

Knowledge management: An innovative capability perspective

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Abstract

This paper reviews literature on knowledge management and its implications on innovation. Like various innovative capabilities contributing to the innovativeness of a firm, knowledge management can become one of the core capabilities of a firm consisting of its human, organizational and social capital. In addition, it can also comprise of various other innovative capabilities in terms of sophisticated technologies developed to implement successful knowledge management practices. When dealt appropriately, knowledge management can increase the efficiency as well as the effectiveness of organizational processes enabling innovation.

Keywords: *Knowledge management, Innovative Capability, Innovativeness, Firm performance*

In an interview, Thomas Edison was asked “You have failed 1000 times before inventing electric lighting/bulb but now everybody knows how to make electric lighting/bulb, then what is the difference between you and them?”

Edison replies – “I also know what are those 1000 ways by which an electric bulb can not be made”

Introduction

Innovation requires either continuous improvements or achieving radical breakthroughs. Both demand different sources of knowledge. Improvement requires knowledge about existing products while radical breakthrough requires nurturing and diffusion of new ideas. Organizations need to manage this knowledge in order to ensure their timely usage, thus avoiding rework and improve efficiency. This article reviews literature on knowledge management and its association with firm's innovative capability and performance. The rest of the paper is organized as follows.

In section 2, the importance of knowledge management in innovation is discussed. Section 3 covers various types of innovation and the required knowledge management approaches. Section 4 reviews literature on collaboration for knowledge sharing using technology. Section 4 also addresses the question of why and how collaborative efforts using technology are better than traditional collaborative efforts for innovation. Section 5 covers some determinants of innovative capabilities and their effect on knowledge sharing practices for innovation, leading to improved performance of firms. Section 6 explains how the theoretical framework reproduced in section 5 can help in choosing a right partner firm having desired level of knowledge management competency. Section 7 concludes the paper.

Knowledge management and innovation

With the advent of state of the art information technology, the knowledge management and its impact on various organizational capabilities and organizational outcomes has become one of the prime areas of research and discussion. These discussions are giving two major influences, both having complementary and contradictory features. The first of these influences are internal to the innovation research, which requires observation of path dependency of innovation. It deals with the specific routines that help firms to achieve innovation. For example, according to Metcalfe & de Liso (1995), "*business units meant for fostering innovation follow a specific normal design configuration, a shared mental framework of fundamental design concepts relating to specific technologies, providing the operational route to specific artifacts*". This perspective actually link knowledge and innovation by saying that innovation over the time stabilize certain bodies of knowledge because of firm specific routines and embed such knowledge as shared understanding with in the firm. This perspective also gives templates for deploying this embedded knowledge to produce distinctive innovation for the firm.

The second underlying influence is in the form of considering knowledge as one of the resource, an important factor of production. This perspective provides a complete different view of knowledge becoming source of major technical and economical changes both with in the firm as well as outside the firm and the market as a whole.

Nonaka's (1991; 1995) work on knowledge management gave firms a new focus on achieving organizational advantage by following better knowledge management practices. Nonaka studied various Japanese firms involved in new product development and then proposed a model describing various ways by which organizations create knowledge. Accordingly, Nonaka also suggest different management styles and organizational structures that best support creating and managing organizational knowledge. Nonaka's major work is on the distinction given by Polanyi (1962) between two types of knowledge viz. tacit and explicit knowledge. Nonaka further elaborated that these two types of knowledge can be converted from one to other by certain organizational processes viz. socialization, externalization, internalization, combination. Nonaka's work focused upon how to manage the interaction between four modes of knowledge conversion (Tacit to Tacit, Tacit to Explicit, Explicit to Tacit and Explicit to explicit). Nonaka also proposed organizational processes that support these interactions (See Figure 1).

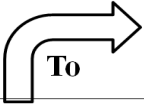
 To	Tacit	Explicit
Tacit	Socialization	Externalization
Explicit	Internalization	Combination

Figure 1 : Interaction and conversion process between different types of knowledge

Leonard-Barton (1992) discuss more towards the core competence strategy of an organization and calls "*The whole system of knowledge management*" as an integral element of competitive advantage or core technological capability. Her major area of interest were in the field of key knowledge building activities. For example, shared problem solving, implementing and integrating new technical processes and tools, experimenting and prototyping, and importing and absorbing technological and market knowledge. Now, let us see how knowledge management initiatives are affected by the type of innovation.

Types of innovation and knowledge management approach

Based upon the inherent characteristics, Henderson & Clark (1990) developed a framework to categorize various types of innovation (Refer Figure 2). The characteristics are like whether the components of new product are re-enforced or changed and whether linkages between these components inside a product are kept same or altered. Henderson & Clark (1990) categorized innovation in to four different categories viz radical, incremental, architectural and modular. Radical innovation involves changes in components or redefinition of core concepts as well as changes in the linkages between these core concepts. Architectural innovation involves only changes in linkages while the core-concepts are re-enforced. Incremental innovation does not involve any changes both in terms of core concepts as well as their linkages. It is an improvement

to the previous version of the product, thus re-enforcing core concepts as well as their linkages.

