

Enhancing Knowledge Acquisition through the use of ICT

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Abstract

For firms in complex, uncertain, and high-velocity environments a source for competitiveness is their external knowledge-related relationships. Information and communication technologies (ICT) can play an important role in knowledge-intensive processes and flows. Using the dynamic capability and absorptive capability views the paper presents and discusses how ICT can be used to enhance knowledge acquisition from external sources. Absorptive capability is a dynamic capability pertaining to knowledge creation and utilization that enhances a firm's ability to gain and sustain a competitive advantage. Four capabilities compose a firm's absorptive capacity: acquisition, assimilation, transformation, and exploitation. This paper focuses acquisition, which is a firm's capability to identify and acquire externally information and knowledge that is critical to its operations. The paper discusses how ICT can be used to enhance knowledge acquisition. The core business process used for illustration is (new) product development.

Keywords

Knowledge acquisition, absorptive capacity, ICT, knowledge management, knowledge management systems

1. INTRODUCTION

Strategic management scholars stress that a firm's competitive advantage flows from its unique knowledge and how it manages knowledge (Barney 1991, Boisot 1998, Spender 1996, Nonaka & Teece 2001). Some scholars even state that the only sustainable competitive advantage in the future will be effective and efficient organizational knowledge management (Wikström & Normann 1994, Nonaka & Takeuchi 1995, von Krogh et al. 2000). Research suggests that an important source for competitive advantage in complex, uncertain, and high-velocity environments is organizations' external knowledge-related relationships (Gulati et al. 2000, Brown & Eisenhardt 1998, Huber 2004).

The increased interest in organizational knowledge has prompted the issue of how to manage knowledge to an organization's benefit and to the use of information and communication technologies (ICT) for managing knowledge. Generally, knowledge management (KM) refers to identifying and leveraging the individual and collective knowledge in an organization to support the organization in becoming more competitive (Davenport & Prusak 1998, O'Dell & Grayson 1998, Cross & Baird 2000, Baird & Henderson 2001).

This paper addresses the question: "How can firms use ICT to enhance external knowledge acquisition?" We acknowledge that other means for organizations to acquire knowledge and knowledge assets exist, for example, through intra-organizational processes and by buying or renting knowledge assets (Davenport & Prusak 1998). We focus primarily on "designed" relationships. Knowledge can of course also be created, integrated, and shared in informal and naturally emerging channels, processes, and relationships.

The remainder of the paper is organized as follows: the next section sets the scene by briefly discussing knowledge, KM, and KMS. It also argues that knowledge acquisition can be a critical component of a firm's dynamic capability. This is followed by a presentation and discussion of how firms are using ICT and can use ICT to enhance knowledge acquisition. The core business process used for illustration is (new) product development. This is based on Nonaka's argument: "When markets shift, technologies proliferate, competitors multiply, and/or products become obsolete almost overnight, successful companies are those that constantly create new knowledge, disseminate it widely throughout the organization, and quickly embody it in new

technologies and products.” (Nonaka 1991). The final section presents conclusions and suggests further research.

2. POINTS OF DEPARTURE

2.1 Knowledge, KM, and KMS

Numerous views of knowledge are discussed in the information systems (IS), strategy, management, and organization theory literature as well as in the philosophy and philosophy of science literature (Blackler 1995, Sparrow 1998). The different views of knowledge lead to different conceptualizations of knowledge management and on the roles of ICT in knowledge management (Carlsson et al. 1996, Alavi & Leidner 2001). Our starting point is “knowledge as resource”. This is in accordance with the resource-based view (RBV) of the firm. The main reason for this choice is that this view can be used to address the links between knowledge, knowledge management, and firm performance. There is a debate about what “knowledge as resource” means. One strand argues that “knowledge as resource” focuses on knowledge per se, meaning that knowledge is something that can be transferred, recombined, licensed, codified and put into a computer-based knowledge repository, and used to create value to a firm. Another strand argues that it is not knowledge per se that should be in focus, but “knowing”. This means an emphasis on the context where knowledge is created, shared, integrated and put to use. The latter view has primarily a process and flow view, while the former has primarily an object view. The view taken here is the process and flow view, which means that the design and structuring of knowledge processes and flows form the basis for achieving competitive advantage. Hence, our focus is firm’s ability to through external relationship-based knowledge processes and flows create new knowledge and to share and employ existing knowledge to solve problems, make decisions, and take actions.

