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## SOCIAL CAPITAL AND VALUE CREATION: THE ROLE OF INTRAFIRM NETWORKS

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**Using data collected from multiple respondents in all the business units of a large multinational electronics company, we examined the relationships both among the structural, relational, and cognitive dimensions of social capital and between those dimensions and the patterns of resource exchange and product innovation within the company. Social interaction, a manifestation of the structural dimension of social capital, and trust, a manifestation of its relational dimension, were significantly related to the extent of interunit resource exchange, which in turn had a significant effect on product innovation.**

The term social capital was originally used to describe the relational resources, embedded in cross-cutting personal ties, that are useful for the development of individuals in community social organizations (e.g., Jacobs, 1961; Loury, 1977). Recent research has applied this concept to a broader range of social phenomena, including relations inside and outside the family (Coleman, 1988), relations within and beyond the firm (Burt, 1992), the organization-market interface (Baker, 1990), and public life in contemporary societies (Putnam, 1993, 1995). As several studies have pointed out, like physical and human capital, social capital is a productive resource, facilitating actions that range from an individual's occupational attainment (e.g., Lin & Dumin, 1986; Lin, Ensel, & Vaughn, 1981; Marsden & Hurlbert, 1988) to a firm's business operations (e.g., Baker, 1990; Burt, 1992; Coleman, 1990). In this study, we examined the way in which social capital affects the internal functioning of firms and, more specifically, how social capital contributed to a firm's ability to create value in the form of innovations.

In a recent article, Nahapiet and Ghoshal (1997) presented a theoretical model of how social capital may facilitate value creation by firms. Building on Moran and Ghoshal's (1996) formulation of value creation as arising from the combination and exchange of resources, Nahapiet and Ghoshal

(1) identified three dimensions of social capital—structural, relational, and cognitive—and (2) theoretically justified how attributes of each of these dimensions facilitate the combination and exchange of resources within firms. In this study, we extended and elaborated Nahapiet and Ghoshal's framework, formulated some specific hypotheses based on their model, and subjected those hypotheses to empirical testing based on a survey conducted among 15 business units of a large multinational electronics company. Our findings provide strong support for Nahapiet and Ghoshal's proposals about an association between social capital and firms' value creation while also revealing some interesting discrepancies suggesting avenues for further theoretical and empirical work in this emerging area of inquiry.

### THEORY AND HYPOTHESES

Several scholars have conceptualized social capital as a set of social resources embedded in relationships (e.g., Burt, 1992; Loury, 1977). Other scholars, however, have espoused a broader definition of social capital, including not only social relationships, but also the norms and values associated with them (e.g., Coleman, 1990; Portes & Sensenbrenner, 1993; Putnam, 1995). Taking child safety in Jerusalem as an example, Coleman (1990: 303) showed how certain values collectively held in a society can be a kind of social capital that benefits the society as a whole, even in the absence of specific links between individual members of

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that society.<sup>1</sup> According to Portes and Sensenbrenner, “value introjection” is a key element of social capital, “because it prompts individuals to behave in ways other than naked greed” (1993: 1323). Hence, viewed broadly, social capital encompasses many aspects of a social context, such as social ties, trusting relations, and value systems that facilitate actions of individuals located within that context. Drawing on a comprehensive review of previous work on social capital, Nahapiet and Ghoshal (1997) called these different aspects of social context the structural, the relational, and the cognitive dimensions of social capital.

In distinguishing between the structural and the relational dimensions of social capital, Nahapiet and Ghoshal relied on Granovetter’s (1992) distinction between structural and relational embeddedness—a distinction also made in the work of Lindenberg (1996) and Hakansson and Snehota (1995). According to this view, the structural dimension of social capital includes social interaction. The location of an actor’s contacts in a social structure of interactions provides certain advantages for the actor. People can use their personal contacts to get jobs, to obtain information, or to access specific resources. The relational dimension of social capital, in contrast, refers to assets that are rooted in these relationships, such as trust and trustworthiness. Trust can act as a governance mechanism for embedded relationships (Uzzi, 1996). Trust is an attribute of a relationship, but trustworthiness is an attribute of an individual actor involved in the relationship (Barney & Hansen, 1994). Since trust can induce joint efforts (e.g., Gambetta, 1988; Ring & Van de Ven, 1994), a trustworthy actor (one who can be trusted by other actors) is likely to get other actors’ support for achieving goals to an extent that would not be possible in a situation where trust did not exist.

The third dimension of social capital, which Nahapiet and Ghoshal called the cognitive dimension, is embodied in attributes like a shared code or a shared paradigm that facilitates a common understanding of collective goals and proper ways of acting in a social system. Such a common under-

standing is appropriable by the collectivity as a resource (Portes & Sensenbrenner, 1993). This dimension of social capital actually captures the essence of what Coleman described as “the public good aspect of social capital” (1990: 315). Inside an organization (especially a large, complex organization), a shared vision and/or a set of common values help develop this dimension of social capital, which in turn facilitates individual and group actions that can benefit the whole organization.