		Core Concepts	
		Reinforced	Overturned
Linkages between Core Concepts and Components	Unchanged	Incremental	Modular
	Changed	Architectural	Radical

Figure 2 : Henderson and Clark's Typology for various types of innovation

The term technology transfer is same as communicating innovation. It is also termed as transfer of information. The innovation need to pour new knowledge in to people's heads like filling water from a pitcher in to a glass. This kind of communication might work for incremental innovations but may not suit work that fundamentally redefines a technology, product, work process, or business problems. In such cases, instead of pouring knowledge in the people's head, it is required to provide them new eyeglasses to view the work from a completely different perspective. This requires challenging the implicit assumptions by which the organization looked at things. It also demands a new set of communication channels and filters.

The architectural innovation require the management of

knowledge of the existing components of the product. With the synthesis of unfamiliar technologies, architectural innovation requires knowledge about alternate components and how these alternate components can be integrated in to the existing product. When any technology is in the development stage before becoming a dominant design, organizations compete to experiment with many different technologies in order to develop a successful product. As soon the dominant design emerges, firm stops experimenting with alternate configurations. Rather, they start paying attention to knowledge on new components because the competition increases to refine the particular components of the dominant design. Thus, successful organizations start learning about dominant design rather than learning about many possible designs.

Every organization develops two kinds of communication channels, one is implicit as per the reporting structure of organization while second is the informal (A contacts B because B knows). These communication channels are developed to enable interactions that are critical to the task (Galbraith, 1973; Arrow, 1974). These interactions are also critical for effective design. Architectural knowledge is build around these relationships. In fact, these communication channels embody architectural knowledge about the linkages between critical components of effective design.

Over the time, when the organizations develop a plethora of information and knowledge about the components and linkages, the role of information filters become effective. As the task stabilizes and becomes less ambiguous, the

filters are developed in the organizations in order to filter most crucial knowledge from not so important knowledge (Arrow, 1974; Daft & Weick, 1984). With the emergence of dominant design, the organizational filters embody parts of its knowledge and the key relationships between the components. But over the time, as engineers acquire knowledge about the solutions to recurring and specific kind of problems, they does not re-examine all possible alternative solution to the problem but they refer to the history of their tacit knowledge repository and approach this problem on the basis of their previous experiences. Therefore, organization's problem solving strategies are affected by what is learned from its immediate environment (Lyies & Mitroff, 1980; March & Simon, 1958; Nelson & Winter, 1982). This in turn increases efficiency because knowledge from immediate environment is not created every time, neither it requires to approach the problem as of it is novel. As these knowledge and learning becomes effective and familiar, using them becomes natural. This makes the channels and filters implicit within the organization and architectural knowledge can be encoded in this form. In case of incremental innovations, the architectural knowledge is almost stable. Thus the organization involved in incremental innovation manage their architectural knowledge implicitly while component knowledge needs to be managed explicitly because it is a constant source of incremental innovation. (Henderson & Clark 1990)

Innovations can also be classified on the basis of dependency between different innovations (Chesbrough

& Teece 1996). Some innovations are autonomous means they can be undertaken independently from other innovations. In contrast, some innovations are systemic means their benefits can only be realized in conjunctions with related, complementary innovations. Further, this distinction is fundamental to the choice of organizational design. When innovation is autonomous, the decentralized virtual organization can manage the development and commercialization tasks quite well. However, when innovation is systemic, members of virtual organization are dependent on the other members over whom they have no control. Hence, systematic innovation requires information sharing and coordinated adjustment throughout an entire product system (Chesbrough & Teece 1996). The role of knowledge management is prominent in the case of systemic innovation then the autonomous innovations.

Collaboration for knowledge sharing using technology

Encouraging people to share their insights within the organization is another issue, which needs to be addressed carefully. Hansen et al. (1999) in their work calls these kind of managers (who are ready to share their knowledge) as T Shaped Managers. These are people who share knowledge freely across the organization (the horizontal part of T) while remaining committed to the performance of their own business unit (the vertical part of T). However, the decision to share insights and knowledge is not simply a matter of managers responding to a new corporate initiative. It is a

matter of individual's choice. Researchers at the Roffey Park Institute in UK have identified two ways in which individual willingness to contribute their creativity to their organization is cut short. The first is "psychological withdrawal" where uncertainty about their personal future in the organization (due to change of any kind) leads to fear and stress and as a consequence, inhibition in the work. The second is "psychological work to rule" where more confident staff deliberately hold back their best ideas until they can ascertain what personal benefits the change will bring – using their creative insights to start up their own enterprise or to win themselves a better position in a competitor firm, should the outcome not suit their needs.