We refer to knowledge management (KM) as a capability pertaining to knowledge creation, knowledge organization and storage/retrieval, knowledge transfer, and knowledge applications which enhances a firm’s ability to gain and sustain a competitive advantage (Pentland 1995, Davenport & Prusak 1998, Boisot 1998).

Knowledge management systems (KMS) refer to a class of information systems applied to managing individual and organizational knowledge processes and flows. They are ICT-based systems developed and used to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application. While not all KM initiatives involve the use of ICT and KMS, and warnings against an emphasis on the use of ICT/KMS for KM are not uncommon (Davenport & Prusak 1998, O’Dell & Grayson 1998, McDermott 1999, Swan et al. 1999, Walsham 2001), many KM-initiatives rely on ICT and KMS as important enablers. This paper focuses on how ICT and KMS can be used to support and enhance external relationships, but we acknowledge the warnings against a heavy emphasis on the use of ICT and KMS. For the relationships we will discuss, ICT and KMS can be a necessary, but not sufficient, condition for effective and efficient knowledge management.

2.2 Knowledge acquisition as a critical capability for competitive advantage

Using existing theories, this section presents a view of knowledge management within the context of absorptive capacity. The starting point is in business strategy theory, and specifically the resource-based view (RBV) of the firm. The main proposition of the RBV is that competitive advantage is based on valuable and unique internal resources and capabilities that are costly to imitate for competitors (Barney 1991, Wernerfelt 1984). Resources are assets available in the firm or which the firm can acquire. Capabilities are developed by combining and using resources; these resources can be capabilities. The knowledge-based view of the firm states that these resources and capabilities are knowledge-related and knowledge-intensive resources and capabilities (Grant 1996, 1997). A number of questions can be raised in relation to this view. First, what sources can be used to create, acquire, and integrate knowledge in knowledge-intensive processes, for example, in new product development (NPD) processes? Second, how can knowledge-intensive processes be designed in the first place, how can the processes be redesigned and adapted to changing technological and market conditions, and what resources and capabilities can be used to design the processes?

An answer to the first question can be found in the research suggesting that an important source for competitive advantage lies in an organization’s external relationships and environment (Gulati et al. 2000, Nohria & Ghoshal 1997, Kale et al. 2001, Huber 2004). The RBV argues that competitive advantage is an outcome of resources and capabilities residing within the firm, but these capabilities can be “directed” towards the environment of the firm. For example, a critical capability in an NPD process can be to use the Internet to communicate with customers to fast incorporate new or changed consumer preferences in new products. If the firm is able to exercise this capability faster than its competitors it can give the firm a competitive advantage. Support for that capabilities can be “directed” towards the firm’s environment, can be found in the literature

discussing how the RBV can be “extended” to external relationships (Eisenhardt & Schoonhoven 1996, Choudhury & Xia 1999).

An answer to the second question can be found in the discussion on the RBV, absorptive capacity, and dynamic capabilities. Most RBV-writings focus on stable rents that are costly, or impossible, to imitate. Some writers have addressed the dynamic nature of resources (Teece et al. 1997, Eisenhardt & Martin 2000). From a KM-perspective this points to the importance of dynamic aspects of knowledge processes. Teece et al. (1997) point out that the RBV recognizes, but does not attempt to explain the mechanisms that enable a firm to sustain its competitive advantage. According to Cohen and Levinthal (1990), a firm’s “absorptive capacity” is critical to its innovative capacity. Absorptive capacity is a firm’s ability to “...recognize the value of new, external information, assimilate it, and apply it to commercial ends.” (Cohen & Levinthal 1990). Recently, Zahra and George (2002a, 2002b) proposed a reconceptualization of absorptive capacity as a dynamic capability “...pertaining to knowledge creation and utilization that enhances a firm’s ability to gain and sustain a competitive advantage.” (Zahra & George 2002a). Zahra and George (2002a) argue that four distinct but complementary capabilities compose a firm’s absorptive capacity: acquisition, assimilation, transformation, and exploitation. Acquisition is a firm’s capability to identify and acquire external information and knowledge that is critical to its operations. A firm’s routines and processes allowing the firm to process, analyze, interpret and understand the information and knowledge from external sources is referred to as assimilation. Transformation is a firm’s capability to design and redesign the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge. Exploitation capability “... is based on the routines that allow firms to refine, extend, and leverage existing competencies or to create new ones by incorporating acquired and transformed knowledge into its operations.” (Zahra & George 2002a). The primary emphasis is on the routines that allow firms to exploit knowledge. An important distinction is made between potential absorptive capacity and realized absorptive capacity (Zahra & George 2002a). The former makes a firm receptive to acquiring and assimilating external information and knowledge and the latter reflects a firm’s capacity to leverage the knowledge which has been acquired. Hence, the literature suggests that for innovative firms a crucial capability is the ability to recognize new external information and knowledge and through processes apply it to commercial ends. The dynamic capability and absorptive capacity views suggest that profits not just flow from the assets structure of the firm and the degree of imitability, but also from the firm’s ability to reconfigure and transform. This ability is especially critical for firms in turbulent and high-velocity environments (Eisenhardt & Martin 2000).

