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ABSTRACT

The resource-based view (RBV) considers organizational routines as fundamental for IT value creation as they determine the efficiency with which firms transform inputs to outputs. Yet, our understanding of how routines affect firm performance is still incomplete, especially concerning the contribution and complementarities between IT and non-IT-resources. As routines involve humans and consist of more than just technical aspects, we propose to use methods of Social Network Analysis (SNA) to formalize the social aspects of routines. We extend central findings of the RBV by considering the impact of the social embeddedness of a firm's employees using Granovetter's strength of ties argument. By considering RBV and SNA perspectives, we develop a model regarding the role of routines for alignment explaining how and why routines are able to generate positive outcomes of IT. The model provides good support for the effects cited in the literature and is illustrated by a case.

Keywords

Social network Analysis, organizational routines, resources.

INTRODUCTION

How to use IT to improve a firm's competitive position is a fundamental question in IS research. Consequently, there are many studies investigating the connection between IT and firm performance (Wade and Hulland, 2004). The path from resources to a performance effect has been addressed by the resource-based view (RBV) providing important insights into how IT can be used to gain and sustain a competitive advantage. IS and organizational researchers alike have been especially interested in the concept of "capabilities" as a firm's ability to deploy its resource endowment. Collis (1994) defines organizational capabilities as "socially complex routines that determine the efficiency with which firms physically transform inputs to outputs". Capabilities are seen as a bundle of routines within and across the boundaries of organizational units and firms aimed at transferring input into desirable output (Sambamurthy, Bharadwaj and Grover, 2003; Winter, 2003). Therefore, we focus on the case of two interconnected routines with one within an organizational unit (internally-oriented) and another across the boundaries of a specific organizational unit (externally-oriented).

While on an abstract level findings of the RBV are very instructive, the understanding of how routines affect firm performance is still incomplete, especially concerning the contribution and complementarities between IT and non-IT-resources (Bharadwaj, 2000). As organizational routines predominantly involve humans rather than technology, we propose to use methods of Social Network Analysis (SNA) to formalize and operationalize the important social aspects of routines. We believe that by combining the two theoretical perspectives of RBV and SNA, a better understanding of the transformation process from resource to performance as indicated by Bharadwaj (2000) can be obtained. By considering both perspectives, this research aims to develop a model regarding the role of routines for alignment, which explains how and why routines are able to generate positive outcomes of IT. Overall, we aim at contributing to a better understanding of the social formation of routines and their impact on IT value creations and to making this important concept better manageable and applicable for empirical research. Therefore, we define the following research question:

How do routines impact business process performance?

Accordingly, this paper is organized as follows. Drawing from a review of the findings of the RBV and SNA literature (section 2), we delineate a general research model for analyzing routines (section 3). Based on this, we propose an analytical model derived from SNA methods and incorporate the concept of strong ties and week ties as introduced by Granovetter

(Granovetter, 1973). Using numerical simulations it is shown how the model can be used for predicting the effectiveness of an IT-reliant business process involving two interconnected routines.

The paper contributes to the literature by incorporating the strength of ties argument from SNA into IS research. Applying the research model to a business process employing two routines, the mixture of strong and weak ties between two organizational units and within one unit can be examined. It is shown that the model provides good support for the effects cited in the literature when examining routines.

THEORETICAL FOUNDATION

Resource-based View

The literature on the RBV provides a theoretical basis for analyzing how IT can be a unique resource (Barney, 1991; Peteraf, 1993) that can determine the effectiveness of a firm (Bharadwaj, 2000). It is based on the premise that a firm's success derives from superior resources and the capability to exploit and develop its resource endowment. For example, Melville et al. (2004) distinguish between technological IT resources consisting of IT infrastructure and applications, and human IT resources comprising technical and managerial knowledge. Other authors focus on organizational resources like the relationship asset (Powell and Dent-Micallef, 1997; Ross, Beath and Goodhue, 1996) that deals with the linkage between the IS function and business units and that is found to enhance performance (Melville et al., 2004). This underpins the significance of the complementarity between IS and business resources. At an organizational level, the relationship asset can be interpreted as a set of routines (Nelson and Winter, 1982) which are "regular and predictable patterns of activity which are made up of a sequence of coordinated actions by individuals" (Grant, 1991).