As a concept rooted in the structure and content of relationships, social capital can be conceptualized and operationally defined at many different levels of analysis, including individuals (e.g., Bellevue, O’Reilly, & Wade, 1996), organizations (e.g., Burt, 1992), interorganizational arrangements (e.g., Baker, 1990), and societies (Putnam, 1995). In this study, our focus was on the relationships among the different business units of a multiunit company. Accordingly, as we explain in greater detail in the Methods section, we measured all our constructs and tested our model at the business unit level. Therefore, it is at this level that we formulated all our hypotheses on (1) how the three dimensions of social capital interact among themselves, (2) how they influence resource combination and exchange among the different business units of a multiunit company, and (3) how resource combination and exchange in turn influence value creation in the development of new products through innovations. Figure 1 graphically shows both our hypotheses and our findings.

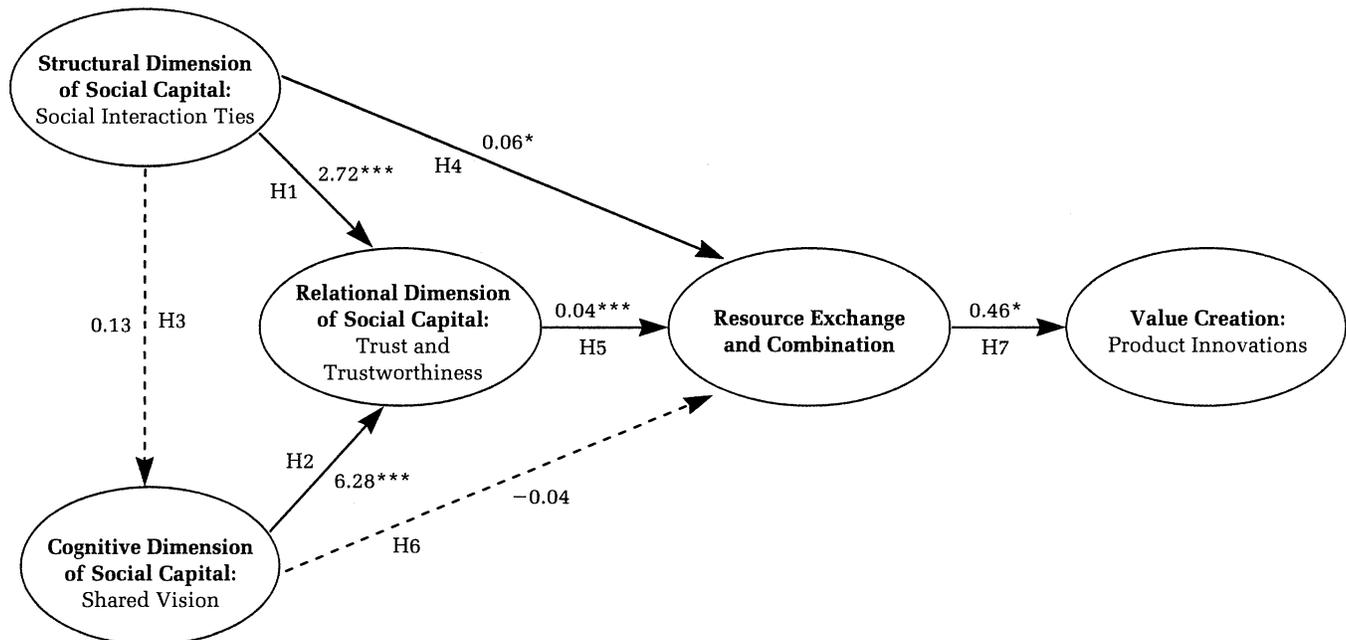
### Associations among the Different Dimensions of Social Capital

#### *Linking structural and relational dimensions.*

The structural dimension of social capital, manifesting as social interaction ties, may stimulate trust and perceived trustworthiness, which represent the relational dimension of social capital. Previous studies have suggested that trusting relationships evolve from social interactions (e.g., Gabarro, 1978; Gulati, 1995; Granovetter, 1985). As two actors interact over time, their trusting relationship will become more concrete, and the actors are more likely to perceive each other as trustworthy (Gabarro, 1978). Moreover, the network literature on tie strength has documented the implications of strong interaction ties for trust and trustworthiness (e.g., Krackhardt, 1992; Nelson, 1989). Frequent and close social interactions permit actors to know one another, to share important information, and to create a common point of view. Hence, an actor occupying a central location in a social interaction network is likely to be perceived as trustworthy by

<sup>1</sup> Coleman described a mother who had moved her family from suburban Detroit to Jerusalem because she saw people in Jerusalem as sharing the value that a child playing alone in a park should be taken care of by any adult, even a stranger, who was nearby. This kind of value is an important part of social capital, yet it is not based on interactor relationships—the mother did not necessarily know the people in her community in Jerusalem, but she believed nevertheless that they would take good care of her children.

FIGURE 1  
A Model of Social Capital and Value Creation<sup>a,b</sup>



<sup>a</sup> The figure depicts a structural model with maximum likelihood estimates. We set the error variances for single indicators at  $(1 - \alpha)^2$ , with loadings (lambdas) fixed at  $\alpha^{1/2}\sigma$ , where  $\alpha$  is the estimated reliability and  $\sigma$  is the standard deviation of the single indicator in use.