In discussing the necessary nature of future firms, Huber (2004) argues that “...*future firms will more actively attempt to acquire knowledge from their environments.*” And, in acquiring knowledge a crucial means is the use of information and communication technologies.

Urban (2004) argues that some firms are moving toward “advocacy relationship development” instead of using “customer relationship management.” The former stresses the development of a mutual dialog with customers and consumers in order to become trustworthy in the eyes of the customers and consumers. Cooperative design can be an important element in the development of customer advocacy. Vandenbosch and Dawar (2002) argue that cooperating with customers and consumers in “forming the future” can also lead to lowering of costs and risk reduction in the development of new products and services. We will return to cooperative design in Section 3.

The above points to two main uses of ICT and KMS for enabling and enhancing a firm’s absorptive capacity. First, as a general support in a firm’s absorptive capacity, especially in its potential absorptive capacity. That is, to use ICT and KMS to identify and acquire external information and knowledge, and to process, analyze and interpret this information and knowledge. An example of the former is environmental scanning on the Internet using advanced search techniques and an example of the latter is knowledge discovery in databases containing external information using data mining techniques. Second, as a support (resource or capability) in a specific knowledge process so that the outcome of the process will lead to a competitive advantage for the firm. For example, a firm can in an NPD process use the Internet to get customers’ opinions about different product features. Using the Internet can lead to: 1) a faster process, speeding up the NPD process, and 2) an increased reliability in that more customers can be involved, leading to products with a better fit with customer expectations.

2.3 Using ICT in external relationships: Some trends

ICT and computer-based IS (CBIS) have primarily been used to gain and sustain competitive advantage through economies of scale or economies of scope. In the knowledge economy, ICT and IS (especially KMS) will also be used to gain and sustain competitive advantage through “economies of knowing.” In light of what we have presented, next section addresses the use of ICT and KMS in external relationships. Before addressing

the issue, three changes and trends are worth noting: 1) easier access through knowledge portals, 2) increased mobility, and 3) infrastructure and architecture for external-oriented KMS.

ICT and KMS can be a significant means for enabling and enhancing external relationships, for example, they can link a firm with customers and consumers and enable electronic communication across time and space. Increasingly, we will see that the gateway to ICT-based external relationships will be portals (Vering et al. 2001)—in the case of knowledge management: “knowledge portals” (Mack et al. 2001, Tsui 2003). Knowledge portals (KP) are digital “knowledge workplaces” designed to provide a single access point to internal and external applications, information, and services for an organization’s knowledge workers, partners, customers, suppliers, and other persons/organizations that an organization is cooperating with. The KP is an entry point to information, applications, and services available primarily via the Web. The information and knowledge, applications, and services made available through a KP can be personalized depending on participation in external relationships. The use of KP will make it easier to develop and change external relationships, for example, to add and delete participants as well as to add and delete information, applications, and services. In the last years many KM-tool vendors have re-positioned their product offerings to align with the growing portal market (Tsui, 2003).