More recently, research has turned to the concept of dynamic capabilities which builds upon routines. A routine develops over time and is socially embedded making it immobile, hard to imitate and to substitute, thus showing strong ex-post limitations to competition (Peteraf, 1993). Smoothly functioning routines between IT and business units are seen as valuable leading to a more effective development and use of IT. Such routines are also rare as they are idiosyncratic and not broadly distributed nor available. Therefore, routines can have the potential to gain and sustain competitive advantage according to the RBV.

Social Network Analysis

SNA focuses on relationships among social entities, and on patterns and implications of these relationships (Wasserman and Faust, 1994). Accordingly, the notion of relation is a central concept. Relations build on linkages between social entities, e.g. individuals or organizational units (Burt, 1992). Attributes of social entities are invoked by relational processes and are thereby understood in terms of patterns or structures of ties among the units. Therefore, a main focus of SNA is trying to understand the properties of the structural environment of social entities, i.e. their social linkages, and methods to operationalize these linkages. Fundamental concepts for this purpose used in SNA include especially *actor*, *tie*, *relation*, and (*sub*)*group* (Wasserman and Faust, 1994). A linkage between two *actors* (social entity like individuals, organizational units, communities, etc.) is called *tie*. In contrast, a *relation* refers to a collection of ties of a specific type among a set of actors. Finally, a (sub)group is a defined (sub)set of actors on which ties are to be measured. Direct relationships are critical to the exchange of knowledge, especially tacit knowledge (Granovetter, 1973) and are decisive for knowledge creation (Nonaka, 1994).

The following section uses these SNA concepts to provide a better understanding of organizational routines and to help overcome the incomplete understanding of the role of routines in the IT value creation process (Bharadwaj, 2000).

RESEARCH MODEL

Strong and weak ties in routines

As organizational processes, routines provide the mechanism by which assets of a firm are applied to a specific problem context. Routines can thus be conceptualized as being built upon the formal or informal interaction of human agents (Feeny and Willcocks, 1998; Mata, Fuerst and Barney, 1995; Ross et al., 1996). The challenge now is to come up with a formal measure for these types of interaction. We propose to formalize the social interaction among actors that underlies organizational routines by using the notion of ties as proposed by Granovetter (1973). Therefore, using SNA concepts, a routine can be interpreted as being based upon a finite set of actors belonging to one or more subgroups, and the ties between these actors.

Granovetter distinguishes between strong and weak ties. A *strong tie* can be characterized by frequent and direct interaction that is reciprocal and path-dependent. Strong ties also provide for redundant information as over time the degree of connectedness increases, thus enhancing the probability that different actors are structurally equivalent and have access to similar information (Burt, 1992; Hansen, 1999; Wasserman and Faust, 1994). In contrast, ties reaching outside a subgroup are probably *weak ties* and prone to more valuable, non-redundant information (Granovetter, 1973). Thus, there is an inherent tradeoff between cohesion and informational benefits.

Case study illustrating strong and weak ties

To exemplify this tradeoff, a retail banking case is described in the following. The bank in focus serves the customer segment of private customers in a regional German market and has 25 branches. Each branch serves between 3,000 and 20,000 customers and has at least four and up to 15 employees. Some of the branch's employees (at least one, up to three) serve so-called customers with potential which are the most lucrative customers. These employees are called P-customer advisors and take special care of the needs of their clientele. P-customer advisors have specific technical know-how and interpersonal skills and are trained to serve their specific focus clientele. For basic services and day-to-day operations, like transfer processing or contacting in case of a credit, the P-customer advisors rely on their colleagues in the branch. At the same time, know-how from P-customer advisors shall be transferred to their colleagues to increase the skill level in general. Within the branch, there are regular team meetings at least once in four weeks where operative tasks are discussed and streamlined but also more strategic tasks like the competitive environment and changing customer requirements and potential responses to changes, or actions to be taken, respectively. In addition to the regular meetings, there frequently are informal interactions due to the small size of the branches. Furthermore, activities taken by branch employees are in general similar among branches but differ with regard to the concrete sequences of activities and allocation of tasks. For example, while in one branch processing of remittances is exclusively done by so-called bank clerks (which are not the P-customer advisors), in other branches a P-customer advisor primarily has to serve the specified clientele but may also help in day-to-day business.