<sup>b</sup> Solid lines indicate significant paths. Dashed lines indicate nonsignificant paths.

- \* $p < .05$   
 \*\* $p < .01$   
 \*\*\* $p < .001$

other actors in the network. For interactions among the business units of a multiunit company, where each unit is considered an actor in the interunit exchange network, we can hypothesize this:

*Hypothesis 1. The centrality of a business unit in interunit social interaction will be positively associated with the level of its perceived trustworthiness.*

**Linking relational and cognitive dimensions.** Common values and a shared vision, the major manifestations of the cognitive dimension of social capital, may also encourage the development of trusting relationships. A trusting relationship between two parties implies that “common goals and values have brought and kept them together” (Barber, 1983: 21). As Ouchi noted, “Common values and beliefs provide the harmony of interests that erase the possibility of opportunistic behavior” (1980: 138). Sitkin and Roth (1993: 368) also maintained that trusting relationships are rooted in value congruence—the compatibility of individuals’ values with an organization’s values. With collective goals and values, organization members are

inclined to trust one another, as they can expect that they all work for collective goals and will not be hurt by any other member’s pursuit of self-interest. Put differently, inside an organization, any unit that shares the organization’s collective goals or values is likely to be perceived as trustworthy by other units in the organization. Hence,

*Hypothesis 2. The extent to which a business unit shares a vision with other units and with the organization as a whole will be positively associated with the level of its perceived trustworthiness.*

**Linking cognitive and structural dimensions.** The association between the structural and the cognitive dimensions of social capital relies on the premise that social interaction plays a critical role both in shaping a common set of goals and values and in the sharing of those goals and values among an organization’s members. Krackhardt (1990) studied individual actors’ cognitive accuracy by examining the overall social structure in an organization. The structure of organization members’ social interactions influences the formation of a

shared vision. The literature on organizational socialization (e.g., Van Maanen & Schein, 1979) has highlighted the importance of informal social interaction in helping individuals to learn organizational values. Through the process of social interaction, actors realize and adopt their organizations' languages, codes, values, and practices. At the same time, these socialized actors may also create new sets of values or new visions based on their common interests and mutual understandings. Inside a multiunit organization, different units may have different goals and plans for satisfying their local interests. Individuals inside a unit may share a collective orientation toward the pursuit of these goals and plans. Such a collective orientation constitutes the vision of a unit. Therefore, we expected that a business unit occupying a central location in the interunit network of social interactions within a company would be likely to share a vision and values with other business units in the network. Accordingly, we propose:

*Hypothesis 3. The centrality of a business unit in interunit social interaction will be positively associated with the extent to which it shares a vision with other units and with the organization as a whole.*

### **Social Capital and Resource Exchange/Combination**

**Social interaction.** Social ties are channels for information and resource flows. Through social interactions, an actor may gain access to other actors' resources. Such access, as Kanter observed, "allows innovators to go across formal lines and levels in the organization to find what they need" (1988: 190). Inside firms, social interactions among different business units blur the boundaries of those units and stimulate the formation of common interests. An individual unit then has more opportunities to exchange (or to combine) its resources with other units. Several studies on intraorganizational communication have documented the importance of interunit interaction for the creation and diffusion of innovations within complex multiunit organizations (e.g., Ghoshal, Korine, & Szulanski, 1993; Ibarra, 1993; Leonard-Barton & Sinha, 1992; Powell, Koput, & Smith-Doerr, 1996). Thus, an actor that is central in a network of social interactions likely has greater potential to combine and exchange resources with other actors because of its locational advantages in the network. Hence,

*Hypothesis 4. The centrality of a business unit in interunit social interaction will be positively associated with the extent of the resource ex-*

*change and combination the unit engages in with other units in the organization.*

**Trust and trustworthiness.** Trust has been viewed as an aspect of organizational context (e.g., Ghoshal & Bartlett, 1994) and as an antecedent of cooperation (e.g., Gambetta, 1988; Gulati, 1995; Ring & Van de Ven, 1994). Bradach and Eccles claimed that "trust is a type of expectation that alleviates the fear that one's exchange partner will act opportunistically" (1989: 104). When two parties begin to trust each other, they become more willing to share their resources without worrying that they will be taken advantage of by the other party. Thus, cooperative behavior, which implies the exchange or combination of resources, may emerge when trust exists.

As trusting relationships develop inside a network, actors build up reputations of trustworthiness that may become important information for other actors in the network. It is reasonable, therefore, to expect that a more trustworthy actor is more likely to be a popular exchange partner for other actors in the network. Hence, we argue that differences in levels of trustworthiness may result in different levels of resource exchange and combination among both organizations and different units of the same organization.

