

**KNOWLEDGE CREATION IN ORGANIZATIONS:  
EXPLORING FIRM AND CONTEXT SPECIFIC EFFECTS**

by

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**Knowledge Creation in Organizations:  
Exploring Firm and Context Specific Effects**

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## **ABSTRACT**

This paper investigates factors contributing to organizational knowledge creation, incorporating various concepts from the literature such as social network theory, absorptive capacity and organizational learning. Case studies, utilizing both quantitative and qualitative methods, on five organizations are conducted with the objective of determining whether effects on knowledge creation are firm specific or related to the nature of the firm's problem solving process. The results revealed several contributing factors (i.e., knowledge sourcing, creativity and consensus) that were independent of firm and context. On the other hand, firm differences in informal networking and absorptive capacity had significant effects, while in efficient problem solving contexts, the impact of the level of consensus was magnified. These results present significant theoretical and empirical contributions towards the knowledge management and strategy literature, while providing recommendations for managers to enhance knowledge creation in organizations.

## INTRODUCTION

The notion that knowledge is a source of competitive advantage has been advocated extensively in the management literature over the past decade (i.e., Winter, 1987; Quinn, 1992; Nonaka and Takeuchi, 1995). The value of intangible assets increases as goods and services become more sophisticated in content and production and the foundation of competition becomes intensively knowledge-based. As hypothesized by Teece (1998: 76), “the key sources of wealth creation at the dawn of the new millennium will lie with new enterprise formation; the renewal of incumbents; the exploitation of technological know-how, intellectual property, and brands; and the successful development and commercialization of new products and services”.

One cannot dispute such statements made by Teece and his proponents as we continuously witness the thriving of knowledge-based industries—the latest Fortune’s Most Admired Companies listed General Electric, Intel, Cisco Systems, Microsoft, Charles Schwab and Dell Computer to be among the top ten companies. We know that one of the keys to commercial success and longevity in today’s economy lies in the ability to constantly create new knowledge and innovations, to develop and capitalize on the firm’s knowledge base, and to “transform intellectual output into a service or a group of services embodied in a product” (Quinn, 1992). However, the more interesting question is “what are the factors that matter most to the development of new knowledge in organizations?”

There is an abundance of theoretical and empirical work (in the strategy, organizational behavior and industrial organization fields) on the factors that contribute to innovation (e.g., von Hippel, 1986; Powell et al, 1996; Henderson and Cockburn, 1994; Frost, 2001) and Soo, Midgley and Devinney (2002) show a strong and consistent relationship between new knowledge, innovation and performance. Where this paper differs is that we are interested in

decomposing more finely how organizations create new knowledge (which can then lead to innovation) and whether differences in a firm's capability on this front are due to the firm's structure (i.e., whether it is firm specific) or the types of problems they are dealing with (i.e., whether it is problem specific).

There are several schools of thought that advocate for differential factors contributing to knowledge development in organizations. For example, social network theorists (e.g., Liebeskind et al., 1996; Nahapiet and Ghoshal, 1998; Steensma and Lyles, 2000) argue the importance of knowledge sourcing through network ties. Studies on dynamic capabilities and organizational learning (e.g., Teece et al., 1997; Miller and Shamsie, 2001) advocate the importance of adaptation and experimentation, while other studies (e.g., Leonard and Sensiper, 1998) examined more micro-level capabilities such as knowledge transfer in group problem solving. However, none of these papers have explicitly attempted to examine the differential importance of variation within the firm versus variation between firms as the more important component of knowledge creation. This paper contributes to the current literature by investigating the differential effects of firm versus context specific variables—that is, whether the incubator of new knowledge creation is firm specific or related more to the problem-solving context in which the firm's employees are operating. From an empirical position we are interested in discovering the extent to which (1) new knowledge creation is a firm-specific or problem-specific phenomenon and (2) whether the factors that affect new knowledge creation are moderated by the context in which they are embedded. From a managerial perspective this distinction is important because it gives managers guidance as to which factors matter most allowing them to avoid needless investment in areas that may be out of their real control.

## **FACTORS INFLUENCING ORGANIZATIONAL KNOWLEDGE CREATION**

Much of the earlier literature on knowledge-based strategy focused on concepts such as firm resources (Wernerfelt, 1984; Barney, 1991), core competencies (Hamel and Prahalad, 1990), organizational capabilities (Stalk et al., 1992) and dynamic capabilities (Teece et al., 1990). The essence of this stream of work is that certain firm resources possess characteristics that are potentially rent-producing; i.e., if they are valuable, rare, durable, not easily traded and difficult to imitate (Barney, 1991) and hence for managers, the challenge is to “identify, develop, protect, and deploy resources and capabilities in a way that provides the firm with a sustainable competitive advantage and, thereby, a superior return on capital” (Amit and Schoemaker, 1993: 33).

One of the major criticisms of the resource based view (RBV) of the firm is that it does not provide insights into ‘how’, ‘when’ and ‘why’ do certain firm resources generate superior returns for the firm. The literature on firm capabilities (e.g., Teece, et al., 1997; Levinthal and Myatt, 1994; Eisenhardt and Martin, 2000) is also predominantly silent on the specific sources of improved firm performance. In fact, Collis (1994: 151) argued that “the source of sustainable competitive advantage is likely to be found in different places at different points in time in different industries....this very unpredictability only reinforces the fact that prescriptions for building organizational capabilities are likely to be elusive”.