Syrett & Lammimam (2002) in their book write that e-mail is the biggest thing that has happened to effect creativity at work since the telephone. It enabled individuals to capture their thoughts instantly in text, thus capturing the spontaneity of a face-to-face exchange with the validation that occurs when we see our ideas in print. Since creative breakthroughs nearly always occur in quick-fire exchanges, where the individual does not have the time or need to censor what he or she is saying, e-mail has the capacity to make brain storming virtual, greatly extending the creative reach of a multisite or multinational organization. Indeed, there is considerable research evidence that brainstorming conducted by email or over the internet are more productive. Recent tests of new software designed to support electronic brainstorming involving 800 researchers at the MIT found that the creative output from electronic brainstorming sessions was greater than those conducted

face-to-face, and furthermore, the productivity gains increased along with the size of group. This was because in face-to-face session, the most assertive and outgoing members of the group dominated the exchange, with quieter but equally insightful individual keeping their thoughts to themselves. Thus, the electronic collaboration helps these passive listeners to shoot their thoughts and become indirectly active contributors for achieving organizational goals.

Morgan (2006) points out that the collaborative new product and process development (NPPD) collects and integrates many sources of design ideas and data. Collaboration not only help in stimulating creativity but also addresses the many interdependencies among market choices, product and process design decisions. Bi-directional communication has importance for both the parties (inside or outside) of the NPPD project team. The benefits of collaborative innovation projects found to be far beyond the earlier form of cooperative innovation efforts. Collaboration not only increases the source of new breakthrough ideas for innovation but also enables cross-fertilization and stimulation of ideas through shared knowledge and experience. The knowledge barriers emerging due to various organizational factors can form strong impediments to collaboration. However, advanced organizational and technical information systems can be put in to the place in order to overcome these barriers. Still, barriers may exist because these systems need to be populated by identified experts and codified knowledge. At the end, organizations also need to spend time and

resources to develop and classify knowledge and knowledge retrieval protocol before the benefits of collaboration can be fully exploited.

Learning inside an organization actually involves transfer of knowledge among its different units. These different units of an organization are linked to each other through a shared social context, which enables them to transfer knowledge within the boundaries of the organization. The co-ordination mechanism for the network of these units is maintained through knowledge transfer and resource sharing (Galbraith, 1977; Gresov & Stephens, 1993). Such a network enables these different units of the organization to gain critical competencies, which further leads to increased competitiveness of the organization in the marketplace.

Inter-unit links and social networks are an important part of a learning process. Such processes when exist provides opportunities to share and/or obtain new knowledge by interacting with each other. As noted by Gupta & Govindarajan (1986) "The potential for synergistic benefits from resource sharing varies across strategic contexts, and the realization of these potential synergistic benefits depends on how effectively linkages between SBUs are actually managed". If we take in to account the knowledge-based view of a firm, the active social network in a firm facilitates the creation of new knowledge within organizations (for example, Kogut & Zander, 1992; Tsai, 2000). The organizational learning can be enhanced or broadened by developing such inter-unit

network links. Any organization, which is characterized by motivated and intimately connected units, can become a learning organization (Huber, 1991). Over the time, this network arrangement replaces old hierarchical structures by a flexible learning structure.

Drawing a network perspective on organizational learning, Tsai (2000) examined two important concepts to determine the effectiveness of inter-unit learning and knowledge transfer. First is the network position, and the second is the absorptive capacity of the organization. The former determines the unit's location in an inter-unit network and describes its access to knowledge while the later one determines unit's R&D investment and describes its capacity to learn. The organizational units may not necessarily equally capable of acquiring knowledge or being equally efficient or effective learners. These differences among organizational units, especially in terms of their knowledge access and learning capacity is likely to create a difference in their innovation output which in turn can have significant impact on their innovative capability and ultimately their performance.

Innovative capabilities driving knowledge management and firm performance

Technology and innovation must be managed. This is very important for organizations in which both of these two elements are vital and critical. So is the importance of management of resources of organization for innovation. Technology is also one of the resource that require

alignment with overall organization strategy. Competition and rapid changes in technological paradigm requires improvements in the organizational innovative capability. An organizational innovative capability can be assessed with two difference views – product market based view and the resource based view. The product market view of organizational strategy is concerned with the products and services that organization offers to the market and its competitive position in the market. The resource-based view is concerned with the resources available with the organization to develop and exploit its innovative capability. The resource based view includes how the firm can secure the factors needed to create the core competencies and capabilities that form the basis for establishing and sustaining competitive advantage.