*Hypothesis 5. The level of a business unit's perceived trustworthiness is positively associated with the extent of the resource exchange and combination the unit engages in with other units in the organization.*

**Shared vision.** A shared vision embodies the collective goals and aspirations of the members of an organization. When organization members have the same perceptions about how to interact with one another, they can avoid possible misunderstandings in their communications and have more opportunities to exchange their ideas or resources freely. Furthermore, the common goals or interests they share help them to see the potential value of their resource exchange and combination. As a result, organization members who share a vision will be more likely to become partners sharing or exchanging their resources. Several studies have shown that a shared vision (or a similar construct, such as goal congruence) may hold together a loosely coupled system and promote the integration of an entire organization (e.g., Orton & Weick, 1990). We can thus view a shared vision as a bonding mechanism that helps different parts of an organization to integrate or to combine resources. Hence,

*Hypothesis 6. The extent to which a business unit shares a vision with other units and with the organization as a whole will be positively associated with the extent of resource exchange and combination the unit engages in with other units in the organization.*

### **Resource Exchange/Combination and Value Creation**

Following Schumpeter (1934), Moran and Ghoshal (1996) argued that new sources of value are generated through novel deployments of resources, especially through new ways of exchanging and combining resources. To create new or better products, firms need to reallocate resources, to combine new resources, or to combine existing resources in new ways. Similar arguments appear in the literature on organizational innovation. For example, several researchers have claimed that innovation requires diverse resource inputs (e.g., Kanter, 1988) and combinative capacities (Kogut & Zander, 1992). Thus, the processes of resource exchange and combination may be associated with innovation that may serve as an indicator for value creation. As Hitt, Hoskisson, Johnson, and Moesel noted, "Firm innovation has become important for value creation" (1996: 1085). In this study, we focused on product innovation as both a dependent variable and a measure of value creation, so we predicted the following:

*Hypothesis 7. The extent of resource exchange and combination a business unit engages in with other units will be positively associated with the unit's level of product innovation.*

## **METHODS**

### **Research Site and Data Collection**

The research was conducted in a multinational electronics company. One-site sampling schemes are not uncommon in network analysis, as a clear network boundary can be defined under this kind of research design (e.g., Krackhardt, 1990). A number of broad contextual factors that are known to influence the innovative ability of organizations and organizational units are, in essence, controlled for in a research design that focuses on the differences among units within the same company.

In 1996, at the time of data collection, the company employed 30,700 people and had annual sales of over \$4 billion (U.S. dollars). Its product lines included home appliances, industrial equipment, and computer communication products. It consisted of 15 business units that had operations in

North America, Europe, and Asia. The organizational structure of the company was a typical multiunit form in which each unit dealt with conceptually distinct businesses, was self-contained, and had its own functional hierarchy.

Interactions among the 15 business units were basically voluntary. A firm believer in decentralization, the founder of the company had instilled a set of policies that institutionalized divisional autonomy as a core organizational value. Thus, the divisions had no obligation to purchase any product or service from one another, even though some of them were engaged in complementary businesses. For example, one of the units was engaged in the computer and workstation business. This unit's managers could decide, on the basis of their own needs and preferences, whether to initiate a business relationship with another unit that specialized in the production of television sets and computer monitors. Such voluntary interactions within the company were the main focus of our study, and the 15 business units constituted the intrafirm (or interunit) network in our analysis.

Our data were collected through a questionnaire survey mailed during 1996. We asked three members of the management team of each business unit to respond.<sup>2</sup> The questionnaire was designed to collect both relational and nonrelational data. We obtained relational data by using sociometric techniques. We provided a list of all the business units in the company and asked the respondents to indicate the nature of their relations with each unit along a set of dimensions identified in our questions. Since relationships can change over time, the respondents were asked to base their answers on their own experience in the recent past (1993–96). Nonrelational data were gathered mostly through questions using Likert-type scales. Because we selected the respondents in consultation with managers in the corporate headquarters—a fact that was known to the respondents—all of them filled out and returned our questionnaires. To reduce possible social desirability bias (e.g., Arnold & Feldman, 1981), we (1) promised that we would keep all individual responses completely confidential, (2) confirmed that our analyses would

<sup>2</sup> The respondents in our sample were the key decision makers (usually the director and senior managers) in each business unit. We had sought a larger number of respondents from each unit, but the company approved the study on the condition that we restrict the survey to only three respondents per unit. Given this restriction, we based our choice on recommendations from managers at the company's headquarters indicating that the people in these positions thoroughly understood the operations and interunit activities of their own business units.

be restricted to an aggregated level that would prevent the identification of any individual or business unit, and (3) arranged for all the completed questionnaires to be mailed back directly to us instead of being routed through the company.

### Unit and Level of Analysis

As is manifest from the preceding description of the survey, most of our variables were relational and were measured at the dyadic level. But, as we indicated earlier, our theory and hypotheses were framed at the level of business units, and it was at this level that we wished to test our model. Doing so required two kinds of conversions of our data, both of which need some explanation.

The first conversion related to obtaining locational properties of individual units from relational measures. We did this by using a network analytic methodology that allowed us to compute locational properties (or centrality measures, such as "in-degree centrality" or "betweenness" (Freeman, 1977, 1979) from the relational data. These data could then be combined with data on nonrelational measures (such as product innovations) in a traditional statistical analysis. In adopting this approach, we emulated many earlier studies that have used a similar research design to considerable advantage (e.g., Ibarra, 1993; Powell et al., 1996).