Building on Collis’ (1994) statement above and Nonaka and Takeuchi’s (1995: 49) assertion that we understand very little about knowledge creation, we aim to develop a better understanding of the drivers of new knowledge. In doing so, we integrate various concepts in the literature such as social network theory (Liebeskind et al., 1996), absorptive capacity (Cohen and Levinthal, 1990), and socio-cognitive capabilities (Ginsberg, 1994) in developing a framework

for understanding organizational knowledge creation, an area that has received little attention in the empirical research realm.

This study builds upon our previous work (Soo, Midgley and Devinney, 2002; Soo, Devinney, Midgley and Deering, 2002) where we presented a comprehensive theoretical and empirical investigation of organizational knowledge creation and its impact on firm performance, utilizing cross-sectional data from 317 firms across 17 industry categories. Appendix 1 presents a brief description of the study and its results. The main findings of this work revealed that new knowledge creation is a direct function of the way a firm approaches its problem solving situations, and an indirect function of the firm's propensity to extract knowledge from its internal and external environments. Our next step (which is the focus of this paper) is to uncover richer insights into the knowledge creation phenomenon by adopting a more qualitative methodology on an in-depth study of five organizations.

### **OBJECTIVES**

Although Soo, Midgley and Devinney (2002) provides a comprehensive examination of the linkages operating in the knowledge creating process from a cross-sectional perspective, they are unable to make generalizable statements that apply *within* firms facing specific issues related to the appropriateness of their information and know-how acquisition activities, problem solving quality and organizational practices. The main objective of the current work is to further refine their thinking through multiple case studies. This allows us to investigate the many important aspects of the knowledge creation process that cannot be captured by questionnaire surveys alone. Hence this work is a refinement and broadening of their approach, not a replication.

Also, the conjunction of the large sample cross-sectional survey with the individual firm case study samples, allows us to benchmark the case studies against a more general set of results.



This provides us with an opportunity to not only learn new things from the case studies but to also recognize specific aspects where the firms differ substantively from the population at large. We also investigate additional factors contributing to knowledge creation that can be incorporated in future empirical work. The more qualitative data collected in the case study research represent an important avenue for further theory development in an area of organizational studies that is currently suffering from an acute lack of theoretical and empirical advancement.

## **METHODOLOGY**

The basic model we are considering is simple—the knowledge creation process itself is one where (*externally and internally*) *acquired knowledge* enhances *the problem-solving capability of the firm*, which in turn facilitates *the creation of new knowledge*. The overall knowledge creation process operates within a structure where factors such as *absorptive capacity* and the nature of the organization's environment also affects knowledge creation. Where we differ from Soo, Midgley and Devinney is that we add a within firm manipulation that allows us to look at different problem-solving contexts *within* the firm. Hence, we are able to investigate differences between firms as well as different contexts within the firm to address the question of which is more important for knowledge creation, the differences between firms or the differences that arise within firms when different problems are solved.

### **Measures**

To increase the comparability of our work, we employ the constructs and measures used in Soo, Midgley and Devinney (2002), which are presented in detail in Appendix 2. They give an extensive review of the theoretical and empirical literatures behind the development of these measures for the sake of space we have excluded any detailed discussion of why specific

measures were chosen. There are three levels of analysis operating. At the firm level we investigated the extent of *formal networking*—the breadth and depth of formal firm linkages—and *organizational absorptive capacity*—firm incentives for knowledge and learning. At the individual level we examined *informal networking*—the breadth and depth to which the individual interacted informally with other organizations and persons—*individual absorptive capacity*—the degree to which the individual engaged in knowledge acquisition and learning—*information sourcing* and *knowledge sourcing*—the breadth and depth of the individual's acquisition of information and knowledge from different sources. At the problem solving level we measured Ginsberg's (1994) socio-cognitive capabilities which were *comprehensiveness*—the exhaustiveness with which options were created—*creativity*—the creativity that was brought to bear on the problem—and *consensus*—the extent of team work and consensus building utilized. Measures for new knowledge creation were developed by incorporating concepts from the organizational learning literature (i.e., Garvin, 1993; Fiol and Lyles, 1985), which included *new ideas, new insights and new ways of doing things that were generated from a problem solving situation*. Finally, to measure the effects of *problem-solving context*, we employ two scenarios—one where a problem was solved efficiently and a second where a problem was solved inefficiently. Individuals were randomly assigned (within firms) to either one or the other of these problem solving context conditions. Appendix 3 presents these two scenarios as used in our survey instrument.

## **Research Design**

We adopt a multiple case study approach using a combination of quantitative (survey-based) and qualitative (interview-based) data. This methodology has been used extensively in previous research, most notably by Henderson and Cockburn (1994) and Brown and Eisenhardt

(1997). A multiple case approach allows us to compare the results with those reported in Soo, Devinney and Midgley (2002) as well as obtain evidence to further refine the model using ‘pattern-matching’ ‘explanation-building’ procedures described in Yin (1994).

Data was collected from five firms—two of the firms were industrial in orientation with large labor forces—one in engine design and manufacturing and the other in railway design engineering. The other three were professional business service organizations that were large in their respective markets and also respected for their financial and service quality performance—one each in legal services, management consulting, and executive search. All but the railway design engineering and legal services firms operated in multiple countries and would be classified as large multinationals within their industry grouping. Confidentiality requirements imply that we cannot give sample statistics on these firms since their size would reveal their identity.

