Relationship Analysis between Intellectual Capital and Knowledge Management  
(Case study: Tehran Science & Technology Park)  

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Abstract  
Knowledge management has become one of the most important trends in business, yet many knowledge management initiatives fail. To understand the success and failure of knowledge management, organizations must identify and assess the organizational capabilities required for the effort to prosper, which is the focus of this study. Literature has offered important theoretical grounding for this study with regard to organizational capability as a predictor of knowledge management effectiveness, but empirical examination is lacking. In this study we aim to appear effects of intellectual capital dimensions on knowledge management success. With a comprehensive survey and distributing two questionnaires among 27 managers of organizations in Tehran science and technology park, we found that the main dimension of IC toward KM success in structural capital. Although, human & relational capital have some effects in this way, but it is not significant relationship. Our findings suggest that if we promote culture, communications, processes and objectives of organizations, we could hope to improve our KM skills.  

Keywords: Intellectual capital, Knowledge management, Science & Technology Park.  

1- Introduction  
Today’s economy is characterized by a rapid rate of change, globalization and knowledge-intensive products. The resource-based view of the firm postulates a firm’s profitability as a function of its market and competitive position. Too, a firm’s resources consist of its internal capabilities and know-how that facilitate delivery of products and services to customers as well as enhance organizational performance (Alavi, 2000). The competitive environment today dictates that firms must manage their resources well and must endeavor to provide their knowledge workers with the right knowledge assets. This makes knowledge management (KM) vital to organizations. The Gartner Group, a leading research/consulting firm for the information technology industry in the US, defines “KM as a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving and sharing enterprise information” (Seubert, Balaji, and Makhija, 2001), thus making knowledge available when needed. In recent research by InformationWeek (Forley, 2001), 94 percent of companies considered KM strategic to their business or information technology (IT) processes. Most of those companies were in the early stages of their KM activities. Based on Nonaka (2002), the distinction between information and knowledge is that information is a flow of messages, while knowledge is created and organized by the very flow of information, anchored on the commitment and beliefs of its holder. Due to a number of issues, such as enhanced technologies, the global arena, and efforts to achieve competitive advantage, KM has received an increasing amount of attention in the MIS literature. The goal of an effective KM strategy should be to enhance the creation, transfer, and utilization of all types of organizational knowledge (Alavi, 2000), thereby taking less time to process the information and reuse the knowledge. Corporations not only realize that knowledge is the critical resource, but they also try to manage organizational knowledge more intensely and effectively. However, there are many
issues influencing these activities, such as 1) how knowledge content translates into “historically dependent” capitals (Barney, 1996, 1997, 2002); 2) who are the users that involve knowledge creation processes and commit to using, assimilating, internalizing, externalizing the knowledge (Nonoka, 1994, 2002); and 3) what should be further developed for sustaining a firm’s competitive advantage. This research seeks to study some of these issues by examining the relationship between KM and intellectual capital (IC).

“Historically dependent” capitals spell out the accumulation of a firm’s assets or knowledge over time that is most likely embedded in organizational routines, policies, or culture. They are invisible, invaluable, and immobile all at the same time. In other words, the historically dependent capitals are used over time and help account for task fulfillments in the firm. “Immobility,” intertwined with historically dependent capitals, can be difficult or costly to move from one firm to another. Therefore, the more immobility of a firm’s capital, the more competitive advantage it brings to the firm. Most IC researchers (Stewart, 1997; Bontis, 2001; Van Buren, 1999) and Barney’s resource-base view (1991, 1997, and 2002) agree that IC is a critical firm resource. ICs are intellectual materials that can be captured as assets, such as knowledge, information, intellectual property, and employees’ experiences, commitments or capabilities. These assets may increase a firm’s performance, and they may in turn translate into a competitive advantage if some important assets are “immobile” (Barney, 2002). “Immobile” resources are firm resources that are idiosyncratic, costly to duplicate, and/or “historically dependent” (Barney, 1991, 1997, 2002). To further integrate the concepts of IC and KM, this research introduced a new view between these two variables using a correlation method.