Beside these branch activities, the P-customer advisors have regular bank-wide meetings (every six weeks) to exchange information and experience regarding their customer focus group, methodology, etc. Additionally, there are meetings where the P-customer advisors are informed from headquarters or external consultants about the newest trends, competitive environment in general and strategy.

Thus, the P-customer advisors interact far more with people outside the branch than the other employees. Beside the director of the branch no other employee has formal meetings outside the branch. P-customer advisors do not interact as frequently outside the branch as they do inside. But regarding informational benefits referring to their clientele they gain more from the different information sources outside the branch than from the contacts with the colleagues in the branch. Furthermore, P-customer advisors may choose to communicate more frequently with P-customer advisors of other branches. In doing so, more working time of the advisor is spent gathering information from outside and less time is available for communication and internal know-how transfer.

We can thus identify a specific repetitive pattern of activity (routine) within the branch and another one covering all P-customer advisors, bank-wide. Also, there is an obvious tradeoff between group cohesion within the branch, i.e. frequent interaction, and gaining informational benefits from interaction with other groups outside the branch.

Ties between and within organizational units

We now adopt the dichotomy of Granovetter but also consider strong ties to the outside of a subgroup as being both possible and valuable depending on the context. Thus, strong and weak ties can occur within a subgroup and across subgroups and may be beneficial in a given context. Strong and weak ties create the structural framework for describing organizational processes. As it depends on the context which relation of weak and strong ties fits best, we need to specify the context and units (actors) to be examined. Assuming that actors of a specific subgroup, in the following called a focal unit, to a different extent have to both acquire information from actors in other subgroups and distribute and integrate this information within the focal unit, we can identify two interconnected routines. Using the case used in the last section as an example, the focal unit is the organizational unit "branch", and the other subgroup is the group of P-customer advisors. The advisors acquire information from outside the branch not only to use for their focus clientele but also to distribute it within the branch to train other employees on the job. Both routines are interconnected via the P-customer advisors. Depending on the chosen context more strong ties may be required for an improved internal information flow, or more weak ties for more non-redundant information. In this context, it can be distinguished between centripetal properties of the cohesiveness of a subgroup and centrifugal properties referring to the sparsity of ties to actors outside the subgroup (Alba, 1973). Both properties together

form a tradeoff between two powers: one directed to dissolving and one directed to densifying a subgroup. A totally cohesive focal unit may work very smoothly but is worthless if the context requires interworking with other subgroups and vice versa.

MODELING THE TRADEOFF BETWEEN INSIDE AND OUTSIDE ORIENTED ROUTINES

Outside oriented routines: modeling centrifugal effects

Starting with the centrifugal effects, ties outside of the focal unit are investigated by defining the set of actors, the relevant structural linkages, and their context. The membership criterion is used to define the set of actors and relations between the units (Wasserman and Faust, 1994). Let G be the subgroup in focus (e.g. the IT unit); then all ties from actors belonging to G to actors outside of G (e.g. business units) are examined. To keep the model simple without a loss of generality, according to Granovetter the strength of a tie is developed as a dichotomous variable that can be either weak or strong at a given point in time (Granovetter, 1973). A subgroup's tie weakness score is the average weakness of all its ties to other divisions in a given period. Let X_{ij} be the tie between actor i and j where i belongs to G and j does not belong to G. Then the sum of the ties can be denoted as

$$\sum_{i \in G} \sum_{j \notin G} X_{ijs} \tag{1}$$

with s for strong ties. In order to normalize the values to a range from 0 to 1 the sums are divided by $n_G(n - n_G)$ (Wasserman and Faust, 1994) where n_G is the number of actors within G and n is the number of all actors including G. Therefore:

$$s = \frac{\sum_{i \in G} \sum_{j \notin G} X_{ijs}}{n_G(n - n_G)} \tag{2}$$

Similarly, definitions are implemented for weak ties w with

$$s + w \leq n_G(n - n_G) \tag{3}$$

The complexity of knowledge transfer between business and IT units can be formalized using the adapted coefficient KQ (Schrott and Beimborn, 2003). KQ is redefined by dividing the project at stake, measured by budget, by all projects within a certain timeframe. The measurement of project complexity using the budget is concordant with (Hansen, 1999) and sufficient for our purpose yet still a simple proxy.