Both the questionnaire surveys and the interviews targeted all three basic levels of the organization. Level 1 managers comprised the most senior management level such as CEOs, vice presidents and directors. Level 2 covered middle management positions such as project managers and marketing managers. Level 3 managers consisted of non-managerial staff such as technical officers, paralegals, associate consultants and business analysts (excluding administration/secretarial level staff). In the case of the larger organizations stratified sampling was used. In the case of the smaller organizations, all employees were surveyed although not all employees were interviewed. In the case of multinational firms, e.g., the consulting firm, we limited ourselves to a specific set of offices rather than surveying the company worldwide. Table 1 lists the number of returned surveys from each firm. Because we were able to gain senior management support from all five firms to conduct the studies, the response rates were relatively

high, ranging from 70 to 85 percent.

A major difference between Soo, Devinney and Midgley (2002) and the current work is that their level of analysis was the firm and key informants answered the survey. Here, the level of analysis is the individual/project and each analysis is nested by firm with multiple respondents per firm. Hence, the constructs developed for the survey used in the prior work that are relevant here are those pertaining to the individual and the specific problem-solving context they are describing. Hence, firm level variables (e.g., financial and market performance, innovative outputs, etc.) used in Soo, Midgley and Devinney (2002) were excluded from the surveys used in the case level work.

The survey addressed five major areas: (1) the breadth and depth of formal and informal *networking*, (2) the breadth and depth of access to information and know-how *sources*, (3) the organization's policies and individual's activities associated with *absorbing* information and know-how, (4) the nature of a specific *problem-solving context*, and the (5) the *new knowledge* generated from the problem solving context. Table 2 lists the Cronbach's Alpha scores on the constructs obtained from each firm. As noted earlier, each case sample was split 50–50 in efficient and inefficient problem-solving scenarios, thereby ensuring a balance between the context in which problems were being addressed in the organization (i.e., either well or poorly). As will be shown, this manipulation was valid as represented by the measured quality of the outcomes described.

The interview stage commenced after the surveys were returned and analyzed. This was deliberately timed to ensure that the interviews included questions that probed particular results that were obtained from the surveys. For example, survey results may reveal that a firm was particularly weak in sourcing information from its network. Subsequent interview questions for

this firm will then include additional questions that would further investigate this phenomenon.

Table 1 also lists the number of interviews conducted with each firm (across each level of the hierarchy). The interviews were purposely semi-structured, which allowed interviewees to describe their individual behaviors as well as organizational policies in detail. The average duration of the interviews was 90 minutes and each was taped and transcribed. The interview began with the background of the interviewee and progressed onto questions regarding the nature of information and knowledge sourcing behaviors of the individual and the firm in general. Interviewees were also asked to describe the factors that encouraged or inhibited information and knowledge sourcing and sharing within the firm. The final part of the interview focused on the nature of problem solving and innovation within the firm, again concentrating on inhibiting and enabling factors. Each interview ended with a request for the interviewee to rank the various problems faced by the firm in terms in information/knowledge sourcing and utilization—that is, the interviewee was asked to state the most urgent concerns facing the firm. This line of questioning allowed for rich descriptions and clear understanding of the factors that needed to be addressed.

## **DATA ANALYSIS AND RESULTS**

### **The Survey Component**

The data was analyzed in two ways. First, we conducted a simple mean comparison and MANOVA to examine the effect of the manipulation and the impact of that different problem solving contexts play in altering the antecedents of new knowledge creation. Second, we estimate a general linear model with the effects of the independent variables nested within problem solving context and firm. This second analysis is the heart of our paper since it allows us to examine the marginal effect of specific variables on new knowledge creation.

### *Mean Comparisons*

Table 3 provides a comparison of the constructs of interest by company and problem solving context. The first item that is most important from our standpoint is the problem rating. In all cases, those asked to describe a problem ‘less well solved’ rated the problem as less effectively solved. However, there was no overall significant effect on the criticality or typicality of the problem—in other words, the problem situations being described by the respondents were not significantly more critical or typical (although there are some exceptions).

In all five companies, the more efficiently solved problem was rated as leading to more new knowledge being created. In examining the problem solving components, the more efficiently solved problem was rated as higher on both consensus (in five of five firms) and creativity (in four of five firms) without any overall pattern with respect to comprehensiveness. These results confirm that new knowledge creation is indeed affected by context—that is, in an *efficient* problem solving situation (characterized by higher levels of comprehensiveness, creativity and consensus) a high level of new knowledge eventuates.

Because all the remaining variables are measured at the individual or firm level there is no reason to believe that there would be any difference in their means based on a problem solving context split and this is indeed found. Of the thirty possible mean comparisons, only two differences are significant at the 0.05 level. Although some between-firm differences exist, these are not of critical importance in examining whether our manipulation worked and the data is measuring constructs at the appropriate level of analysis (i.e., firm or problem solving context).

### *MANOVA—Firm and Problem Solving Context Effects*

To further examine the differences in the case study firms and problem-solving manipulation, we conducted a MANOVA with independent variables being the firm, the problem-solving context (efficiently or inefficiently solved) and the problem-solving context

nested within the firm. These results are presented in Table 4 and give a finer level of detail on the differences in the case study firms and the impact of problem-solving context. The most important difference to note is that all the problem specific variables are affected significantly by the problem-solving context and all the remaining firm and individual variables by the firm. There are additional firm effects on consensus, comprehensiveness and criticality and problem-solving context effects on informal networking. The only significant nested effect is with respect to new knowledge creation. From this and the mean comparison in Table 3, we can conclude that we are indeed measuring the factors of interest at the level of analysis we are targeting.