Innovative capabilities as Burgelman (2004) defines “the comprehensive set of characteristics of an organization that facilitate and support innovation strategies” Burgelman (2004) suggested innovative audit framework for assessing innovative capability of an organization in terms of five important categories of variables. Combination of these category of variables are able to determine the relative strength of an organization in formulating and implementing innovation strategies. Two of the important categories are

- Resource availability & allocation
- Business unit structural & cultural context

Resource availability and allocation include variables like

- Breadth and depth of skills at business unit level in R&D, engineering and market research
- Distinctive competencies in areas of technology relevant to business unit

And business Unit structural and cultural context include variables like

- Mechanisms for managing R&D efforts
- Mechanisms for transferring technology from research to development
- Mechanisms for integrating different functional groups in to new product development process

According to Prahalad & Hamel (1990), any diversified organization is a large tree in which the leaves, flowers and fruits are products. Prahalad & Hamel (1990) further point out that we often see organization's competence only in terms of its products but actually, which is in its root where the core strength lies. This root is nothing but the core competence of corporation. Core competences are the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies. Prahalad & Hamel (1990) defines core competence as the *"communication, involvement, and a deep commitment to working across organizational boundaries"*. Core competence does not diminish with use but is enhanced as it is applied and shared. In addition, these competencies need to be nurtured and protected; knowledge fades if it is not used.

Sherwood (2002) in his book writes that the innovation is not only to have a great idea, but about managing a four stage process viz. idea generation, evaluation, development and implementation. Individuals can carry out the first activity i.e. the idea generation, but the other three activities require organizational cooperation and coordination. Therefore making innovation happen depends on how well people within organization cooperate with one another and how well the organization itself coordinates its resources. An organization's success or failure in making innovation happen is therefore totally depends upon its people and culture.

Further, it is widely accepted that the innovative capability of an organization is closely associated with its intellectual capital and ability to manage and utilize its knowledge resources. Many studies examining and/or measuring innovation uses knowledge or intellectual capital as antecedent. Vice versa, studies examining knowledge or intellectual capital uses innovation as a measure of outcome (for example, see Ahuja, 2000; Dougherty, 1992; Subramaniam & Venkatraman, 2001; Tsai & Ghoshal, 1998). In order to accumulate and utilize knowledge, organizations adopt different approaches and these approaches are determined by different aspect of intellectual capital viz. human, organizational and social capital (Davenport & Prusak, 1998; Nahapiet & Ghoshal, 1998; Scultz, 1961). It is demonstrated that the intellectual capital involves human, social and organizational capital. All these

three aspects of intellectual capital are different from each other. Human capital is associated with the knowledge, skills and abilities possessed and used by individuals of an organization (Schultz, 1961), whereas organizational capital comprises of codified and institutionalized knowledge maintained in the form databases, patents, manuals, structures, systems, and processes (Youndt et al., 2004). The social capital is the abilities of the individuals to connect with each other in order to share and utilize knowledge through their interrelationships (Nahapiet & Ghoshal, 1998).

By virtue of the kind of breakthrough achieved, an innovation can be classified either as incremental or radical (Dewar & Dutton, 1986). The incremental innovations refine and/or modify existing products, services, process or technologies and therefore provide an opportunity to reinforce the existing product/service designs, processes and technologies (Ettlie, 1983). Contrary, the radical innovation result in to either a complete or a major transformation of existing products, services, process or technologies thus making the existing product/ service designs, processes and technologies obsolete (Chandy & Tellis, 2000). The nature of difference between incremental and radical innovations insists organizations to draw and use their knowledge very differently (Cardinal, 2001). As Gatignon et al., (2004) observed that the incremental innovations involve “improving and exploiting an existing technological trajectory” whereas radical innovations “disrupt an existing technological trajectory” Similarly, Abernathy & Clark (1985) noted that the incremental innovations “build on and reinforce the

applicability of existing knowledge” while radical innovations “*destroy the value of an existing knowledge base*”. Thus, incremental innovative capabilities draw upon reinforced existing knowledge in such a way that the product/service/process and its knowledge both improve in comparison to existing ones whereas radical innovative capabilities draw upon transformed existing knowledge by making the existing product/design, processes, technologies and associated knowledge totally obsolete.

The knowledge preserved by an organization influence its propensity to reinforce it. Activities, which are structured and recurrent in the organization, tend to use this preserved knowledge, which is generally considered more reliable and robust (Katila, 2002). But it makes organizations bias towards their current innovation trajectory which they found or proved to be useful (Lyles & Mitroff, 1980) and thus motivates them to explore only upon closely related areas of their existing knowledge (Martin & Mitchell, 1998). Studies have found convergence in the domain of knowledge an organization possesses and domain of knowledge of their fresh patenting activities (Stuart & Podolny, 1996). Therefore, the greater the organizational capital in an organization, the higher will be its incremental innovation capability (Subramaniam & Youndt, 2005).