A problem with many KMS is that the intended users have to come to the KMS, for example, by finding a PC hooked up to the Internet. Knowledge workers, partners, customers, etc. are not always tied to specific places when participating in knowledge-intensive processes. Increasingly, the needs of knowledge workers and other persons (like customers) involved in knowledge management activities are real-time, situational, and unpredictable (Keen & Mackintosh 2001). Mobile KMS can be a means for overcoming the real-time, situational, and unpredictability problem. This means that the gateway in many cases will not only be a KP, but actually a mobile KP (m-KP). KP makes it possible to have a personal gateway to desired information and knowledge, applications, and services. Mobile-KP can further reduce persons’ burdens of getting access to desired sources and resources at moment of relevance and truth. For example, an organization can make it possible for a customer—using a Wap-phone—to make comments (feedback) about a service or product at the moment of experiencing the product or service.

In the last years, hardware and software companies, as well as service providers, have been promoting a new approach to organizational information systems. The approach is based on the idea that organizations will increasingly buy and rent parts of their ICT and services over the Internet rather than owning and maintaining their own hardware and software (Hagel 2002). The approach is launched under a number of different concepts: “.Net” (Microsoft), “Web services” (IBM), “network services” (Oracle), and “open network environment” (Sun). A result of this trend is that previous proprietary architecture—where companies built and maintained unique KMS—will to a growing extent be substituted by an open architecture where companies can rent data storage, processing power, specific applications, communication capabilities, and other services from different types of external service providers. For example, the Application Service Providers (ASP) Zoomerang is offering web-based surveys and a number of other ASP have announced commercial applications for the design of web-based surveys. Some of these applications make it possible for a firm to, through a web-based menu-driven system, choose product/service features and feature levels to be tested. Given this information, Zoomerang sets up the web-page to be visited by the respondents. It also sets up the database, collects data, and makes analysis. Using an application/service like the described, a firm can gather sophisticated market information in a few days and, for example, improve its new product development process. It can speed up the process and also get inputs from more customers or potential customers.

The described approach—renting and buying ICT and services over the Internet—suggests that external KMS will increasingly be built and maintained using non-proprietary hardware, software, and data. Furthermore, these KMS can be more flexible and dynamic, which could make it easier to develop and change external relationships.

3. ENHANCING KNOWLEDGE ACQUISITION THROUGH THE USE OF ICT

A firm can use ICT to identify and acquire external information and knowledge. An example is environmental scanning on the Internet using advanced search techniques, like agent-based search techniques. It can also be through interaction with, for example, consumers and customers or other value chain-partners where the focus is on integration of knowledge resources in relationships and collaboration with partners. This means that collaborations and relationships are being structured to pursue goals beyond coordination and transactional efficiencies.

For a deeper illustration of how a firm can enable and enhance its knowledge acquisition capability through the use of ICT and KMS, we choose a critical core business process: new product development (NPD). There are several reasons for the choice. First, NPD is a business process that is highly knowledge-intensive and one of

the key business processes for creating new organizational knowledge (Nonaka and Takeuchi 1995, Madhavan and Grover 1998). Second, in many industries NPD projects are under pressure to accelerate development cycles and decrease development costs, while increasing design quality and flexibility (Towner 1997, Iansiti and MacCormack 1997). Third, from a learning perspective for an organization, NPD is the context from which the organization is most likely to transfer methods (resources and capabilities) to other areas of the organization. NPD is seen as a main driver of organizational renewal. It is a continuous process of knowledge-related activities, in which the organization is adapted to its changing environment and technologies (Dougherty 1992). Nonaka and Takeuchi say it most elegantly: “Organizational knowledge creation is like a ‘derivative’ of new-product development. Thus, how well a company manages the new-product development process becomes the critical determinant of how successfully organizational knowledge creation can be carried out.” (Nonaka & Takeuchi 1995). Hence, what we discuss should be applicable to other core business processes. Fourth, in NPD, as well as in many other core business processes, knowledge-related activities play a critical role, and thus provide excellent leverage points for ICT- and KMS-enhancement. Fifth, NPD projects are increasingly using external sources and resources to overcome the learning curves related to new markets and new technologies (Schilling & Hill 1998).

NPD can be viewed and described in many different ways (Cooper & Kleinschmidt 1986, Brown & Eisenhardt 1995). For our illustration, we will use a model consisting of three major phases: 1) creation phase, exploration, 2) development phase, exploitation, and 3) diffusion and ending phase, exportation (Ancona & Caldwell 1990). Exploration, exploitation, and exportation require different types of KM-activities. Therefore, relationships, ICT, and KMS supporting NPD must facilitate diverse patterns of KM processes and activities.