#### *A General Linear Model of New Knowledge Creation*

The primary purpose of this study is to examine the antecedents of new knowledge creation at the level of the firm and whether they are generalizable, firm-specific or problem-solving context specific. Our last analysis attempts to do this by examining the role of networking, information and knowledge sourcing, absorptive capacity and problem-solving quality and context on new knowledge creation. Because our MANOVA indicated a possible problem context by company effect we have to run a model that looks at both nested and direct effects. The results are presented in Table 5.

Knowledge sourcing and creativity in problem solving have significant direct effects on new knowledge creation, while consensus in problem solving has both direct and nested effects. This implies that not only do firms need to constantly acquire knowledge from their external and internal networks, but also that the way in which that knowledge is utilized to solve problems is just as important (Ryle, 1945). These results support Cohen and Levinthal's (1990: 130) claim that "problem solving skills represent a capacity to create new knowledge", and also Gold et al.'s (2001) argument that both knowledge infrastructure (i.e., supporting mechanisms for capturing and storing knowledge) and processing (i.e., application of knowledge) capabilities are equally

important for organizational effectiveness. The ‘criticality’ of the problem-solving situation is found to be significant (both direct and nested effects) in influencing new knowledge creation. This implies that in situations where the problem (being addressed) has a ‘critical’ impact on business performance, there is a higher propensity for firms to generate new knowledge. This finding is similar to the concept of dynamic capabilities (Teece et al., 1997), which argues that firms need to constantly adapt and innovate according to the demand of the environment in which they operate.

In the company-specific cases, both informal networking and individual absorptive capacity have positive effects on new knowledge creation. This is interesting as it tells us that firm differences in the ability to network and absorb knowledge is crucial in explaining propensity for new knowledge creation. This supports the view of social network theorists (e.g., Liebeskind et al., 1996) that network ties are valuable sources of new knowledge, and that of Cohen and Levinthal’s (1990) assertion that the ability to absorb and assimilate external knowledge is a contributing factor towards firm innovation.

In summary, the survey results have revealed specific factors that are important to the process of new knowledge creation—i.e., the criticality of the problem being solved, creativity and consensus in problem solving, and knowledge sourcing—and pointed out that these effects are independent of both the firm and the problem-solving context. However, some effects are reinforced in more efficient problem-solving contexts—in the case of consensus—while others represent firm specific factors—for some firms, the effects of informal networking and individual absorptive capacity are magnified.

These results provide answers to our research objective—which is to determine whether factors contributing to new knowledge creation are firm specific or problem solving context



specific—and we found evidence of direct independent factors as well as factors nested in firm and context. The next step in our analysis is to uncover the various organizational phenomena that can impact these factors, and the qualitative component of the research allows us to do this.

### **The Interview Component**

Preliminary analysis of the transcribed interview data revealed several factors that explain instances where informal networks break down, where individuals are not able to acquire knowledge, or where problem solving processes are negatively affected. These will be described in the following discussion.

Preliminary analysis of the transcribed interview data revealed several recurring instances where knowledge that is sourced or created is not fully utilized within the firm. Specifically, knowledge resides within (and is shared among) a finite group of people and does not travel to other parts of the organization where it can be applied. This presents a situation where *individual learning does not equate organizational learning*, that is, the accumulated information or knowledge can reside within an individual (or group) without having contributed to wider organizational problem solving processes. As Simon (1991) argues, “it is usually important to specify where in the organization particular knowledge is stored, or who has learned it. Depending on its actual locus, knowledge may or may not be available at the decision points where it would be relevant”.

These are intriguing results as they pose important managerial questions—Where does the acquired knowledge go? Why should managers encourage employees to learn from each other (and from external sources) if the firm does not benefit from improved (i.e., more comprehensive and creative) problem solving? In the following sections, we will discuss the various phenomena (experienced by all five firms studied) that impeded problem solving

effectiveness, knowledge sourcing, and the firm's ability to extract knowledge from its informal networks.

#### *Leveraging Individual Level Tacit Knowledge*

One of the biggest challenges facing organizations is in understanding how to effectively leverage each individual's knowledge. As a director at the executive search firm states, "the biggest problem has been transferring information and knowledge from people's heads onto a system so we can retain it". A significant amount of knowledge that is embedded in the organization is in fact tacit and hence cannot be codified and transferred onto formal database systems. Leonard and Sensiper (1998: 117) acknowledges that "it is the tacit dimensions of their knowledge bases that make individuals especially valuable contributors to group projects; perspectives based on such knowledge cannot be obtained any other way except through interaction". A solicitor in our sample expressed the same sentiments commented that "it is difficult to pass on experience...the only way of passing on that knowledge is to have someone working for you or with you". For the five firms in our sample, the tacit component of their knowledge base is a significant part of their product and service offering. This is especially true for the service firms where the leveraging of accumulated intellectual capital developed from client projects has become one of the most important sources of competitive advantage.

#### *Transferring Knowledge Across Business Units*

We found instances where a piece of knowledge or solution that is developed in one part of the firm does not make its way to other parts in order to be used or re-applied. This problem of 'sticky' information or knowledge has been documented in previous work (i.e., von Hippel, 1994; Szulanski, 1996; O'Dell and Grayson, 1998) and is often cited as a key factor inhibiting the transfer of best practices within the firm.