$$KQ = \frac{P_n}{\sum_{t=1}^{T} P_t} \tag{4}$$

with P_n = new project measured by budget volume and P_t = all projects measured by budget volume in period t.

$$If\ P_n > \sum_{t=1}^{T} P_t \Rightarrow KQ = 1 \text{ and } If\ P_n = 0 and \sum_{t=1}^{T} P_t = 0 \Rightarrow KQ = 0 \tag{5}$$

KQ takes on values between 0 and 1 with 1 indicating high and 0 no complexity. KQ=0 can be interpreted as a project that can be fully developed within the focal unit. KQ and the number of ties are now related by the following formula using the construct of Wagner, Weitzel and König (2005).

$$p1 = e^{-\left(\frac{KQ}{s+\varepsilon_1 / w+\varepsilon_2}\right)} \tag{6}$$

ε_1 and ε_2 are introduced as infinitesimally small numbers in case s or w become zero (else: $\varepsilon_1=\varepsilon_2=0$). The Euler function is used for standardization and transforms the coefficient to the range between 0 and 1 which allows interpreting p1 as a probability to successfully complete a project. Within the given context, a value of p1 close to one reflects a good performance of this routine.

Inside oriented routines: modeling centripetal effects

We can now model these centripetal effects (absorbing knowledge (Hansen, 1999)). Let X_{ij} be the tie between actor i and j where i and j belong to G which denotes the focal unit. Then the sum of strong ties within G can be denoted as

$$\sum_{i \in G} \sum_{\substack{j \in G \\ i \neq j}} X_{ijs} \tag{7}$$

with s indicating strong ties. In order to normalize the values to a range from 0 to 1 the sum is divided by $n_G(n_G - 1)$ where n_G is the number of actors within G. Therefore:

$$s_G = \frac{\sum_{i \in G} \sum_{\substack{j \in G \\ i \neq j}} X_{ijs}}{n_G(n_G - 1)} \tag{8}$$

with s_G being the average number of strong ties within G. Weak ties w_G are defined similarly with

$$s_G + w_G \leq n_G(n_G - 1) \tag{9}$$

Finally, p2 is similarly defined as p1 but refers to centripetal processes as it is engaged in the ties within the focal unit strengthening the coherence of the subgroup. KQ´ represents the complexity of the task to integrate knowledge from outside and is defined corresponding to KQ:

$$p2 = e^{-\left(\frac{KQ'}{s_G + \varepsilon_1 / w_G + \varepsilon_2}\right)} \tag{10}$$

Complementarities: modeling the tradeoff between centrifugal and centripetal effects

In a third step, the measures for centripetal and centrifugal processes can now be combined in a complementary sense which mathematically implies the multiplication of both measures. Furthermore, a constraint is introduced because the maintaining and creating of ties is a time-consuming task for any actor. We assume that an actor can maintain a certain maximum number of ties where each tie can be either directed to other subgroups or to other actors of the focal unit. Because a strong tie is more time consuming than a weak tie, $s=\beta*w$, with $\beta>1$, holds, assuming there is no difference regarding the time consumption between s and s_G, and w and w_G, respectively.

Relating to actors, the maximum number of ties from all actors of the focal unit G to other actors within G and to the actors in other subgroups is

$$v = n_G(n - n_G) + (n_G(n_G - 1)) \tag{11}$$

The constraint is defined as the maximum number of strong ties which can be maintained from all actors of G:

$$c=\alpha*v \text{ with } 0 \leq \alpha \leq 1 \tag{12}$$

Weak ties are recognized by aggregating them to strong ties using $s=\beta*w$. The constraint is separated into ties directed outside of G and ties within G by subtracting ties used for inter-subgroup linkages from the constraint. This results in the maximum number of strong ties available for linkages within G. Therefore, the product $p=p1*p2$ expresses a complementary relationship between centrifugal and centripetal processes, i.e. between cohesion within G and sparsity, resembling the notion of two interconnected routines.