Creation phase (exploration): Opportunity identification, ideas and concepts generation. The role of customers as information and knowledge sources of new product and service ideas and opportunities is well documented in the literature (Lengnick-Hall 1996). ICT-based relationships open up new ways to involve the customers in the creation phase. Using a “gated-community” approach in the creation phase a firm can involve those customers perceived to be useful idea generators and innovators (the term customer denotes both current customers as well as potential customers; it denotes both industrial customers as well as consumers). For example, Hallmark Inc. uses its Hallmark Knowledge Creation Community to together with its lead retailers generate ideas on new product designs, e.g., new greeting cards (Kambil et al. 1999). Using an open approach in the creation phase a firm makes it possible for any customer to participate in the phase. It can lead to an input from a larger number of customers, but the firm must have an elaborate way to manage the many, and maybe diverse and inconsistent, ideas. There is a risk that the firm ends up with extraneous information that can complicate the creation phase and lead the NPD process astray. Fiat used an open approach to generate design ideas for its Punto model. Fiat invited customers to select features for the car on its web-site. More than 3000 people took the chance and gave Fiat valuable design information—this is a good example of co-creation using the Internet (Iansiti & MacCormack 1997).

A number of ICT-based tools and services are available to use for enabling and enhancing knowledge acquisition. Zoomerang (zoomerang.com) offers a web-based application service that can be used by firms in the creation phase (can also be used in the other phases). The service allows a firm to seek out ideas. Through a web-based menu-driven system the firm can create a survey, for example, for concept testing, and customize it in different ways. The created survey can be sent to customers from the firm’s e-mail list or to a sample provided by Zoomerang. It can also be placed as a link on a Web-site. It is also possible to manage the survey, for example, controlling status and inviting new customers. Based on the responses, Zoomerang calculates the result and presents it in tables and graphs.

Dahan and Hauser (2002) present and review other web-based methods for generating and capturing knowledge from customers. One method is the information pump (Prelec 2001). The information pump (IP) is a “focused group” and in essence IP enables customers to interact (discuss) with each other through a web-based game. This is a way for customers to verbalize the product features that are most important to them. The customers pose and answer each other’s questions. Individual incentives are “bootstrapped” by comparing the information provided by one customer against that provided by other customers at the same time. A customer gets credits for “...presenting statements that are non-redundant on what has previously been said and that are recognized as relevant (an ‘a-ha’) by the others.”(Prelec 2001). One of IP’s strengths is its ability to gather customers’ language. This means that it can be useful in generating and testing integrated concepts that can be hard for customers to articulate or when customers have problems generating and evaluating specific features.

Although, ICT and KMS can be used in the creation phase, there is a number of critical question to be addressed before using these in the phase: 1) what customers should we try to involve and how can we establish links with them, 2) what incentives can create and foster customer participation, and 3) how should the acquired knowledge be integrated into our internal NPD-process. It is also critical to ask the right question to be able to acquire relevant knowledge. Some argue that involving customers in idea generation will lead to

imitative and unimaginative products and services. Ulwick (2002) argues that organizations should stop asking customers what they want. Instead, they should ask what the customers want the products and services to do for them. Some of the available ICT- and Web-based tools can be used for generating ideas on what products should do for the customers.

Development phase (exploitation): design and engineer. Customers can also play critical roles in the development phase. Customer involvement can range from design to development and engineering. In the software industry it is common to have customers as members of NPD projects. For example, to use a gated-community approach, like Xerox (Sawhney & Prandelli 2000), to involve a selected group of customers to participate in product design and development—these customers represent the most valuable and important customers. Using an open approach, the statistical software package developer and seller Stata encourages its customers to develop add-on modules for performing the latest statistical techniques. The best of those are adopted and incorporated in later releases of the firm's products. Using an open approach in the development phase can be problematic if a large number of customers would be interested in participating. A problem will be to handle a large number of designs. Firms can also use an open approach, for example, to offer customers the possibility to design their products, within given constraints—more on this below.

User design (UD) can also be used in the development phase. UD has some similarities with what some firms, like Dell (Dell.com) and Gateway (gateway.com), are offering customers today. The firms offer customers the possibility to configure and order products by selecting features from drop-down menus. By using UD in an NPD process it is possible to show to a customer the results of choices interactively and to track the process (i.e., tracking the customer-system interaction). UD enables an NPD-project to understand feature interactions, even for complex products. It also allows customers to learn their own preferences for new products and product features. Using web-based UD makes it possible to show real and virtual features to a customer and to display changes interactively. This makes it possible for an NPD-project to have better knowledge when determining what products and product features to offer customers.