Impediments to knowledge sharing may also appear in structural forms. Firms that are

structured along the lines of autonomous business units may find it difficult to encourage sharing across units simply because there is no incentives to do so. The business units of the engine design firm are autonomous profit centers that do not promote cross-divisional sharing. One of the consequences of this insularity is that employees are confined to their own units to find solutions to problems. During the interviews, an engineer at the firm told us that if somebody from a different business unit was experiencing a problem that he fix, he would have no way of knowing about it and hence, helping. Similarly, the partnership structure of the legal firm has created subcultures within the firm whereby the incentives are to concentrate on the achievements of individual practice group. As a partner explains, “we are structured on practice groups, you’d have a budget for your practice group and the incentives are to meet your budget. So you basically focus in on your group and not externally. The incentives are to have that kind of focus and not necessarily to share information or work or whatever else beyond your group”.

#### *Providing Appropriate Incentives to Share Knowledge*

It is often for the lack of incentives that people fail to share their knowledge. We came across numerous statements made during the interviews that people did not feel they had any incentives to share knowledge with other people beyond their immediate work group or team. On the contrary, the main incentives seemed to be meeting budgets and client deadlines. As a manager at the executive search firm commented, “the culture is so fast paced it inhibits the sharing of knowledge. You don’t have time to share knowledge, it is not a priority”. In the legal firm, we came across a more severe example where if knowledge sharing was not seen as generating revenue, it was not encouraged, as illustrated by a solicitor: “I think learning is seen as valuable but it is also seen as a second priority to just getting the work done. By and large if you’re going to sit down and have a chat, this chat should have a matter behind it which we can charge to a client”.

These examples pertaining to the lack of incentives (and the previous discussion on structural barriers) bring to mind Szulanski's (1996) term 'barren organizational context', described as an environment that hinders the gestation and evolution of knowledge transfer. In our case research, we found ample evidence of a barren organizational context that inhibits the effective transfer and sharing of knowledge.

#### *Lack of Formal Structures for Capturing Knowledge*

Discussion so far has focused on the several knowledge transfer inhibitors that are common and have been uncovered in previous studies. Specifically, we found evidence of 'sticky' information/knowledge, both at the individual level (i.e., knowledge, often tacit, that resides in individuals' heads) and at the group level (i.e., knowledge that resides within a group, team or unit). We also found evidence of 'barren' organizational environments, characterized by structural barriers to knowledge sharing and a lack of incentives (generated by an over-emphasis on meeting deadlines and budgets). Collectively, these factors have a significant impact on the firms' ability to solve problems effectively.

However, we also found an interesting phenomenon that points to a *lack of formalized knowledge capture*, and this has occurred across two dimensions. First, we found instances where formal knowledge capture through database systems was not at an optimal level, contributing to knowledge loss. The management consulting firm in our sample had established a data base system for capturing relevant information and knowledge that consultants can search for during client engagements. However, the firm faces further challenges in making the system comprehensive, relevant and updated enough to make a real contribution to the firm. One partner commented on the lack of readily available data—"I've been surprised by how little we have at hand. We should have on hand a lot more stuff than we do and I think that is because we just haven't been very good at efficiently cataloguing it for retrieval". Similarly, employees at the

legal firm have described their database system as “frustrating to use and out of date”. A firm’s formal repository of information and knowledge is often the first point of call for most employees as it provides insights and directions for further investigations. It can also direct its users to the relevant parties (who have worked on similar projects) within the firm who are important sources of expertise. An effective database system that can assist in structuring the myriad of information and knowledge that reside in the firm can be an indispensable source of advantage, especially for service firms where the core product offering is knowledge-based.

An important issue to complement the above discussion is that a database system is not a mechanism that develops itself when left alone (or left alone with the IT staff). For the system to flourish, there must be a concerted effort on part of the organization to ensure that any part of the knowledge that is codifiable is in fact codified and captured. One of the biggest challenges facing the management consulting firm was capturing the intellectual capital that flowed from client projects. The difficulty was the lack of time and incentives allocated for this activity, as illustrated by an associate’s statement—“no one is given time to actually do it (recording knowledge). You come off one client and move onto the next one. That (recording) is the part left undone. It just continues to be on your list and just never gets done. It’s not looked on as an important thing”.

The second dimension of formal knowledge capture pertains to the capturing of more tacit knowledge. A ‘formalized’ procedure for capturing tacit knowledge may sound counter-intuitive but it simply means establishing structured forums for employees to physically get together and share knowledge and experiences. As mentioned before, a large proportion of an organization’s knowledge base cannot be codified and captured in database systems. The tacit nature of knowledge means that it is more effectively shared or transferred through informal

networking. Network theorists such as Nohria and Eccles (1992) have long advocated the advantages to be gained from informal channels of communications in terms of the exchange of rich tacit know-how. For the firms in our sample, personal networks are important sources of both data and knowledge, as acknowledged by a director at the executive search firm, “for this organization to work effectively, you need to network and you need to network across a range of areas within the business. I don’t believe there are formal channels that exist in a way that’s easy for you to run your business, so you need to have a lot of informal channels of communication”.

Despite the obvious advantages of informal channels, there is an inherent risk of spontaneity—that is, the risk of these informal interactions being too dependent on “chance meetings”. This lack of structure within informal channels can result in important information being lost—in other words, it is not a guarantee that an essential piece of information will be communicated to all relevant parties. We found various instances where information sharing was random and incidental. One attorney articulated how at his firm “information is shared anecdotally and sometimes by sheer luck because sometimes you do it by walking around the floor and asking people. It’s quite surprising what I have found by sheer accident”. This anecdotal sharing may work for smaller firms but as organizations grow in size, knowing “who’s who and who’s done what” becomes increasingly difficult. This can be seen as a problem where people are unable to locate a particular source of expertise within the firm.