ANALYSIS

Using this operationalization of the social interactions underlying routines, the following figures show the result of 100 calculation steps each, varying the value of KQ and s of measure p1 by holding constant the value of KQ´ of measure p2. This can be interpreted as a sensitivity analysis regarding the effectiveness of a business process involving two interconnected routines. The effectivity is expressed by the relation between complexity and structural linkages regarding the interworking between the focal unit and another subgroup, e.g. the IT unit and a business unit, holding constant the degree of

complexity of knowledge distribution and integration within the focal unit expressed by KQ´. The resulting p is depicted on the ordinate while the values of s used in p1 (inter-subgroup activity) are shown at the abscissa displaying the values for different shares of strong ties s. For example, a value of s=0.9 means that 90% of all possible ties are strong ties regarding the interworking between focal unit and another subgroup. The remaining are weak ties.

The more strong ties are dedicated to centrifugal processes represented by p1 the less are available for p2 representing centripetal processes. Figure 1 (left) shows the results for KQ´=0.0 and figure 1 (right) for KQ´=0.3 both employing a constraint of 50% of the maximal possible ties c=0.5*v where v=20 assuming an equal distribution of actors between the focal unit and the other subgroup. Note that the sequence of the 11 graphs for the different KQ values from left to right reflects the sequence from KQ=0 to KQ=1 (top to bottom) in the caption of both figures.

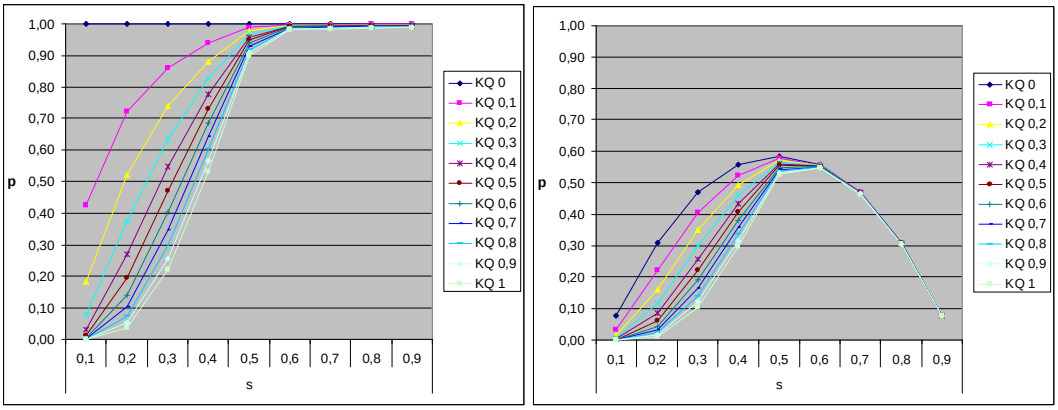

Figure 1. Effectiveness of interconnected routines (left: KQ´ = 0.0, right: KQ´ = 0.3)

Situation I: Routine with low intra-unit complexity (KQ'=0)

The left diagram shows an extreme situation in which the specific context within the focal group is not relevant (KQ´=0) which indicates that knowledge distribution and integration are no issues. Thus, all possible ties can be directed towards the inter-subgroup context. Looking at at high inter-group coplexity in this scenario (light graph most to the right of Figure 1 left with KQ=1, KQ'=0), we find low functional values for very low s, or high w, respectively. The complexity is so high that a knowledge transfer with a few strong ties but a lot of weak ties is hardly feasible. High values of s in turn lead to a fairly high value of p. Furthermore, the lower KQ the higher the positive effect of an additional strong tie and the higher the resulting value of p et v.v. In this situation, there is no tradeoff between centripetal and centrifugal processes because as many strong ties as needed can be dedicated. Therefore, the left diagram displays the results known from studies finding that for high complexity more strong ties lead to better results, whereas for low complexity a high share of weak ties may also be appropriate (Hansen, 1999; Tiwana, Bharadwaj and Sambamurthy, 2003).