In continuation, the social capital of an organization helps in improving the quality of group work by enhancing the richness of information exchange among the team members. Social capital facilitates interactions and exchange of ideas inside organization. Thus, social capital

iteratively reinforces knowledge not only by drawing upon the existing body of knowledge but refine evolving body of knowledge. However, greater social capital in an organization does not necessarily reflect the stronger influence of organizational capital on incremental innovative capability (Subramaniam & Youndt, 2005).

Knowledge access propensity and exposure to diverse knowledge domains reflects an organization's human capital. The creative, bright, skilled, experienced (in their roles and functions) human capital constitutes vast source of new ideas and knowledge for an organization (Snell & Dean, 1992). These individuals not only provides a good repository and diversity of skills to an organization (Hayek, 1945), but are most flexible in developing or acquiring new skills (March, 1991). Furthermore, such individuals are also found to be most questioning to existing norms in organizations (Tushman & Anderson, 1986). These set of individuals helps organizations in crossing the technological boundaries to absorb and deploy knowledge domains from outside (Hill & Rothaermel, 2003). However, greater the human capital in organizations does not necessarily imply its higher radical innovative capability (Subramaniam & Youndt, 2005)

In order to improve radical innovative capability by strong human capital, the unique ideas of individuals must be tied to one another. The process of connecting and combining previously unconnected ideas is called as brokering (Hargadon & Sutton, 1997). The individual breakthrough ideas need recognition, dissemination and currency so that

their impact can be maximized. Various studies (for example, see Schilling, 1998; Schön, 1963; Tushman & Murmann, 1998) had shown that the social network & lobbying helps in acceptance of individual radical ideas. One of the key attribute of social capital is ties and links which encourages sharing of information and knowledge among diverse individuals. Such attributes also facilitates human capital's role in transforming existing knowledge. If human capital can give platform for diverse ideas and thought to nurture with in the organization, social capital can connect them to achieve radical breakthroughs. The greater the social capital in an organization, stronger will be the influence of human capital on its radical innovative capability (Subramaniam & Youndt, 2005).

Innovation is also closely related to organizational learning. Organizational leaning not only helps in the development of new knowledge but also is crucial for firm's innovative capability and its performance (Hurley & Hult, 1998). It is seen that any organization, which is committed to learning, is likely to possess state-of-the-art technology (Gatignon & Xuereb, 1997). Such resources further lead to greater innovative capability. As described in the literature, learning orientation is conceived as composed of four factors: commitment to learning, shared vision, open-mindedness, and intra-organizational knowledge sharing (Hult, 1998; Hult & Ferrell, 1997; Hurley & Hult, 1998)

Learning orientation as defined by Calantone et al. (2002) is the "organization-wide activity of creating and using knowledge to enhance competitive advantage". This

includes obtaining and sharing information across the boundary viz customer needs, market changes, competitor actions, new technologies (Hurley & Hult, 1998; Mone et al., 1998; Moorman & Miner, 1998). Learning orientation influences what kind of information is gathered (Dixon, 1992) and how it is interpreted (Argyris & Schon, 1978), evaluated (Sinkula et al., 1997), and shared (Moorman & Miner, 1998).

Further, learning cannot occur unless an organization has an effective and efficient system of information sharing. Such information sharing system allows a reexamination of past decision strategies and implementation activities (Moorman & Miner, 1998). Intra-organizational knowledge sharing actually refers to the spread of learning among different units within an organization (Moorman & Miner, 1998; Zaltman et al., 1973). Such systems prepare a repository of knowledge and information and become single reference point for future actions. Organization learns with the accumulation of individual learning. Intra-organizational knowledge sharing prevents loss of information arising due to employee turnover and transfer (Lukas et al., 1996). Learning will be limited without accumulation of knowledge even after an organization is committed to learning and has a shared vision. (Moorman & Miner, 1998). Intra-organizational knowledge sharing is not only about obtaining information from various sources but includes systematic reexamination and structuring of information. It is shown that higher the level of learning orientation, greater the degree of firm's innovativeness (Calantone et al., 2002).

Innovation is also closely related to a firm's absorptive capacity. Cohen & Levinthal (1990) define the concept of absorptive capacity as a "firm's ability to evaluate, assimilate and apply new external knowledge to a firm's operational environment". The ability to evaluate and utilize outside knowledge is again depends upon level of their prior related knowledge (Cohen & Levinthal, 1990). The absorptive capacity of a firm is positively related to innovation efforts (Nieto & Quevedo, 2005), innovation output (Tsai, 2001) and to its performance (George et al., 2001; Lichtenthaler, 2009; Tsai, 2001). Flatten et al. (2011) studied and found a positive relationship between absorptive capacity of small and medium enterprises and their performance. However, absorptive capacity alone is not going to make a difference until and unless people are not motivated to share their tacit knowledge. Figure 3 provides a systematic relationship between the various innovative capabilities discussed above and the firm innovativeness and thereafter its performance.