A guard against the randomness of informal networks (and hence the sharing of information and knowledge) is simply to make them more *structured*. A manager at the railway engineering firm alluded to the problem of lack of structured time in bemoaning how “people find it difficult to get together and share. Lack of time is often the easy excuse, but what is contributing to our lack of time is our lack of structure to time”. For companies facing a fast

paced working environment, this lack of structured time may be even more detrimental as new knowledge becomes lost and mistakes (when not dealt with in a timely fashion) perpetuate. Opportunities for knowledge sharing may come in the form of weekly presentations, breakfast meetings, project de-briefs or mentoring schemes. Merely having these forums on the books is not enough, what is more important is there is an explicit intention to *structure in the time* for employees to learn from each other. An engineer at the railway firm expressed similar concerns that his firm needed to encourage learning by “having internal dedicated time for formal sharing of knowledge”.

The numerous examples presented here reflect both the importance and difficulty of implementing structured knowledge sharing. Most organizations these days exist in a world of tight schedules, multiple projects and quick turnaround time and in this type of environment, meeting client deadlines is given priority ahead of forums for general learning and knowledge sharing. However, organizations often suffer the consequences of this oversight when they fail to capture and distribute the intellectual capital that is produced from the projects they undertake. This is especially true for service organizations where their output is in the form of intangible know-how and only a small proportion of it can be codified—the more tacit components of the knowledge that is developed will be lost if they are not shared via regular structured interpersonal interactions.

## **CONCLUSIONS AND IMPLICATIONS**

This study indicates clearly that the processes of knowledge acquisition, utilization and creation are both complex and intricate. However as in Soo, Midgley and Devinney (2002) we are able to establish the validity of a set of constructs and relationships that are generalizable across firms and industries and to match these with a rich qualitative investigation into the

factors that influenced the entire knowledge creation process. From this research, we are able to show that new knowledge creation is a function of knowledge sourcing and problem solving quality (i.e., high levels of creativity and consensus). The fact that these results appeared significant in two very different sample sets (i.e., large scale multi-industry survey and case studies across five organizations) points to its stability and robustness. These results suggest that not only is it important for firms to constantly source knowledge from its internal and external networks—supporting the views of social network theorists (e.g., Liebeskind et al., 1996; Powell et al, 1996)—the ability to be creative and generate the necessary consensus to implement solutions to problems is also essential for generation new knowledge—supporting Ginsberg’s (1994) notion of socio-cognitive capabilities as sustainable rent-producing resources. By taking into account firm differences, we found that it is the level of informal networking and individual level absorptive capacity that have the most impact on new knowledge creation. And by taking into account contextual differences, we found that in efficient problem solving scenarios, the level of consensus generated a larger impact on new knowledge creation.

An important implication of these results is that the antecedents of new knowledge creation are both firm specific—individual absorptive capacity and informal networking—and context specific—problem criticality and consensus in problem solving—but that there are an equal number of effects that are independent of either the firm or the context—problem criticality, creativity and consensus in problem solving and know-how sourcing. In essence, effective problem solving situations are as important as the firm’s general ability for effective networking and knowledge sourcing.

Having uncovered the specific factors (through the survey component) that are important to new knowledge creation, we endeavor to further investigate the organizational phenomenon



that impact on those factors. Specifically, our interview data provided important insights into specific organizational phenomenon that can inhibit knowledge sourcing, effectiveness of informal networking, and the quality of problem solving processes. We found that the main factors impacting on problem solving processes were (1) an inability to leverage individual employees' tacit knowledge, (2) an inability to transfer knowledge or best practices across business units, (3) a lack of incentive for knowledge sharing and, (4) a lack of effective database systems to capture and share codifiable knowledge and structured learning forums to encourage the exchange of tacit knowledge. These four factors also explain why some firms fail to extract knowledge resources from their informal networks and hence, impacting on their ability to absorb and assimilate external knowledge.

These results present important managerial implications such as the need for explicit organizational policies to institute incentives for knowledge sharing and structured learning forums. In terms of future research, these results need to be refined conceptually and empirically. For example, some interesting questions will be “what constitutes structured learning forums and how should they be measured?” and “how should a firm's formal (i.e., database systems) and informal (i.e., inter-personal interactions) mechanisms complement each other to facilitate learning and to generate new knowledge?”

**TABLE 1:** Description of case study data

	Interviews				Surveys				
	Managerial Level				Managerial Level			Not Indicated	Total
	1	2	3	Total	1	2	3		
Executive search	7	7	4	18	9	19	17	0	45
Management consulting	4	7	6	17	18	15	17	1	51
Legal	4	6	8	18	22	50	22	0	94
Engine design	3	2	3	8	16	24	20	4	64
Railway engineering	5	6	7	18	20	53	32	10	115

**TABLE 2:** Reliability score (Cronbach's Alpha)

	Executive search	Legal	Management consulting	Engine design	Railway engineering
Individual absorptive capacity	0.82	0.77	0.60	0.82	0.81
Organizational absorptive capacity	0.89	0.88	0.80	0.87	0.91
Comprehensiveness	0.76	0.69	0.73	0.77	0.75
Creativity	0.67	0.72	0.78	0.71	0.71
Consensus	0.84	0.79	0.85	0.71	0.70
New knowledge	0.86	0.86	0.82	0.83	0.81