However, as a precaution against the limitations of using a small sample in a traditional statistical analysis, we carried out a supplemental analysis in which all the constructs were operationally defined as relational measures at the dyadic level. For this analysis, we converted the nonrelational measures (such as our measure of shared vision) into dyadic scores and then used the Multiple Regression Quadratic Assignment Procedure (MRQAP) suggested by Krackhardt (1988) to carry out the overall analysis at the dyadic level. The procedure we followed and the results of this analysis are reported separately in the Results section; to our considerable satisfaction, the findings were entirely consistent with the associations and paths we identified at the business unit level.

The second conversion was the aggregation of the responses from the three managers in each business unit into a unit-level measure for each of the constructs. With relational measures, it is not possible to establish the appropriateness of such aggregation using standard tests of interrater convergence. As we indicated in our description of the survey, for each relational measure, each respondent had to pick, out of the 15 business units listed in the survey, the units with which his or her unit enjoyed that specific relationship. To check the extent

of consistency in the three responses from each unit, we computed convergence indexes. The index was defined as  $C_{kx} = A_{kx}/B_{kx}$ , where  $C_{kx}$  is the index of consistency for measure  $k$  for business unit  $x$ ,  $A_{kx}$  is the number of units selected by at least two of the three respondents of business unit  $x$  for measure  $k$ , and  $B_{kx}$  is the number of units selected by at least one of the three respondents of business unit  $x$  for measure  $k$ . Note that the value of  $C_{kx}$  can range from 0.0 (perfect inconsistency) to 1.0 (perfect consistency). In this study, the value of  $C_{kx}$  varied from 0.5 to 1.0, with an overall average of 0.77 across all our relational measures.

### Measures

**Social interaction.** Following Marsden and Campbell (1984), we constructed two "sociomatrixes" from data on the social interactions among the 15 business units based on the following two questions: (1) "With people of which units do you spend the most time together in social occasions?" and (2) "Please indicate the units which maintain close social relationships with your unit." In framing these two questions, our objective was to explicitly focus the respondents on their social rather than their business ties. The formal business links were captured in our measures of resource exchange and combination (see below). Since we wished to explore the relationship between social interaction and formal business ties, represented by resource exchange, it was necessary to distinguish between these two types of interactions.

After we coded the data into the two sociomatrixes measuring social interactions, we calculated the betweenness index for each business unit in each sociomatrix. We chose this index because, as Freeman (1977) argued, it is the most suitable centrality measure for capturing the information or access benefits within a social structure. We standardized the betweenness index using the following calculation suggested by Wasserman and Faust (1994: 190): *Standardized betweenness index* =  $2 \sum g_{jk}(n_i)/g_{jk}(g-1)(g-2)$ . In this equation,  $g_{jk}$  is the number of geodesics linking the two actors (business units)  $j$  and  $k$ ,  $g_{jk}(n_i)$  is the number of geodesics linking the two actors that contain actor  $i$ , and  $g$  is equal to 15, the number of actors in the network. We calculated the standardized betweenness index for the above-mentioned time spent and close contact matrixes, respectively. The zero-order correlation for the two standardized betweenness indexes was .86.

**Trust and trustworthiness.** We developed two questions to examine the interunit trusting relationships in the company: (1) "Please indicate the

units which you believe you can rely on without any fear that they will take advantage of you or your unit even if the opportunity arises" and (2) "In general, people from which of the following units will always keep the promises they make to you?" Using data gathered from the two questions, we created two relational matrixes measuring interunit trust and trustworthiness.

To measure the extent to which trust existed between different units in the company (the unit's trustworthiness), we calculated the degree centrality of the interunit trusting networks from the above two questions. Since the trusting relationships here were directional (that is, the fact that X trusted Y did not necessarily imply that Y also trusted X in return), both in-degree and out-degree centrality could be calculated. The in-degree centrality of an actor (unit  $i$ ) was the number of units that were adjacent to unit  $i$ , or the number of units that indicated that they trusted unit  $i$  in their answers to the above two questions. For the analysis reported here, we used in-degree as a measure of trustworthiness as it counted the number of nominations each business unit received in the interunit trusting relations matrix. We then standardized the in-degree measure for each of the two interunit trusting networks. The zero-order correlation for the two in-degree measures (reliability and promise keeping) was .96.

**Shared vision.** We used a two-item measure to assess the level of shared vision in the different business units. The items were (1) "Our unit shares the same ambitions and vision with other units at work" and (2) "People in our unit are enthusiastic about pursuing the collective goals and missions of the whole organization." These items were assessed on a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree). We simply averaged the three responses within each unit to get unit-level data. The zero-order correlation for the two-item measure was .71.