2- Literature review
2-1- Intellectual capital
A firm creates value from what it captures during the processes of knowledge creation. From accumulation, the stock of knowledge and capabilities is unique to an organization’s learning and experience (Choo and Bontis, 2002). Choo and Bontis (2002) referred to this stock as “the firm’s intellectual capital” (p. 16). Intellectual capital consists of different capitals that are rooted in employees, organizational routines, intellectual property, and relationships with customers, suppliers, distributors, and partners (Choo and Bontis, 2002). Stewart (1997) defined IC as the intellectual material -- knowledge, information, intellectual property, and experience -- that can be put to use for creating wealth. In the spirit of Barney (1991, 1996), a firm’s resources were defined as “capitals.” As such, the firm’s resources can be divided into financial capital, physical capital, human capital, and organizational capital (Barney, 1991, 1996). Financial capital includes all money resources. Physical capital is physical technology in a firm. Human capital refers to the training, experience, judgment, intelligence, relationships, and insight of individuals. Organizational capital includes a formal and/or informal structure in a firm in addition to its culture, reputation, and relations among groups within and between firms (Barney, 1996, 2002). Bontis (2002a) defined similar concepts, referring to them as human capital, structure capital and customer capital. Among three components of IC, IC researchers such as Stewart (1997), Van Buren (1999) and Bontis (2002b) all included human capital. Customer capital is the relationship between firms and their customers. Pike, Rylander, and Roos (2002) referred to customer capital as relational capital; however, customer capital and relational capital were defined similarly. Since the main focus of this research emphasizes inward relationships of an organization, the customer/relational capital is beyond the scope of this research. Van Buren (1999), however, split Stewart’s “structure capital” into two new measures: innovation capital and process capital. Innovation capital is the capability of an organization to innovate and to create new products and services, and process capital represents an
organization's processes, techniques, systems, and tools. Structural capital by Bontis (2002), innovation capital by Van Buren (1999) or organizational capital by Pike et al. (2002) and Barney (1996) are titled differently, but they overlap in terms of the properties of IC. In terms of definition, structural capital is the most controversial component of IC because of the constant changes among different IC models (Bontis, 2001, 2002a, 2002b; Van Buren, 1999; Pike et al., 2002). Quite controversially, there are different views on evaluation of IC. One direction includes accounting cost-base and financial value-base, and the other is an effectiveness evaluation. The conventional accounting-based evaluation adjusts its traditional instruments, such as historical transactions, and balanced scorecards (Norton and Kaplan, 1996). These accounting indices were criticized as “lagging measures” (Pike et al., 2002) because they were “cost-based.” Acting as a supplemental evaluation to cost-based calculations, the financial value-based approach utilizes net present value to estimate a company's market value. However, it still demonstrates problems of homogeneity, nonfinancial benefits, and forecasting (Lewis and Lippitt, 1999).

As an example, Skandia first developed its IC report internally in 1985 (Bontis, 2001; Pike et al., 2002). Skandia combined financial and non-financial capital to estimate a company's market value as shown in Figure 2.1. Following Skandia's multi-dimensional IC measure, Dow Chemical weighed and valued its R&D and patent process in terms of an organization value. IC is visualized by the company's core competencies that reflect knowledge-sharing technology and knowledge assets beyond intellectual property and/or R&D expenditures. A growing body of IC evaluation is concerned with carefully disclosing information about a firm to its stakeholders. Based on the information asymmetry between a firm and its stakeholders, the “disclosure” of even strategically sensitive R&D information is beneficial to a firm’s market value (Narayanan, Pinches, Kelm, and Lander, 2000). A meaningful “disclosure” of an IC report to a firm’s long-term stakeholders achieved more satisfactory ratings and valuations than those firms without (Narayanan et al., 2000).

Pike et al. (2002) pointed out the important disclosure should include the “present and future performance of the value-creating mechanisms of the company” (p. 664). Besides the “disclosure” of a firm’s information, Tobin’s q has gained in importance as an indicator of a firm’s intangible value (Hall, 1993; Megna and Klock, 1993). It is a ratio of the capital market value of a firm to the replacement value of its assets. These assets incorporate a market measure of a firm value that is forward-looking, risk-adjusted, and less susceptible to changes in accounting practice (Montgomery and Wernerfelt, 1988). Tobin’s q can be high, e.g., 7.0, where a firm’s IC is resourceful, such as in the semiconductor industry, whereas a value as low as 1.00 can occur where firms have large capital assets, e.g., steel industry (Bontis, 2002b). In support, the semiconductor industry has some characteristics, such as active patenting, large R&D expenditures, and rapid price declines that reflect the frequent introduction of new production processes and products (Appleyard, 2002).