Situation II: Routine with higher intra-unit complexity (KQ'=0.3)

These monotonously increasing dynamics completely change when introducing a context complexity within the focal unit. The right diagram shows the curves for a KQ´=0.3 resulting in parabolas. This is remarkable as it displays at subgroup level the latest results of a study reporting an inverted U-shape when examining the context of knowledge creation (McFadyen and Cannella, 2004). They found a curvilinear relation to knowledge creation. The findings indicate that the number of exchange partners has a positive, and then negative, effect on the amount of knowledge that a person creates with more significance for the strength than the number of ties. This can be interpreted due to a tradeoff between the acquisition and the integration of knowledge.

The inverted U-shape implies that there is an ideal share of strong ties directed outside the focal unit in comparison to the share of strong ties within the focal unit given specific contexts of complexity. The proposed function can be seen as representing the basic concept of routines known from RBV in the case of interconnected routines. It clearly shows a tradeoff between inter- and inner-group-activity. Both represented routines have to perform in their own context and relate to one another in order to produce overall positive outcomes. This means that beside extreme situations, the best overall outcome of

a business process does not result from solely optimizing one routine but by considering the effects on the related routine as well.

Using the case again to illustrate these findings, we can interpret the analysis as follows. Goal of the bank is to deliver high-quality service to customers in their region. Therefore, several activities within the branch have to be carried out. This requires frequent communication and interaction. Accordingly, strong ties evolve over time and also provide the basis for centripetal forces strengthening the cohesion of the subgroup. The problem is that potentially beneficial information from outside cannot enter the subgroup and might hamper the continuous delivery of high-quality service. Developing ties to the outside provides for informational benefits. Increasing numbers of ties, especially strong ties, to the outside will lead to less or weaker ties within the subgroup, therefore decreasing cohesion. Below a specific number, the ties within the subgroup are not sufficient to transfer the gained knowledge among the members of the subgroup, thus lowering the capability to deliver continuous service quality. Therefore, there is an optimum point for delivering continuous service quality that is achieved by a certain mix of ties directed outside the subgroup (to gain informational benefits) and ties within the subgroup (necessary to distribute and integrate the gained knowledge) that can principally be determined using our proposed model.

CONCLUSION

Based on a critical discourse of the RBV we proposed to understand organizational routines as based on social interactions of knowledge sharing and developed an analytical model based on SNA and Granovetter's strength-of-tie-argument to formalize the impact of strong and weak ties on business process performance. A simple computational approach examined the mixture of strong and weak ties between two units, e.g. the IT and the business unit, and within the IT unit in relation to the complexity of a problem. This approach is appropriate as it provides a controlled environment for testing and makes explicit functional relationships in a simple form. The results are supported by recent findings in the literature (e.g. McFadyen and Cannella, 2004) and illustrated by a case.

Employing the strength-of-ties-argument it is possible to operationalize the concept of routines in the context of knowledge transfer considering the interconnection of routines, thereby demonstrating the basic relationships mentioned in the literature. Using the algebraic formulation we can identify conditions for developing an optimization model for employing strong or weak ties among actors in business process. The model provides good support for the effects cited in literature when examining routines.

In a further step the model has to be tested empirically to validate results. A limitation of our model is that is static: ties either exist or not and are either weak or strong. Thus, the model will be enhanced by relaxing the dichotomy of ties allowing for a continuum of tie strengths between 0 and 1. Furthermore, some studies provide evidence that it is more time consuming building up a strong tie than maintaining it (Fortune, 2003; Hansen, 1999; Tiwana et al., 2003). This also suggests another area of further research. While we have so far focused on identifying a desired state of alignment, characterized by an advantageous constellation of strong and weak ties, we expect promising results from research on informal communication networks (e.g. Schrott and Beimborn, 2003) to evaluate ways of how to establish certain constellation of ties. Also, the measurement for the context needs to be refined and incorporate the degree of formalization (Fortune, 2003). Finally, the network structure (Burt, 1992) and its influence on effectiveness and efficiency of routines will have to be considered.