**Resource exchange and combination.** We investigated the flows of several kinds of interunit resources, including information, products, personnel, and support. To see how the business units exchanged resources and combined those resources within their operations, we developed a set of four questions: (1) "With which of the following units does your unit frequently exchange important information (such as market trends, sources of supplies, or ideas for product development)," (2) "Does your unit offer any product or service to other units? If yes, please indicate the units that receive your product or services," and (3) "Have members of your unit been sent to other units to work for them or for a

joint project? If yes, please indicate the units to which they went." We also adopted Galaskiewicz and Marsden's (1978) question on interorganizational support and reworded it to fit our interunit context, so that it read as follows: (4) "Which units on the list does your unit feel a special duty to stand behind in time of trouble: that is, to which units would your unit give support?" Note that we dealt with exchange and combination at the same time in the above questions. In practice, when two business units exchange resources, they will eventually use the exchanged resources for their own operations. Since the exchanged resources are used in a context that contains existing resources, the resource combination process often takes place in conjunction with resource exchange. For example, an engineer is transferred from one business unit to another. This kind of human resource exchange may also involve resource combination when this engineer starts working with other people in the unit to which he or she was transferred. Thus, we did not separate resource exchange and resource combination in these indicators.

Though we surveyed four resource networks (information, product, personnel, and support), we did not use four different variables measuring each kind of resource exchange (and combination) because of concern about the potential complexity of our model. To create a single-item measure that would take into account the exchanges (and combinations) of all the different kinds of resources, we combined the four resource networks into a new matrix and then computed in-degree centrality from the new matrix. The newly computed in-degree centrality measure yielded a single-item measure indicating the level of resource exchange and combination that each business unit engaged in with other units in the company.

Before aggregating the four networks, we examined whether there were correlations among the four resource networks. This procedure was necessary as an aggregation of several networks is meaningful only if these networks are correlated (otherwise, the aggregation may generate a random matrix). Thus, we obtained an in-degree centrality measure for each network and then calculated a Cronbach's coefficient alpha based on the obtained four in-degree measures. The result ( $\alpha = .87$ ) showed that a high level of correlation existed among the four resource networks.

**Product innovations.** In this study, only major product innovations were counted (minor product changes and product facelifts were excluded). We used a single item to measure the level of product innovation in each business unit. We asked our

respondents the following: "On average, how many product innovations per year were produced in your unit during the recent past (from 1993 to 1996)?" We validated the self-reported figures by asking the company's headquarters managers to confirm the data. Since only major product innovations were considered, each of the innovations was quite unique, and the company's headquarters had excellent information about these innovations. During our discussions with the headquarters managers, there was no case in which these managers challenged the figures provided by the business units.

**Control variable: Business unit size.** Large organizations can potentially have more slack resources and, thus, they may be able to develop more technological know-how or to produce more product innovations. The same logic could also apply to the effect of a business unit's size on its innovations. In this study, we used the logarithm of the total assets of each unit as an indicator of unit size and as a control variable in our empirical analysis.

## RESULTS

Table 1 presents the descriptive statistics and correlations for all the variables analyzed in this study. We found no evidence of any restriction of range in the response scales. We applied structural equation modeling techniques to test our hypotheses via path analysis. Using LISREL 8 (Jöreskog & Sörbom, 1993), we estimated the parameters of our research model and, at the same time, tested the validity of our measurement. This approach enabled a comprehensive, confirmatory assessment of both the convergent and discriminant validity of all the constructs used in our model.

## Analysis of Convergent and Discriminant Validity

Convergent validity concerns whether multiple measures of the same construct are in agreement. According to Anderson and Gerbing (1988), convergent validity can be tested with a measurement model by examining whether each indicator's estimated pattern coefficient on its posited underlying construct is significant. Following this approach, we estimated our measurement model using confirmatory factor analysis. The results of this analysis suggested that our measurement model fit the data well ( $\chi^2_{12} = 6.13$ ,  $p = .91$ , goodness-of-fit index [GFI] = .91, normed fit index [NFI] = .96), since we could not reject the null hypothesis that the actual covariance could be obtained from the proposed model. So convergent validity was achieved. Discriminant validity is an assessment of the extent to which a construct of interest differs from other constructs. Adopting a heuristic approach for evaluating standardized loadings on factors (Hoskisson et al., 1993), we assessed discriminant validity by examining whether the indicators' estimated pattern coefficients loaded significantly on expected factors but not on other factors of interest. The results show that our measures loaded well on the five underlying constructs (social interaction, trust, shared vision, resource exchange/combination, and product innovation) in our model. All the loadings were significant at the .05 level, and the measures did not load significantly on alternative constructs.

## Assessment of Model Fit and Path Significance

We assessed the overall fit of our research model using several fit indexes: the chi-square test, the goodness-of-fit index, and the normed fit index.