An alternative approach is to actually allow customers, using “tool kit for customer innovation,” to design and develop their specific products (Thomke & von Hippel 2002, von Hippel 2001). A “tool kit for customer innovation” is a user-friendly “package” developed using new ICT and techniques and used by customers to develop the application-specific part of a product. The tool kit gives customers the possibility to “...develop their custom product via iterative trial-and-error. That is, users [customers] can create a preliminary design, simulate or prototype it, evaluate its functioning in their own use environment, and then iteratively improve it until satisfied. As the concept is evolving, toolkits guide the user to insure that the completed design can be produced on the intended production system without change.” (von Hippel 2001). Putting a tool kit in the hands of customers changes an NPD process. It means that a firm can abandon its attempts to really understand customer needs in detail and transfer the design and development of need-related aspects of products and services to customers. A firm can capture tool kits interactions and feed this knowledge into its NPD-processes. Given the development in technology and techniques we can expect to see more of tool kit design and development by consumers. We can also expect to see third parties developing tool kits that can be used to design a number of different products (e.g., cameras, DVD players) or a specific product (e.g. a copying machine) from different suppliers.

Diffusion and “ending” phase (exportation): testing and support. In the diffusion and ending phase customers can provide information and knowledge through acting as testers of the “final” product. They can also provide information and knowledge based on their experiences on various aspects of product use. ICT-based relationships can be set up for testing a product. In the case of digital products, like software, customers can act as beta testers and the product to be tested can be distributed to the testers over the net. In the case of a gated community this means that the organization will select a few customers to act as testers. In the open approach it means that the firm will allow all customers to act as testers. Compared to if the test is done in-house, using customers as testers can lead to a speed-up of the testing process, decreased cost for the test, and a more varied test of the product. The testing of a product, like software, can continue even after the product has been launched. For non-digital products, virtual concept testing offers an alternative way to test products (Dahan and Hauser, 2002). In virtual testing, consumers view new product concepts and products and indicate what concepts they are likely to buy at varying prices. With the development of multimedia concept representations and increased bandwidth, virtual concept testing can reduce the time and cost of testing. Also, it can lead to that an increased number of concepts can be tested as well as the number of testers can be increased.

Consumers can also play a critical role in the diffusion and ending phase as expert users of the product—consumers as expert user (Nambisan 2002). Some organizations are creating online communities for their customers (McWilliam 2000). In these communities the customers can exchange experiences (knowledge) on ways of using the product, new ways to use the product, and problems in using the product and how to solve these problems. In general, exchange of knowledge of how to enhance the overall value of the product. Online

communities can be a valuable source for customers, but they can also be a value source for the product firm. The exchanged knowledge in a community can be captured and fed into the firm's NPD processes. Firms like Artificial Life (artificial-life.com) offer tools that can be used to retrieve and analyze information from online discussions using neural networking, fuzzy logics, and statistical analysis (McWilliam 2000). Artificial Life also offers smart bots that can be used to bring a human-like presence and appearance to the points of contact between a firm and its customers (smart bots are intelligent software products that integrate computer interaction and natural language understanding). Using these types of products it is possible for a firm to make online communities easier to use and more attractive as well as it is possible for the firm to turn electronic discussions into knowledge that can be used in NPD processes.

To summarize: Firms can use two major approaches to enable and enhance external knowledge acquisition through the use of ICT and KMS. The first can be summarized as web harvesting, using different search tools, more or less intelligent tools, to search the Internet for relevant information and knowledge. There exists a fairly large body of literature describing web harvesting and Internet search. The second approach can be summarized as acquisition through knowledge creation, where a firm uses ICT and KMS to create new knowledge from interacting with its environment (customers, consumers, and partners). According to Zahra and George (2002), effort expended in knowledge acquisition routines has three attributes that can influence a firm's absorptive capacity: intensity, speed, and direction. These three attributes can be seen as design dimensions and be used to decide on how ICT and KMS should be used. This will determine, in part, the quality of the firm's acquisition capability. Zahra and George posit that "the greater a firm's exposure to diverse and complementary external sources of knowledge, the greater the opportunity is for the firm to develop PACAP [potential absorptive capacity]." (Zahra & George 2002a). The second approach enables a firm to increase its exposure to diverse sources, to increase its exposure to complementary external sources as well as to increase the knowledge acquisition speed. At the same time it should be noted that organizations (its members) are likely to be influenced in their search by past experiences. Even if they use ICT and KMS they are likely to search for knowledge in areas where they have had previous successes and over time they will, if they are reasonably successful, develop path-dependent knowledge acquisition capabilities.