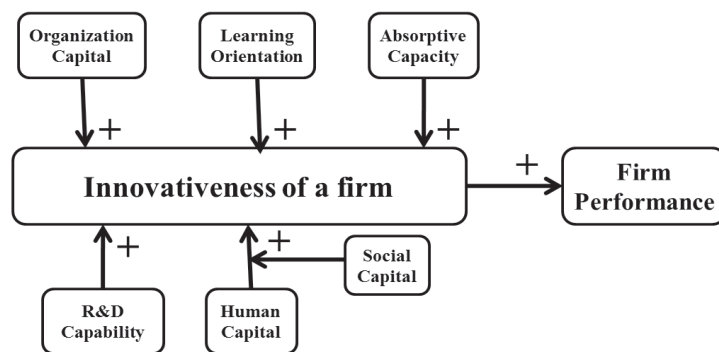


Figure 3 : Knowledge management comprising of various innovative capabilities effecting innovativeness of a firm and its performance

Practical implications

Selecting a knowledge partner firm or a partner firm for undertaking any kind of innovation requires a detailed assessment of the partner firm in terms of various innovative capabilities and their level to knowledge management practices. Greater and efficient practices of knowledge management will take firms in a position to offer more to each other leading to success in their collaborative efforts. Resource based theories also suggested direct positive relation between compatibility of partner firms and their success and many studies found support for this. Partner compatibility actually provides assurance about outcomes even if it is difficult to assess outcomes initially. More is the compatibility, more will be the involvement for collaborative efforts of partner firms. The level of involvement largely depends upon the knowledge management practices internalized by the firms. The framework proposed above can very well be used in a multi criteria decision situation where there are more than one target firms, which are eligible enough to become partner with a partnership-initiating firm but requires a detailed assessment in terms of target firm's knowledge management capabilities. The innovative capabilities proposed above can provide a measure for assessing the overall knowledge management capabilities of target firms and chose the best alternative firm to develop the partnership for innovation. Manager can also appreciate that out of these various innovative capabilities, which one is critical for the success of the partnership. Manger's preferences can very well be captured by using multi

criteria decision framework and arriving at an overall score for each of the target firm for forming a partnership.

Conclusion

Innovative capabilities are the core competence of an innovative organization and reflect the comprehensive set of characteristics that facilitate and support innovation strategies inside that organization. The internal R&D capability of a firm in terms of technology know how, R&D investments etc has a positive effect on its innovation output (Rothaermel & Hess, 2007) and its financial performance (Rothaermel & Hill, 2005). Continued investment in internal R&D creates in house research capability for developing new technology either internally or by assimilating from outside (Tilton, 1971). Such R&D capabilities are valuable, rare, inimitable and non-substitutable resource for superior innovation performance (Barney, 1991; Holm et al., 1999; Peteraf, 1993). Competition and rapid changes in technological paradigm requires improvements in the organization's innovation and its innovative capability. When managed carefully, these innovative capabilities can contribute significantly towards better knowledge management practices, thus enabling innovation.

References

- Abernathy, W.J., & Clark, K. (1985). Innovation: Mapping the winds of creative destruction. *Research Policy*, 14, 3–22.
- Ahuja, G. (2000). The duality of collaboration: Inducements

- and opportunities in the formation of interfirm linkages. *Strategic Management Journal*, 21, 317-343.
- Argyris, C., & Schon, D.A. (1978). *Organizational learning: a theory of action perspective*. Massachusetts: Addison-Wesley Publishing Company.
- Arrow, K. (1974). *The Limits of Organization*. New York: Norton.
- Barney, J.B. (1991). Firms resources and sustained competitive advantage. *Journal of Management*, 17, 99-120.
- Burgelman, R., Maidique, M.A., & Wheelwright, S.C. (2004). *Strategic Management of Technology and Innovation*. New York: McGraw-Hill.
- Calantone, S., Tamer, C., & Yushman, Z. (2002). Learning Orientation, firm innovation capability and firm performance. *Industrial Marketing Management*, 31(6), 515–524.
- Cardinal, L.B. (2001). Technological innovation in the pharmaceutical industry: The use of organizational control in managing research and development. *Organization Science*, 12, 19–36.
- Chandy, R.K., & Tellis, G.J. (2000). The incumbent's curse? Incumbency, size and radical product innovation. *Journal of Marketing*, 64(3), 1–17.
- Cheeseborough, H., & Teece, D. (1996). When is virtual virtuous. *Harvard Business Review*, January-February.

