 4. In contrast, trustworthiness is not statistically significant in this model. The result suggests that a unit's trustworthiness does not increase its likelihood of tangible exchange. Table 2 also shows that prior intangible exchange is not a significant predictor in Model 4, indicating that the occurrence of prior intangible exchange does not increase the likelihood of tangible exchange. The interaction terms between social capital measures and strategic relatedness remain significant in Model 5. Strategic relatedness strengthens the effect of social capital on tangible exchange.

Models 6 and 7 focus on interunit linkages for intangible exchange only. As shown in Table 2, prior network centrality, trustworthiness, and strategic relatedness are all significant predictors ($p < 0.05$) in Model 6, suggesting that both social capital and strategic relatedness increase the likelihood of intangible exchange. Table 2 also shows that prior tangible exchange is not a significant predictor in Model 6, indicating that the occurrence of prior tangible exchange does not increase the likelihood of intangible exchange. Model 7 shows that the interaction between prior network centrality and strategic relatedness is significant at the 0.10 level and the interaction terms between trustworthiness and strategic relatedness are significant at the 0.05 level. The results show that strategic relatedness strengthens the effects of prior network centrality and trustworthiness on intangible exchange.

DISCUSSION

Overall, the findings of this study support the idea that both social capital and strategic relatedness affect the creation of new interunit linkages. The results respond to an unanswered question in the extant literature: Where do network linkages come from? Previous research has explored the role of prior linkages in network formation without explaining how linkages are created in the first place. Social structure evolves through the creation of new linkages. By empirically investigating how new interunit linkages are created within an organization, this study contributes to our understanding of the evolutionary dynamics of an organization's internal social structure. The new linkages modify the existing social structure and provide new opportunities for productive resource exchange among organizational units. Creating new linkages, however, is not an easy task. Inside an organization, the opportunities to create new linkages are not readily available to every organizational unit. This study provides evidence of intrafirm heterogeneity in terms of differential capability to access strategic resources among organizational units. This study shows that some organizational units can quickly create new linkages with a newly established unit, while other units require more time to access the new unit. This study also shows that prior network centrality, trustworthiness, and strategic relatedness significantly affect the rate of new linkage creation. The results provide answers to an important question: What kinds of organizational units are likely to create new interunit linkages quickly? Organizational units that are rich in social capital can more quickly create a new linkage for resource exchange. Also, organizational units that share a higher degree of strategic relatedness are likely to more quickly create a new interunit linkage to realize the potential synergy in related business operations. The results support social capital explanation for network formation and, at the same time, confirm the role of strategic relatedness in shaping intrafirm linkages.

Social capital and strategic relatedness explanations for intraorganizational network formation are not mutually exclusive and could simultaneously affect the rate of new linkage creation. The interaction results suggest that interesting dynamics exist among prior network

centrality, trustworthiness, and strategic relatedness. The results indicate that prior network centrality more effectively influences the rate of new linkage creation between two strategically related units. Similarly, trustworthiness has a more positive effect on the rate of new linkage creation between two strategically related units. The results shed light on studies of diversification in the strategy literature. While strategy scholars have emphasized synergy among related business units in multiunit organizations, they ignore the processes of social interactions that influence the extent to which synergy can be achieved. In fact, each business unit has a unique relational profile underlying its social capital and ability to access other units. Examining the interaction between strategic relatedness and social capital may enhance our understanding of diversification strategy.

To better understand the creation of different kinds of intraorganizational linkages, I have distinguished between tangible and intangible resource exchanges in my analyses. The results suggest that trustworthiness has a more significant positive effect on intangible exchange than on tangible exchange. Because it is difficult to write a detailed contract to govern an intangible exchange, trustworthiness becomes an important concern when organizational units are involved in such exchange. Intangible resources contain 'tacit' knowledge that is difficult to articulate (e.g., Polanyi, 1967; Nonaka and Takeuchi, 1995). Effective transfer of intangible resources requires an intensive, complex communication process in which trustworthiness plays an important role. A high level of trustworthiness, however, may be less important in a situation where interunit linkages are based on transfer or sharing tangible resources. Because tangible resources are more explicit and less ambiguous, fewer communication problems are expected and a more instrumental motivation, strategic relatedness, becomes a major driving force for creating a new interunit linkage.

Drawing on 'the dominant logic' (Prahalad and Bettis, 1986), I developed a strategic relatedness measure based on the similarity of perceived importance of business unit strategic assets. Recent research has investigated several different types of relatedness such as skill-based or manufacturing-based relatedness (Farjoun, 1998; St John and Harrison, 1999). Future studies can

explore how different types of relatedness affect new linkage creation.

An important limitation of this study is the potential sampling bias due to the fact that I relied only on the responses of unit directors in the company. It is possible that some informal exchanges were excluded from this study because these directors were not aware of such exchanges. My choice of these respondents was based on the advice of corporate managers about people in the business units who had a thorough understanding of the operations and interunit activities of their units. Not surprisingly, the unit directors were relatively more knowledgeable on these issues, because of their overview roles.

Despite the limitation, this research provides a source of motivation to study network formation. Even though several researchers have proposed mathematical models to analyze longitudinal network data (e.g., Iacobucci and Wasserman, 1988; Leenders, 1995; Snijders, 1996), specific theory on network formation is still underdeveloped. As pointed out by Wasserman and Faust, 'Network analysis and models have often been criticized for being static. Although much work has been done on longitudinal models, applications of this methodology are sorely lacking' (Wasserman and Faust, 1994: 730). Continuous records of network changes are often hard to collect and methods for analyzing longitudinal data are quite complicated. Many more efforts are still required to study the process of network formation.

With longitudinal network data on intrafirm linkages, future researchers can also examine how an organizational unit's structural position changes over time and indicate how overall organizational structure is altered by the entry of new units. Network structural positions may signal status differences among actors (Podolny, 1993) and shape the pattern of their future interactions. In a longitudinal study of alliances in the semiconductor industry, Stuart (1998) has argued that a firm's position in the network of 'technological building relations' predicts alliance formation at the firm level. Since poorly positioned actors can only access less adequate resources to achieve their economic goals, social structure can act as a selection mechanism, cutting out some actors on the basis of their partners' weaknesses (Walker *et al.*, 1997: 110). Analysis of network structural positions may thus yield some interesting findings showing how different

organizational units survive under such an intraorganizational selection mechanism.

Another interesting theme for future research is the coevolution of social structure and organizational capabilities. In this study, we have seen how organizational units create new linkages to exchange resources. But how do these new linkages enhance the capabilities of the organizational units over time? As Kogut and Zander (1996) have argued, the capabilities of a firm lie primarily in an organizational learning process by which new knowledge is replicated or integrated across different parts of the firm. Such an organizational learning process can be understood by analyzing the social structure of interunit knowledge sharing. Detailed analysis of such intraorganizational social structure can provide important information for business unit managers who are thinking about how to design their units to effectively leverage organizational knowledge and learn from other units.

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