2-2- Knowledge management

Most views of KM recognize that it has both social and technological dimensions integrated with IT. KM also has broad aims involving organizational culture, transparency and agility of processes, and the infrastructure development of KM is harmonious with individual needs and organizational context. It is generally recognized that early KM initiatives focused too heavily on IT and missed opportunities to improve performance through the knowledge and enhancement of employee networks (Parker et al., 2001). Practicing managers especially recognize that human relationships, their deployment, and configuration are critical to KM. For instance, the manager of a technical information center at Xerox emphasized that KM was not technology-driven but “people-driven” (Hickins, 1999). A case study of Xerox described 80 percent of KM systems that involved adapting to the social dynamics of the workplace. For Davenport and Prusak (1998), most KM projects had one of three emphases: 1)
make knowledge visible and show the role of knowledge in an organization; 2) develop a knowledge-intensive culture by encouraging and aggregating behaviors, e.g., knowledge sharing; and 3) build a knowledge infrastructure -- not only a technical system, but a web of connections to encourage interaction and collaboration. Along with Alavi’s (1997) concept that KM should embrace both technology and social-cultural factors, Tiwana (2001) suggested two other emphases: 1) KM should focus on the flow of information; 2) KM was a foremost a management issue-- and technology was only an enhancer driven “by the right people in the right place to support knowledge management” (p. 12). A similar, but more individualistic perspective was expressed by Alavi et al. (2001). For them, KM involves enhancing an individual’s learning and understanding by providing more information to the individual. They also saw the role of IT as providing access to sources of knowledge rather than knowledge itself. Sources of knowledge are the nodes of a social network that create, acquire, or transfer the majority of information and/or knowledge. As mentioned in 2.3.3, ICMM included KM enablers and processes (Van Buren, 1999). He identified five KM processes: define, create, capture, share, and use. Too, he stated that these processes overlapped and reinforced each other. The nature of these KM processes involved different forms of activities and appeared in different functionalities, such as succession planning, market research, total quality management, reengineering, and strategic planning. Similarly, Dow Chemical implemented a six-step process for managing intellectual assets that included 1) defining the role of knowledge in the business; 2) assessing the competition’s strategies and knowledge assets; 3) classifying the company’s portfolio of knowledge assets; 4) evaluating the value of those assets to keep, develop, sell or abandon; 5) investing in areas where gaps have been found; and 6) assembling the new knowledge portfolio (Bontis, 1996).

Van Buren’s (1999) processes and Dow’s management of intellectual assets take on a task-oriented approach; on the other hand, Nonaka’s knowledge creation processes are closely related to Gold et al.’s (2001) KM processes. The knowledge creation processes were investigated in several studies such as Gold et al. (2001), Lee (2003), Sabherwal et al. (2003). In addition, different from a task-oriented approach or knowledge creation processes, IBM’s KM processes engaged in a “knowledge cycle.” The knowledge cycle is the process for knowledge creation, use, and reuse with continuous improvements (Huang, 1998). Continuous improvements introduced dynamics to the KM processes within the boundaries of the users’ working environment. Davenport and Prusak (1997, 1998c) pointed out that increasing knowledge intensity and addressing cultural change are the most challenging issues in the KM processes in addition to making knowledge visible and building knowledge infrastructure. Consistent with IBM’s sweet spot development, Hasen and Oetinger (2001) introduced the next generation of T-shaped management. T-shaped management can help to cultivate a sharing environment to transfer knowledge from experts at the jobs, such as tacit knowledge. At the same time, T-shaped management follows hierarchies and organizational routines within a boundary of functionality where explicit knowledge flows. To explain further, a T-shaped management processes provides for sharing knowledge freely across the organization (the horizontal part of the “T”) while remaining individual business units perform organizational routines in a hierarchy function (the vertical part) (Hasen and Oetinger, 2001).