**TABLE 3:** Comparisons of means by company and variable

	Engineering Services		Business Services		Executive Search		Legal Services		Engine Manufacturing	
	Inefficient	Efficient	Inefficient	Efficient	Inefficient	Efficient	Inefficient	Efficient	Inefficient	Efficient
Problem Rating <sup>+</sup>	4.07	5.31**	3.04	5.11**	3.56	5.10*	3.00	5.28**	3.32	5.38**
Criticality <sup>+</sup>	5.98	5.28	4.67	5.69**	4.91	5.27	4.29	4.61	5.31	5.79
Typicality <sup>+</sup>	4.32	4.64	3.52	5.11*	3.78	4.71**	4.09	4.54	4.48	4.36
New Knowledge <sup>+</sup>	3.89	4.40*	3.78	4.70*	4.19	4.62*	3.09	4.76**	3.85	4.46*
Creativity <sup>+</sup>	3.52	3.75	3.24	4.25*	3.26	4.01**	3.20	4.16**	3.37	4.23**
Consensus <sup>+</sup>	4.28	4.95**	4.04	5.59**	4.40	5.23*	4.88	5.44**	4.69	5.55**
Comprehensiveness <sup>+</sup>	4.05	4.26	4.31	5.16*	3.71	4.01	3.81	4.30	4.40	5.12*
Individual AC <sup>§</sup>	4.66	4.56	4.88	4.60	4.46	4.42	4.68	4.86	3.98	4.12
Organization AC <sup>#</sup>	3.46	3.64	4.47	4.24	4.15	3.58	4.72	4.59	3.55	3.38
Know-how Sourcing <sup>*</sup>	1.24	1.16	1.38	1.31	1.16	1.19	1.33	1.38	1.20	1.16
Information Sourcing <sup>§</sup>	1.41	1.35	1.69	1.52*	1.41	1.35	1.63	1.64	1.26	1.26
Informal Networking <sup>§</sup>	1.26	1.32	1.58	1.32**	1.46	1.34	1.41	1.46	1.52	1.59
Formal Networking <sup>#</sup>	1.17	1.17	1.18	1.06	1.15	1.19	1.24	1.19	1.33	1.37
N	43	43	25	26	23	22	31	31	29	30

Note: + denotes problem solving context specific variables, § denotes individual level variables, # denotes firm level variables

\* difference between efficient and inefficient problem solving context (within firm) significant at the 0.05 level

\*\* difference between efficient and inefficient problem solving context (within firm) significant at the 0.01 level

**Table 4:** MANOVA comparing the effect of problem type nested within company on New Knowledge, Problem Solving Variables and Firm and Individual Characteristics (F-statistics)

Dependent Variable	Direct Effects			Nested Effect:	
	Company		Context	Context by	Company
New Knowledge	0.91		27.99	***	2.30 **
Criticality	4.89	***	9.17	***	0.63
Typicality	0.91		6.93	***	1.00
Creativity	0.25		35.09	***	1.59
Consensus	2.50	**	59.78	***	1.53
Comprehensiveness	6.71	***	14.07	***	0.85
Individual AC	7.09	***	0.06		0.71
Organization AC	12.52	***	0.52		1.40
Know-how Sourcing	3.71	***	0.31		0.41
Information Sourcing	14.53	***	1.95		0.81
Informal Networking	9.15	***	3.09	*	1.84
Formal Networking	3.28	**	0.17		0.51

Note: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Direct company and nested effect with 4 df, Problem solving context type with 1 df.

**TABLE 5:** F–Test of relationship between new knowledge and problem characteristics, decision making variables and firm and individual characteristics

Independent Variable	Direct Effect		Nested Effects			
			Company	Problem Context	Company by Problem Context	
Criticality	3.69	**	0.74	7.58	***	1.36
Typicality	0.52		0.40	2.03		1.08
Creativity	25.24	***	0.36	0.02		1.35
Consensus	11.82	***	0.68	4.93	**	0.40
Comprehensiveness	1.06		0.66	0.32		0.91
Individual AC	0.00		2.34	**	NA	NA
Organization AC	0.43		0.44		NA	NA
Know-how Sourcing	5.89	***	0.74		NA	NA
Information Sourcing	0.55		0.30		NA	NA
Informal Networking	0.62		2.12	*	NA	NA
Formal Networking	0.06		0.54		NA	NA

Note: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

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## **Appendix 1:** An overview of the Soo, Midgley and Devinney (2002) study

This work built upon simple yet powerful concept of knowledge creation and innovation that can be referred to as a sources–uses–outcomes approach. The process of new knowledge creation (an *outcome*) is driven by the nature of the way in which knowledge that is *sourced* internally and external is *used* by the organization in problem solving situations. More specifically, this model takes into account four major factors in the knowledge creating process. First, the model investigates whether knowledge (acquired through internal and external networks) makes an impact on the firm’s problem solving capability is investigated, building upon Iansiti and Clark’s (1994: 560) argument that “knowledge must be implemented in action-producing forms in order create capability”. Second, new knowledge creation is measured as an outcome of problem solving, building on Leonard-Barton’s (1995) findings that knowledge creation is influenced by the quality of problem solving processes. Third, the impact of new knowledge on firm innovative and financial performance is investigated. Finally, the model takes into account the impact of other influencing factors such as absorptive capacity (Cohen and Levinthal, 1990) and the nature of organizational knowledge (Zander and Kogut, 1995) on the firm’s propensity to create new knowledge. The data was analyzed using partial least squares (PLS) estimation and the key findings emerging from the study is as follows:

1. There is a significant positive relationship between knowledge acquisition and firm problem solving capability, (measured using Ginsberg’s (1994) concepts of comprehensiveness, creativity and consensus).
2. Effective problem solving processes contribute to new knowledge creation, in terms of improved productivity, new ways of doing things, new ideas, new ways of thinking, and new ways of solving future problems. The creation of new knowledge in turn generates higher levels of innovative output, which is then manifested in financial performance.