REFERENCES

1. Alba, R. D. (1973) A Graph-Theoretic Definition of a Sociometric Clique, *Journal of Mathematical Sociology*, 3, 113-126.
2. Barney, J. B. (1991) Firm Resources and Sustained Competitive Advantage, *Journal of Management*, 17, 1, 99-120.
3. Bharadwaj, A. (2000) A Resource based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation, *MIS Quarterly*, 24, 1, 169-195.
4. Burt, R. S. (1992) Structural Holes: The Social Structure of Competition, Harvard University Press, Cambridge (Mass.), London.
5. Collis, D. J. (1994) Research Note: How Valuable Are Organizational Capabilities? *Strategic Management Journal*, 15, Special Issue, 143-152.
6. Feeny, D. and Willcocks, L. P. (1998) Core IS Capabilities for Exploiting Information Technology, *Sloan Management Review*, 39, 3, 9-21.

7. Fortune, A. (2003) The Other Side of the Network Coin: Cost Considerations of Network Structure, *Computational & Mathematical Organization Theory 9*, 9, 109-125.
8. Granovetter, M. (1973) The Strength of Weak Ties, *The American Journal of Sociology*, 78, 6, 1360-1380.
9. Grant, R. M. (1991) The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation, *California Management Review*, 33, 3, 114-135.
10. Hansen, M. T. (1999) The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge across Organization Subunits, *Administrative Science Quarterly*, 44, 1, 82-111.
11. Mata, F. J., Fuerst, W. L. and Barney, J. (1995) Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis, *MIS Quarterly*, 19, 4, 487-505.
12. McFadyen, M. A. and Cannella, A. A. (2004) Social Capital and Knowledge Creation: Diminishing Returns of the Number and Strength of Exchange Relationships, *Academy of Management Journal*, 47, 5, 735-746.
13. Melville, N., Kraemer, K. L. and Gurbaxani, V. (2004) Information Technology and Organizational Performance: An Integrative Model of IT Business Value, *MIS Quarterly*, 28, 2, 283-322.
14. Nelson, R. R. and Winter, S. G. (1982) An evolutionary theory of economic change, The Belknap Press of Harvard University Press, Cambridge (Mass.).
15. Nonaka, I. (1994) A Dynamic Theory of Organizational Knowledge Creation, *Organization Science*, 5, 1, 14-37.
16. Peteraf, M. A. (1993) The Cornerstones of Competitive Advantage: A Resource-Based View, *Strategic Management Journal*, 14, 3, 179-191.
17. Powell, T. C. and Dent-Micallef, A. (1997) Information Technology as Competitive Advantage: The Role of Human, Business, and Technology Resources, *Strategic Management Journal*, 18, 5, 375-405.
18. Ross, J. W., Beath, C. M. and Goodhue, D. L. (1996) Develop Long-Term Competitiveness through IT Assets, *Sloan Management Review*, 38, 1, 31-42.
19. Sambamurthy, V., Bharadwaj, A. and Grover, V. (2003) Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms, *MIS Quarterly*, 27, 2, 237-263.
20. Schrott, G. and Beimborn, D. (2003) Informal Knowledge Networks: Toward a Community-Engineering Framework, in Janice I. DeGross, Anne Massey and Salvatore T. March (Eds.) *Proceedings of the 24th International Conference on Information Systems*, Seattle, Washington, USA, 1-7.
21. Tiwana, A., Bharadwaj, A. and Sambamurthy, V. (2003) The Antecedents of Information Systems Development Capability in Firms: A Knowledge Integration Perspective, in Anne Massey, Salvatore T. March and Janice I. DeGross (Eds.) *Proceedings of the Twenty-Fourth International Conference in Information Systems*, Seattle, Washington, USA, 246-258.
22. Wade, M. and Hulland, J. S. (2004) Review: The Resource-Based View And Information Systems Research: Review, Extension, And Suggestions For Future Research, *MIS Quarterly*, 28, 1, 107-142.
23. Wagner, H.-T., Weitzel, T. and König, W. (2005) Modeling the impact of alignment routines on IT performance, in Eds.) *Proceedings of the 38th HICSS*, Kona, USA, 1-10.
24. Wasserman, S. and Faust, K. (1994) Social Network Analysis, Cambridge University Press, Cambridge.
25. Winter, S. G. (2003) Understanding Dynamic Capabilities, *Strategic Management Journal*, 24, 10, 991-995.