Using a gated community approach or an open approach will have different effects on knowledge acquisition. Compared to a gated community, an open approach gives a firm a lesser possibility to govern the relationship leading to a lower degree of disciplined knowledge management, but the firm can increase its exposure to diverse sources as well as to increase its exposure to complementary external sources. This can lead to a higher level of for example NPD as a "communication web." Compared to a gated community approach, an open approach is likely to lead to a decreased degree of stability of the relationship and can lead to a more chaotic knowledge managing, but it can also lead to creative destruction.

Having acquired information and knowledge from external sources the firm needs to process the information and knowledge to create new and useful knowledge. Based on task characteristics and individual cognitive styles this can be enabled and enhanced by ICT-support for information interpretation. Firms can use ICT to process the acquired information to uncover patterns and enhance their understanding. A critical assimilation application is ICT-support for organizational memory. Organizational memory is the means by which knowledge from the past can be brought to bear upon present activities (Stein & Zwass 1995, Wijnhoven 2000). Organizational memory systems could be knowledge repositories storing the history of interactions with the environment, in terms of both the processes that ensued as well as the outcomes. Organizations need to develop their organizational memory system to make sense of externally acquired information by bringing existing knowledge to bear on new information in order to enhance their knowledge base. The presence of organizational memory system is an enabler and enhancer for knowledge assimilation.

4. DISCUSSION, CONCLUSIONS AND FURTHER RESEARCH

The paper presented and discussed how firms can use ICT to enhance their knowledge acquisition. The paper is a step in the development of our understanding of "economies of knowing." Further theoretical work is needed to tighten the presented ideas. The paper has a focus on potential absorptive capacity and primarily knowledge acquisition. Consequently, research on how ICT and KMS can be used to enable and enhance transformation and exploitation is needed. Empirical research is also critical in helping us understand how firms get to be good at using ICT to enable and enhance their absorptive capacity, how they sometimes stay that way, why and how they improve their absorptive capacity, and why sometimes absorptive capacity declines. The presented ideas and exemplifications can be used to generate new research issues on the strategic use of ICT and KMS. A number of issues have not been addressed in the paper, for example, legal aspects, like licensing and patents issues related to that products and services are developed in external relationships.

Furthermore, increasingly “open source”-liked networks affect “traditional” NPD processes, most notably is the open source movement and the development of Linux. In the software industry, firms are increasingly forced to react to the open source movement and they also increasingly have to “manage” knowledge processes in these new environments. IBM’s decision to place in-house tools into the public domain exemplifies this (Thompke & von Hippel 2002, Sawhney & Prandelli 2000). IBM placed \$40 million of in-house tools for developing software into the public domain to encourage people to develop programs that run on Linux. This means a major change from how IBM traditionally develops software and might have a major impact on how IBM “manages” software knowledge. Being part of an open source network means that a firm is outsourcing a portion of a knowledge-intensive process to participants (like customers) in the open source network (Thompke & von Hippel 2002). This can be an effective approach for speeding up the development of new products better suited to customers needs or for tapping into the knowledge created and shared in the relationships. Research on the effects of these changes is needed.

The paper suggests that the potential for using ICT and KMS to enable and enhance absorptive capacity is there, but no one can guarantee the outcomes. Although there is a growing number of enabling and emerging technologies that can be used in knowledge-based external relationships and used to develop absorptive capacity, strategy research stresses the importance of path dependence that influences a firm’s decision to develop new processes, adopt new technology, or to provide new products and services (Zahra & George 2002b).

In our example we have used NPD and customers/consumers, but the underlying idea, the technology, and the techniques presented can be used in other core business processes where firms like to use external relationships to create and capture knowledge. Also other stakeholders and groups like suppliers, partners, and complementors can be used as sources.

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