TABLE 1  
Means, Standard Deviations, and Correlations

| Variable                             | Mean  | s.d.  | 1     | 2     | 3     | 4     | 5     | 6    | 7   | 8    |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|------|-----|------|
| 1. Social interaction: Time spent    | 3.92  | 5.46  |       |       |       |       |       |      |     |      |
| 2. Social interaction: Close contact | 5.46  | 9.18  | .86** |       |       |       |       |      |     |      |
| 3. Trustworthiness: Reliability      | 39.29 | 21.89 | .69** | .75** |       |       |       |      |     |      |
| 4. Trustworthiness: Promise keeping  | 41.90 | 17.98 | .71** | .70** | .96** |       |       |      |     |      |
| 5. Shared vision across units        | 5.37  | 1.10  | .41   | .42   | .49   | .47   |       |      |     |      |
| 6. Shared organizational vision      | 6.02  | 1.03  | .51   | .55*  | .69** | .63*  | .71** |      |     |      |
| 7. Resource exchange                 | 99.05 | 63.25 | .70** | .66** | .89** | .91** | .38   | .53* |     |      |
| 8. Product innovations               | 5.93  | 7.26  | .47   | .23   | .29   | .33   | .14   | .24  | .47 |      |
| 9. Business unit size                | 2.40  | 1.01  | .42   | .37   | .47   | .51   | .58*  | .48  | .49 | -.03 |

\*  $p < .05$

\*\*  $p < .01$

The chi-square test provides a measure of the inappropriateness of a model if the model is not truly representative of the observed data. A small (non-significant) chi-square indicates a good fit. The chi-square for our research model was 7.94 with 15 degrees of freedom, and the  $p$  for the chi-square was .93. These values mean that it is very difficult to reject our model. The GFI assesses the correspondence between the observed and hypothesized covariances. A good GFI should be .90 or higher; our model's GFI of .89 was acceptable but marginal. The NFI is a comparison of a proposed model to the null model (in which no relationships among the variables are posited). Values greater than .80 are considered indicative of good fit. Our model had an NFI of .95, which shows a very good fit. In general, all these results suggested that our model fit the data well.

Figure 1 represents our research model with the maximum likelihood parameter estimates. Five of the seven predicted links were significant. Social interaction had a significant, positive effect on resource exchange and combination ( $p < .05$ ). Furthermore, social interaction showed a positive, direct effect on trustworthiness ( $p < .001$ ). Therefore, Hypotheses 1 and 2 were supported. Contrary to our prediction in Hypothesis 3, no evidence supported a direct effect of social interaction on the existence of a shared vision. Hypothesis 5 was confirmed, as shared vision showed a significant, positive effect on trustworthiness ( $p < .001$ ). It is noteworthy that in this sample, social interaction and shared vision were quite different from each other, and they both promoted assessments of high trustworthiness. Put differently, inside a firm social interaction and shared vision are two different sources of trustworthiness. At the same time, it would appear that strong social interaction is not a prerequisite for creating a shared vision.

Trustworthiness was found to be positively associated with resource exchange and combination ( $p < .001$ ). The more trustworthy an actor was, the more other actors would exchange (or combine) resources with the actor. So Hypothesis 4 was supported. Hypothesis 6, however, was not confirmed. Shared vision did not show a direct effect on resource exchange and combination in our sample. In other words, our data suggest that a shared vision can influence resource exchange and combination only indirectly, via its influence on trust. Finally, Hypothesis 7 was supported. Resource exchange and combination did create value for the firm through a significant, positive effect on product innovations ( $p < .05$ ).

To examine whether the relationship between resource exchange and innovation was affected by

unit size, we performed an ordinary least squares regression analysis in which the size effect was controlled. Our results showed that resource exchange/combination was still significantly associated with product innovation ( $p < .05$ ) after we had controlled for unit size.

### Structural Analysis Using MRQAP

For the analysis described above, we obtained several individual attributes (or locational properties) from dyadic level data to test our different hypotheses at the individual business unit level. As we indicated earlier, this kind of approach is not an uncommon procedure in management studies that apply network analysis, but it does raise some concerns about the level of analysis and the reliability of the results. To address these concerns, we also analyzed our data at the dyadic level (without relying on a computation of each business unit's locational properties), using the Multiple Regression Quadratic Assignment Procedure (MRQAP) suggested by Krackhardt (1988). MRQAP is a nonparametric statistical algorithm regressing a dependent matrix on one or several independent matrixes. First, a standard multiple regression analysis is performed across corresponding cells (each cell reflecting a dyad)<sup>3</sup> of the dependent and independent matrixes. Then, rows and columns of the dependent matrix are randomly permuted and the regression model is recomputed. The analyst repeats this permutation regression process many times (in our case, 4,000) to estimate the standard error for the statistics of interests. The main advantage of this algorithm is that it is robust against varying amounts of row and column autocorrelation in the dyadic data (Krackhardt, 1988).

Using UCINET IV (Borgatti, Everett, & Freeman, 1992), we implemented the MRQAP algorithm to test how each dimension of social capital contributed to resource exchange/combination. Our dependent matrix was resource exchange/combination, and the independent matrixes were social interactions, trust, and shared vision. Since shared vision was not a relational measure in this study, we constructed a new  $15 \times 15$  matrix reflecting the absolute difference in shared vision for each pair of actors (business units). For example, if the level of shared vision in business unit  $i$  was rated as 7, and the level of shared vision in business unit  $j$  was

<sup>3</sup> We aggregated three managers' responses for each unit. Thus, a dyad in this study means a specific relationship (such as social interaction, trust, or resource exchange) between a pair of two business units.

rated as 5, then cell  $ij$  of the new matrix would be 2 ( $7 - 5$ ). All our hypotheses remained the same, but they were assessed for each dyad rather than for all business units. With regard to Hypothesis 2, drawing on the same logic as before, we expected a negative relationship between the new matrix (shared vision difference) and our resource exchange/combination matrix. Put differently, we expected that the larger the difference in the levels of shared vision between a pair of actors, the lower the level of the resource exchange that would occur between them.