3- Research Methodology and findings
This research study utilizes qualitative and quantitative methods of analysis using a survey instrument and case study for primary data collection. Reliance on one method can create issues, for example qualitative research lacks rigid control, while quantitative methods may create predetermined certainties. Many authors recommend both qualitative and quantitative methods to add context to research, offer an expanded view of the topics, and allow validation of findings through more than one methodology. The survey instrument analyzes the research model using formalized
methodology, the case study includes interviews and system information and results. The qualitative and quantitative analysis results were triangulated to form discussion points and conclusion outputs. Our sample was selected among managers of firms in Tehran science and technology parks and using two comprehensive questionnaires of KM & IC, we tried to find relationship between IC dimensions and KM dimensions as shown in figure 1. After distribution of questionnaires, only 27 complete one returned. We show our finding in following tables.

Figure 1: Research model structure
Figure 3: IC Dimensions scores in statistical population

<table>
<thead>
<tr>
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<th>Comparative analysis</th>
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<th>FD</th>
<th>SIG</th>
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<tbody>
<tr>
<td></td>
<td>Average</td>
<td>ES level</td>
<td>Standard</td>
<td>Level of %95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>error</td>
<td>Bottom level</td>
</tr>
<tr>
<td>1</td>
<td>Knowledge Infrastructure capability</td>
<td>-1.50224</td>
<td>.96737</td>
<td>.06478</td>
</tr>
<tr>
<td>2</td>
<td>Team Knowledge Process capability</td>
<td>-1.90583</td>
<td>1.16446</td>
<td>.07798</td>
</tr>
<tr>
<td>3</td>
<td>Organization Knowledge Process capability</td>
<td>-1.39068</td>
<td>1.18506</td>
<td>.07095</td>
</tr>
</tbody>
</table>

Table 2: Relationship between IC dimensions and KM

<table>
<thead>
<tr>
<th>Variables</th>
<th>Level of significance</th>
<th>Coefficient of correlation</th>
</tr>
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<tbody>
<tr>
<td>Human Capital</td>
<td>0.021</td>
<td>0.236*</td>
</tr>
<tr>
<td>Structural Capital</td>
<td>0.000</td>
<td>0.633**</td>
</tr>
<tr>
<td>Relational Capital</td>
<td>0.005</td>
<td>0.065</td>
</tr>
</tbody>
</table>

*: it is significant at 0.01 level
**: it is significant at 0.05 level
Table 3: Relationship between dimensions of IC and dimensions of KM

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Knowledge Infrastructure capability</th>
<th>Team Knowledge Process capability</th>
<th>Organization Knowledge Process capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Capital</td>
<td>0.027</td>
<td>0.003</td>
<td>0.026</td>
</tr>
<tr>
<td>Structural Capital</td>
<td>0.242*</td>
<td>0.270**</td>
<td>0.257*</td>
</tr>
<tr>
<td>Relational Capital</td>
<td>0.430**</td>
<td>0.265*</td>
<td>0.230*</td>
</tr>
</tbody>
</table>

4- Conclusion & Discussion

Organizations develop knowledge infrastructure to drive desired behaviors, yet knowledge workers develop processes to circumvent the organization’s infrastructure (cultural and structural barriers). This may contribute to the problem of knowledge management failure. However, the relationships between knowledge infrastructure and IC dimensions have not been empirically examined, until this study. In addition, most knowledge management research is conducted at the organization level, yet most knowledge management implementation occurs at the team level (project teams, business units, social groups). To help bridge the gaps between theory and practice, this study aligned the unit of analysis more closely with the practitioners’ level of implementation. Using only the organization as the unit of analysis would provide little guidance for business leaders in how they can influence the success of knowledge management programs, and it would present an incomplete picture when assessing the relationships between organizational capabilities and knowledge management effectiveness. The organization perspective helps with generalizability of this study, while the team perspective leads to results of a more informative and prescriptive nature for practitioners. Moreover, we found that there is a significant relationship between all aspects of IC with KM but the mail important section of IC toward a better KM in organizations is structural capital with correlation of 0.633.
References