3. The propensity for individuals to absorb and assimilate external information and knowledge (i.e., absorptive capacity) has a direct impact on both knowledge acquisition and problem solving capability.

## Appendix 2: Constructs and measures in the model

Construct	Measure	Description
<b>Absorptive Capacity</b>		
Absorptive Capacity (Individual)	A	<i>The extent to which individuals:</i> Seek information from external sources, other depts. and parent company
	B	Record and store acquired information for future reference
	C	Use the acquired information
	D	Distribute and share the acquired information
	E	Participate in academic/industry conferences
	F	Constantly update skills through training, workshops, or self-learning
	G	Constantly keep up to date with the latest technology and knowledge
Absorptive Capacity (Organization)		<i>The extent to which organizational policies/practices encourage employees to:</i>
	A	Seek information from external sources, other depts. and parent company
	B	Record and store acquired information for future reference
	C	Use the acquired information
	D	Distribute and share the acquired information
	E	Participate in academic/industry conferences
	F	Constantly update skills through training, workshops, or self-learning
G	Constantly keep up to date with the latest technology and knowledge	
<b>Dimensions of Problem Solving</b>		
Criticality		<i>The extent to which:</i> The problem had an impact on organizational performance
Typicality		The problem occurs frequently in the organization
Comprehensiveness	A	The problem was solved through team effort
	B	The problem solving team was cross-functional
	C	More than one option was considered before the final decision was made
	D	Available options were formally tested before the final decision was made
	E	Orgn. structures/practices encouraged the generation of alternative solutions
Creativity	A	The final choice of solution was new, novel or creative
	B	Key decision makers were flexible in adopting new and innovative ideas
	C	People outside the orgn. provided new ideas or made suggestions
	D	Orgn. structures/practices encouraged the generation of new/novel solutions
	E	There are pressures or incentives to be creative in solving problems
Consensus	A	The final solution was successful in solving the problem
	B	The problem was solved within the expected time frame
	C	There was a high level of consensus among key decision makers
	D	There was shared commitment towards the final goals and decisions
	E	Orgn. structures/practices encouraged the implementation of the final solution
New Knowledge	A	The new solution resulted in improved performance
	B	The new solution resulted in new ways of doing things
	C	The new solution resulted in new projects or product ideas
	D	The new solution resulted in wider organizational thinking
	E	The new solution resulted in increased ability to solve other problems

<b>Construct</b>	<b>Measure</b>	<b>Description</b>
<b>Know-How/Information Acquisition</b>		
Information	A	<i>Entropy index of frequency of acquisition from the following sources:</i> Customers, suppliers, competitors, other businesses, sales/distribution agents, universities, other research institutions, governments or government agencies, market research organizations, advertising agencies, consultants, parent company, overseas business units, other (in country) business units, fellow colleagues, libraries or other published materials, internet
Know-how	B	<i>Entropy index of frequency of acquisition from the following sources:</i> Customers, suppliers, competitors, other businesses, sales/distribution agents, universities, other research institutions, governments or government agencies, market research organizations, advertising agencies, consultants, parent company, overseas business units, other (in country) business units, fellow colleagues, libraries or other published materials, internet
<b>Formal and Informal Networking</b>		
Formal (Organization level)	A	<i>Entropy index of frequency of collaboration with the following parties:</i> Customers, suppliers, competitors, other businesses, sales/distribution agents, universities, other research institutions, governments or government agencies, market research organizations, advertising agencies, consultants, parent company, overseas business units, other (in country) business units, fellow colleagues, libraries or other published materials, internet
Informal (Individual level)	B	<i>Entropy index of frequency of interaction with the following parties:</i> Customers, suppliers, competitors, other businesses, sales/distribution agents, universities, other research institutions, governments or government agencies, market research organizations, advertising agencies, consultants, parent company, overseas business units, other (in country) business units, fellow colleagues, libraries or other published materials, internet

### Appendix 3: Efficient and Inefficient Problem Solving Scenarios

#### Efficient

Please think of an incident when you were involved in solving an **important problem for the organization**. This must involve a problem that was actually solved. Please note that this may involve solving a client's problem, or solving an internal problem (such as a restructuring).

Please select an incident where the **process** of solving the problem was **efficient**. An example would be the case of a project where a time-saving communication procedure was devised during the course of the project. Not only was the client's problem solved successfully, your company was able to apply this new procedure to other upcoming projects with other clients.

Please describe the problem and the problem-solving process briefly:

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#### Inefficient

Please think of an incident when you were involved in solving an **important problem for the organization**. This must involve a problem that was actually solved. Please note that this may involve solving a client's problem, or solving an internal problem (such as a restructuring).

Please select an incident where the **process** of solving the problem was **inefficient**. An example would be the case of a consulting project where substantial additional resources had to be called upon at the last minute to meet the client's deadline. Although the client's need was met, poor project management led to an unprofitable project.

Please describe the problem and the problem-solving process briefly:

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