Table 2 presents the MRQAP results. As this table shows, the results are consistent with the findings of our previous analysis using structural equation modeling. As expected, social interaction and trust were significant determinants of resource exchange/combination. Although the coefficient of shared vision did show a negative sign as expected, the result was not statistically significant. The adjusted  $R^2$  for this model is .49, suggesting that in this sample 49 percent of the variance in the patterns of resource exchange/combination can be explained by the three dimensions of social capital.

## DISCUSSION

Overall, the results of this research provided strong support for the argument that social capital facilitates value creation, and this finding was robust at both the dyadic and the business unit levels. The three dimensions of social capital assessed—social interaction, trustworthiness, and shared vision—had significant effects, directly or indirectly, on resource exchange and combination. Also, the extent of resource exchange and combination was associated with product innovation. Our analysis suggests that investing in the creation of social capital inside a firm eventually creates value. Informal social relations and tacit social arrangements encourage productive resource ex-

change and combination and thereby promote product innovations.

We also examined the relationships among the three dimensions of social capital and showed how each of them contributed to the value creation processes. Among the three dimensions of social capital, the relational dimension represented by the trustworthiness of a unit was significantly associated with both of the other two dimensions. Although both social interactions and shared vision exercised positive effects on trustworthiness, our results did not confirm a significant relationship between social interactions and shared vision. This counterintuitive finding is interesting as it contradicts some of the previous research on organizational socialization. We must be cautious in our interpretation of this result, if only because of the possible deficiencies in our measurement of shared vision (these limits are discussed later in this section), but it does remind us of Coleman's (1990) account of child safety in Jerusalem, which we described earlier. Members of a society may share a vision or values even if they do not have specific interpersonal relationships. As we focused our study on the interunit relationships within a single firm, this finding suggests that different units may embrace the same organizational goals and values even when the units do not have strong interactions.

## Implications and Future Research

Social network theory has confirmed the importance of interpersonal networks for individuals' career success. In this study, we provided clear performance implications for the role of intrafirm (or interunit) networks by showing how social capital contributed to product innovations at the business unit level. Such an emphasis on the role of intrafirm networks is consistent with a recent development in the strategy literature, the argument that organizational advantage (Ghoshal & Moran, 1996) can be achieved through resource sharing among different organizational units. Since each organizational unit usually possesses unique resources, a study of the exchanges of such resources between different units may provide greater insights for business strategy than a study of interpersonal networks does.

Our investigation of the internal social capital of an organization also posed an interesting question: How is social capital created and accumulated inside an organization? We suggested and demonstrated that each dimension of social capital reinforced the creation of the other dimensions. There are clearly other factors that may influence the creation and accumu-

**TABLE 2**  
**Results of Multiple Regression Analysis: The Effects of Social Capital on Resource Exchange<sup>a</sup>**

| Independent Matrix | Unstandardized Coefficient |
|--------------------|----------------------------|
| Social interaction | .79**                      |
| Trust              | .31*                       |
| Shared vision      | -.03                       |
| Intercept          | .25                        |

<sup>a</sup> Adjusted  $R^2 = .49$ . Number of permutations = 4,000.

\*  $p < .05$

\*\*  $p < .01$

lation of social capital. Later studies could explore variables such as organizational attributes to advance theory on social capital in the organizational setting.

The substantive issues we addressed here suggest several directions for further inquiry. Product innovation was the only outcome of resource exchange and combination we examined. Future research could extend this work by investigating other types of innovation or more broadly defined value creation activities. Another extension of this work would be to apply our research design to interorganizational settings such as strategic alliances or buyer-supplier networks. An intra- and interorganizational comparison of the formation and maintenance of social capital may yield some interesting findings and help further elaboration of the underlying theory.

Finally, our measurements suffer from several deficiencies. The generalizability of any finding based on a one-site sampling scheme is inherently suspect. With only 15 business units in the sample, the study also suffered from the problem of small sample size, which forced us to restrict the number of indicators we could incorporate in the measurement model for each of the different constructs. Also, although we tried to adopt validated indicators whenever possible, in retrospect we consider some of the indicators less than satisfactory. Of particular concern is the way we operationally defined and measured shared vision. Future studies could undoubtedly improve the quality and reliability of findings by replicating the study in multiple organizations, preferably with longitudinal designs.

Its deficiencies notwithstanding, this study represents an attempt to move from a conceptual view of intrafirm social capital to a more concrete definition of the construct. The findings are clearly encouraging: we have linked the structural, relational, and cognitive dimensions of social capital and have shown how they interacted within an organization. We have also provided clear empirical support for Nahapiet and Ghoshal's (1997) broad framework relating social capital to value creation in organizations. In addition to offering these substantive findings, this study has, we hope, also demonstrated the value of using network analysis in innovation research and strengthened the importance of network theory and its usefulness for furthering understanding of organizational phenomena.

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