- Cohen, W.M., & Levinthal, D.A. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128-152.
- Daft Richard, L., & Karl E. Weick (1984). Towards a model of organizations as interpretation systems. *Academy of Management Review*, 9, 284-295.
- Davenport, T.H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston: Harvard Business School Press.
- Dewar, R.D., & Dutton, J.E. (1986). The adoption of radical and incremental innovations: An empirical analysis. *Management Science*, 32, 1422–1433.
- Dixon, N.M. (1992). Organizational learning: a review of the literature with implications for HRD professionals. *Human Resource Development*, 3, 29– 49.
- Dougherty, D. (1992). Interpretive barriers to successful product innovation in large firms. *Organization Science*, 3(2), 179-202.
- Ettlie, J.E. (1983). Organizational policy and innovation among suppliers to the food processing sector. *Academy of Management Journal*, 26, 27–44.
- Flatten, T.C., Greve, G.I., & Brettel, M. (2011). Absorptive Capacity and Firm Performance in SMEs: The Mediating Influence of Strategic Alliance. *European Management Review*, 8, 137–152.

- Galbraith, J.R. (1977). *Organizational design*. MA: Addison-Wesley.
- Galbraith, J. (1973). *Designing Complex Organizations*. MA: Addison-Wesley.
- Gatignon, H., Tushman, M.L., Smith, W., & Anderson, P. (2004). A structural approach to assessing innovation: Construct development of innovation locus, type and characteristics. *Management Science*, 48, 1103-1123.
- Gatignon, H., & Xuereb, J-M. (1997). Strategic orientation of the firm and new firm performance. *Journal of Marketing Research*, 34, 77–90.
- George, G., Zahra, S.A., Wheatley, K.K., & Khan, R. (2001). The effects of alliance portfolio characteristics and absorptive capacity on performance: a study of biotechnology firms. *Journal of High Technology Management Research*, 12(2), 205-227.
- Gresov, C., & Stephens, C. (1993). The context of interunit influence attempts. *Administrative Science Quarterly*, 38, 252-276.
- Gupta, A.K., & Govindarajan, V.G. (1986). Resource sharing among SBUs: Strategic antecedents and administrative implications. *Academy of Management Journal*, 29, 895-714.
- Hansen, M., Nohria, N., & Tierney, T. (1999). What is your strategy for managing knowledge, *Harvard Business Review*, 77(2), 106-116.

- Hargadon, A., & Sutton, R.I. (1997), Technology brokering and innovation in a product development firm. *Administrative Science Quarterly*, 42, 716–749.
- Hayek, F.A. (1945). The use of knowledge in society. *American Economic Review*, 35, 519–532.
- Henderson Rebecca, M., & Kim B Clark, (1990). Architectural Innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35, 9-30.
- Hill, C.W.L., & Rothaermel, F.T. (2003). The performance of incumbent firms in the face of radical technological innovation. *Academy of Management Review*, 28, 257–274.
- Holm, D.B., Eriksson, K., & Johanson, J. (1999). Creating value through mutual commitment to business network. *Strategic Management Journal*, 20, 467–486.
- Huber, G.P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science*, 2, 88-125.
- Hult, G.T.M. (1998). Managing the international strategic sourcing process as a market-driven organizational learning system. *Decision Sciences*, 29(1), 193– 216.
- Hult, G.T.M., & Ferrell, O.C. (1997) A global learning organization structure and market information processing. *Journal of Business Research*, 40(2), 155–166.

- Hurley, R.F., & Hult, G.T.M. (1998). Innovation, market orientation, and organizational learning: an integration and empirical examination. *Journal of Marketing*, 62, 42–54.
- Katila, R. (2002). New product search over time: Past ideas in their prime?. *Academy of Management Journal*, 45, 995–1010.
- Kogut, B., Zander, U. (1992). Knowledge of the firm, combinative capacities and the replication of technology. *Organization Science*, 3, 383-397.
- Leonard-Barton, D. (1992). Core capabilities and core rigidities: A paradox in managing new product development. *Strategic Management Journal*, Summer Special Issue, 13, 111-125.
- Lichtenthaler, U. (2009). Absorptive capacity, environmental turbulence, and the complementarity of organizational learning processes. *Academy of Management Journal*, 52, 822–846.
- Lukas, B.A., Hult, G.T.M., & Ferrell, O.C. (1996). A theoretical perspective of the antecedents and consequences of organizational learning in marketing channels. *Journal of Business Research*, 36(3), 233–244.
- Lyles Majorie, A., & Ian I. Mitroff (1980). Organizational problem formulation; An empirical study. *Administrative Science Quarterly*, 25, 102-119.

- March James, G., & Simon, H.A. (1958). *Organizations*. New York: Wiley.
- March, J. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2, 71–87.
- Martin, X., & Mitchell, W. (1998). The influence of local search and performance heuristics on new design introduction in new product market. *Research Policy*, 26, 753–771.
- Metcalf Stanley, J., & Nico de Liso. (1995). *Innovation, Capabilities and Knowledge: The Epistemic Connection*. International conference on Advances in Sociological and Economic Analysis of Technology, September, Manchester.
- Mone, M.A., McKinley, W., & Barker, V.L. (1998). Organizational decline and innovation: a contingency framework. *Academy of Management Review*, 23(1), 115–132.
- Moorman, C., & Miner, A.S. (1998). Organizational improvisation and organizational memory. *Academy of Management Review*, 23(4), 698–723.
- Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23, 242–266.
- Nelson Richard, & Sidney Winter (1982). *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.

- Nieto, M., & Quevedo, P. (2005). Absorptive capacity, technological opportunity, knowledge spillovers, and innovative effort. *Technovation*, 25, 1141–1157.
- Nonaka, I. (1991). The knowledge creating company, *Harvard Business Review*, November-December.
- Nonaka, I., & Takeuchi, H. (1995). *The Knowledge Creating Company: How Japanese Companies Create The Dynamics of Innovation*. Oxford: Oxford University Press.
- Peteraf, M.A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14, 179-191.
- Polanyi, M. (1962). *Personal Knowledge: towards a post-critical philosophy*. London: Routledge.
- Prahalad, C.K., & Hamel, G. (1990). The core competence of the organization, *Harvard Business Review*, 68, 79-91.
- Rothaermel, F.T., & Andrew M. Hess (2007). Building Dynamic Capabilities: Innovation Driven by Individual-, Firm and Network-Level Effects. *Organization Science*, 18(6), 898-921.
- Rothaermel, F.T., & Hill, C.W.L. (2005). Technological discontinuities and complementary assets: A longitudinal study of industry and firm performance. *Organization Science*, 16, 52-70.
- Schilling, M.A. (1998). Technological lockout: An integrative model of the economic and strategic factors driving

- technological success and failure. *Academy of Management Review*, 23, 267–284.
- Schoön, D.A. (1963). Champions for radical new inventions, *Harvard Business Review*, 41(2), 77–86.
- Schultz, T.W. (1961). Investment in human capital. *American Economic Review*, 51, 1–17.
- Sherwood, D. (2002). *Creating an Innovative Culture*. Oxford: Capstone Publishing.
- Sinkula James, M., William E. Baker, & Thomas Noordewier (1997). A Framework for Market-Based Organizational Learning: Linking Values, Knowledge, and Behavior. *Journal of the Academy of Marketing Science*, 25 (Fall), 305-318.
- Snell, S.A., & Dean, J.W. (1992), Integrated manufacturing and human resources management: A human capital perspective. *Academy of Management Journal*, 35, 467–504.
- Stuart, T. E., & Podolny, J. M. 1996. Local search and the evolution of technological capabilities. *Strategic Management Journal*, 17(summer special issue), 21–38.
- Subramaniam, M., & Venkatraman, N. (2001). Determinants of transnational new product development capability: testing the influence of transferring and deploying tacit overseas knowledge, *Strategic Management Journal*, 22(4), 359–378.

- Subramaniam, M., & Youndt, M.A. (2005). The influence of Intellectual capital on the types of innovative capability. *Academy of management Journal*, 48, 450-463.
- Swink, M. (2006). Building collaborative innovation capability. *Research Technology Management*, 49(2), 37-48.
- Syrett, M., & Lammiman, J. (2002). *The Innovative Individual*. Tulsa, OK: Capstone Publishing.
- Tilton, J.H. (1971), *International Diffusion of Technology: The Case of Semiconductors*, Brookings Institution, Washington DC.
- Tsai, W. (2000). Social capital, strategic relatedness and the formation of intraorganizational linkages. *Strategic Management Journal*, 21, 925-939.
- Tsai, W. (2001). Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Academy of Management Journal*, 44(5), 996–1004.
- Tsai, W., & Ghoshal, S. (1998). Social capital and value creation: The role of intrafirm networks. *Academy of Management Journal*, 41, 464-478.
- Tushman, M., & Anderson, P. (1986). Technological discontinuities and organizational environments. *Administrative Science Quarterly*, 31, 439–465.
- Tushman, M., & Murmann, J. (1998). Dominant designs, technology cycles, and organizational outcomes. In B. Staw

& L. L. Cummings (Eds.), *Research in Organizational Behavior* (pp. 231–266), Greenwich, CT: JAI Press.

Youndt, M.A., Subramaniam, M., & Snell, S.A. (2004). Intellectual capital profiles: An examination of investments and returns. *Journal of Management Studies*, 41, 335–362.

Zaltman, G., Duncan, R., Holbek, J. (1973). *Innovations and organizations*. New York: Wiley.